DO WE NEED SOCIO-EMOTIONAL SKILLS?

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DO WE NEED SOCIO-EMOTIONAL SKILLS?

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Editorial: Do We Need Socio-Emotional Skills?

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Editorial on the Research Topic

Do We Need Socio-Emotional Skills?

The question we chose for this Research Topic—Do we need socio-emotional skills?—is deliberately broad. It can be asked on different levels: Do we as individuals need socio-emotional skills to achieve success, health, and happiness? Do we as researchers studying individual differences need data on socio-emotional skills to unravel the determinants of life success over and above cognitive abilities? Do we as organizations need to select applicants with socio-emotional skills, as they will show better performance in the future? Finally, do we as a society need socio-emotional skills to understand or overcome social inequalities?

The articles in this Research Topic offer promising new insights that support the view that socio-emotional skills can be useful on each of these levels. These articles contribute to three strands of the literature on socio-emotional skills: the conceptualization and definition of socio-emotional skills, the relevance of socio-emotional skills for success at school and at work, and how best to foster socio-emotional skills.

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DEFINITION AND CONCEPTUALIZATION: WHAT ARE SOCIO-EMOTIONAL SKILLS?

Socio-emotional skills is an umbrella term used to describe psychological constructs such as personality traits, motivation, or values (e.g., Duckworth and Yeager, 2015; Lechner et al., 2019). Closely related terms are "character strengths," "non-cognitive skills," "soft skills," and "twenty-first-century skills" (e.g., De Fruyt et al., 2015; Abrahams et al., 2019). The common denominator is that these terms describe functional capacities that allow individuals to work efficiently and persistently, build trusting relationships with others, cope with stress and setbacks, lead and motivate others, and be creative and explore novel ideas.

It is readily apparent that socio-emotional skills have a lot in common with the Big Five personality traits, Conscientiousness, Agreeableness, Emotional Stability (Negative Emotionality), Extraversion, and Open-Mindedness. Indeed, the Big Five model is currently the most widely used framework to assess socio-emotional skills. Although the distinction between socio-emotional skills, personality traits, and related constructs is sometimes blurred, there are subtle differences (e.g., Soto et al., 2021): whereas personality traits describe characteristic patterns of feelings, thoughts, and action (i.e., typical behaviors), socio-emotional skills describe how well individuals can perform specific tasks (i.e., maximum performance). To more clearly differentiate socio-emotional skills from related constructs, Schoon proposes an integrative taxonomy of "domains and manifestations of social-emotional competences" (DOMASEC) that represent cross-cutting themes in research on social and emotional learning, personality, and motivation.

SOCIO-EMOTIONAL SKILLS PREDICT IMPORTANT LIFE OUTCOMES—OVER AND ABOVE COGNITIVE SKILLS

Socio-emotional skills predict a broad range of important life outcomes, such as educational achievement (e.g., Poropat, 2009), income (e.g., Danner et al., 2020), reemployment success (e.g., Gnambs, 2017), health (e.g., Bogg and Roberts, 2004), and life satisfaction (e.g., Rammstedt et al., 2017)—often over and above cognitive skills as well as sociodemographic factors such as educational attainment (e.g., Spengler et al., 2015). Findings from Allen et al. for the years 2004–2017 suggest that certain types of socio-emotional skills may even have become more important in the labor market in recent decades.

Several contributions to the present issue provide additional evidence for the predictive power of socio-emotional skills for a broad range of outcomes in different life domains and life stages. The majority of these articles focus on academic achievement. They show that socio-emotional skills—measured with different frameworks—predict academic performance and flow experiences at school (Schmidt et al.; Steinmayr et al.; Wagner et al.) as well as successful transitions to the labor market (Nießen et al.)—over and above cognitive skills and socioeconomic status. Three other contributions address the relation between socio-emotional skills and job outcomes. Specifically, they demonstrate that socio-emotional skills predict adults' job performance over and above cognitive ability (Bergner; Harzer et al.) as well as participation in further training (Laible et al.).

As researchers or organizations, we have tended to focus on constructs that have demonstrated empirical associations with success or criterion variables in the past. However, focusing also on socio-emotional skills allows us to actively shape for the better environment in which we all, as individuals, learn, work, and live. For example, it has been found that less agreeable individuals tend to be more successful (e.g., Boudreau et al., 2001). Should universities or organizations therefore select more aggressive applicants as future students or employees? Perhaps not. Selecting applicants based on socio-emotional skills such as empathy, solidarity, honesty, or fairness may be a more promising approach.

SOCIOEMOTIONAL SKILLS CAN BE LEARNED AND TAUGHT

Given the demonstrable importance of socio-emotional skills for success at school and at work, an essential question from a policy and practice perspective is whether these skills are malleable. There is broad agreement that—despite their substantial heritability—socio-emotional skills can be learned and shaped through education and interventions. However, it remains unclear how the development of these skills can best be fostered. Two articles in this issue contribute to this debate: Schiepe-Tiska et al. examine the role of teachers for social and emotional learning at school; Feron and Schils present evidence from a randomized controlled trial investigating whether self-reflection on school behavior can improve school performance. Their decidedly mixed findings illustrate a broader consensus in the field—namely, that researchers have yet to gain a complete understanding of how best to foster socio-emotional skills, for example, through curricular design or targeted interventions.

SOCIO-EMOTIONAL SKILLS CAN BE ASSESSED ECONOMICALLY—INTERNATIONAL LARGE-SCALE ASSESSMENTS SHOULD INCLUDE THEM TO ENABLE FURTHER RESEARCH

The contributions in this Research Topic underscore that we do indeed need socio-emotional skills. In particular, the incremental predictive power of socio-emotional skills for engagement and success at school and at work is now abundantly clear. However, as discussed in detail in the articles in this Research Topic, there are several unresolved questions about socio-emotional skills that require more comprehensive data. Comprehensively assessing socio-emotional skills with instruments such as the Behavioral and Emotional Skills Inventory (BESSI; Soto et al., 2021) takes 15 min or less. This makes the assessment of socio-emotional skills as a complement to cognitive abilities attractive and cost effective. Without assessing socio-emotional skills also, researchers cannot achieve a complete understanding of individual differences in success, health, or social participation. Hence, we believe that more future studies—especially international large-scale assessments—in educational psychology, work and organizational psychology, and personality psychology should include measures of socio-emotional skills. Large-scale and ideally longitudinal data on socio-emotional skills will enable researchers to resolve long-standing questions, especially those regarding the development of these skills over the lifespan. It is now clear that socio-emotional skills can contribute to life success, broadly speaking. The most potent individual and contextual influences on the development of socio-emotional skills, and the most promising intervention strategies to foster their development, have yet to be identified. These formidable tasks for future research can build on the work in this Research Topic.

AUTHOR CONTRIBUTIONS

DD, CL, and MS wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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The Importance of Students' Motivation for Their Academic Achievement – Replicating and Extending Previous Findings

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Achievement motivation is not a single construct but rather subsumes a variety of different constructs like ability self-concepts, task values, goals, and achievement motives. The few existing studies that investigated diverse motivational constructs as predictors of school students' academic achievement above and beyond students' cognitive abilities and prior achievement showed that most motivational constructs predicted academic achievement beyond intelligence and that students' ability self-concepts and task values are more powerful in predicting their achievement than goals and achievement motives. The aim of the present study was to investigate whether the reported previous findings can be replicated when ability self-concepts, task values, goals, and achievement motives are all assessed at the same level of specificity as the achievement criteria (e.g., hope for success in math and math grades). The sample comprised 345 11th and 12th grade students (M = 17.48 years old, SD = 1.06) from the highest academic track (Gymnasium) in Germany. Students self-reported their ability self-concepts, task values, goal orientations, and achievement motives in math, German, and school in general. Additionally, we assessed their intelligence and their current and prior Grade point average and grades in math and German. Relative weight analyses revealed that domain-specific ability self-concept, motives, task values and learning goals but not performance goals explained a significant amount of variance in grades above all other predictors of which ability self-concept was the strongest predictor. Results are discussed with respect to their implications for investigating motivational constructs with different theoretical foundation.

Keywords: academic achievement, ability self-concept, task values, goals, achievement motives, intelligence, relative weight analysis

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INTRODUCTION

Achievement motivation energizes and directs behavior toward achievement and therefore is known to be an important determinant of academic success (e.g., Robbins et al., 2004; Hattie, 2009; Plante et al., 2013; Wigfield et al., 2016). Achievement motivation is not a single construct but rather subsumes a variety of different constructs like motivational beliefs, task values, goals,

and achievement motives (see Murphy and Alexander, 2000; Wigfield and Cambria, 2010; Wigfield et al., 2016). Nevertheless, there is still a limited number of studies, that investigated (1) diverse motivational constructs in relation to students' academic achievement in one sample and (2) additionally considered students' cognitive abilities and their prior achievement (Steinmayr and Spinath, 2009; Kriegbaum et al., 2015). Because students' cognitive abilities and their prior achievement are among the best single predictors of academic success (e.g., Kuncel et al., 2004; Hailikari et al., 2007), it is necessary to include them in the analyses when evaluating the importance of motivational factors for students' achievement. Steinmayr and Spinath (2009) did so and revealed that students' domain-specific ability self-concepts followed by domain-specific task values were the best predictors of students' math and German grades compared to students' goals and achievement motives. However, a flaw of their study is that they did not assess all motivational constructs at the same level of specificity as the achievement criteria. For example, achievement motives were measured on a domain-general level (e.g., "Difficult problems appeal to me"), whereas students' achievement as well as motivational beliefs and task values were assessed domain-specifically (e.g., math grades, math self-concept, math task values). The importance of students' achievement motives for math and German grades might have been underestimated because the specificity levels of predictor and criterion variables did not match (e.g., Ajzen and Fishbein, 1977; Baranik et al., 2010). The aim of the present study was to investigate whether the seminal findings by Steinmayr and Spinath (2009) will hold when motivational beliefs, task values, goals, and achievement motives are all assessed at the same level of specificity as the achievement criteria. This is an important question with respect to motivation theory and future research in this field. Moreover, based on the findings it might be possible to better judge which kind of motivation should especially be fostered in school to improve achievement. This is important information for interventions aiming at enhancing students' motivation in school.

Theoretical Relations Between Achievement Motivation and Academic Achievement

We take a social-cognitive approach to motivation (see also Pintrich et al., 1993; Elliot and Church, 1997; Wigfield and Cambria, 2010). This approach emphasizes the important role of students' beliefs and their interpretations of actual events, as well as the role of the achievement context for motivational dynamics (see Weiner, 1992; Pintrich et al., 1993; Wigfield and Cambria, 2010). Social cognitive models of achievement motivation (e.g., expectancy-value theory by Eccles and Wigfield, 2002; hierarchical model of achievement motivation by Elliot and Church, 1997) comprise a variety of motivation constructs that can be organized in two broad categories (see Pintrich et al., 1993, p. 176): students' "beliefs about their capability to perform a task," also called expectancy components (e.g., ability self-concepts, self-efficacy), and their "motivational beliefs about their reasons for choosing to do a task," also called value components (e.g., task values, goals). The literature on motivation constructs from these categories is extensive (see Wigfield and Cambria, 2010). In this article, we focus on selected constructs, namely students' ability self-concepts (from the category "expectancy components of motivation"), and their task values and goal orientations (from the category "value components of motivation").

According to the social cognitive perspective, students' motivation is relatively situation or context specific (see Pintrich et al., 1993). To gain a comprehensive picture of the relation between students' motivation and their academic achievement, we additionally take into account a traditional personality model of motivation, the theory of the achievement motive (McClelland et al., 1953), according to which students' motivation is conceptualized as a relatively stable trait. Thus, we consider the achievement motives hope for success and fear of failure besides students' ability self-concepts, their task values, and goal orientations in this article. In the following, we describe the motivation constructs in more detail.

Students' ability self-concepts are defined as cognitive representations of their ability level (Marsh, 1990; Wigfield et al., 2016). Ability self-concepts have been shown to be domain-specific from the early school years on (e.g., Wigfield et al., 1997). Consequently, they are frequently assessed with regard to a certain domain (e.g., with regard to school in general vs. with regard to math).

In the present article, task values are defined in the sense of the expectancy-value model by Eccles et al. (1983) and Eccles and Wigfield (2002). According to the expectancy-value model there are three task values that should be positively associated with achievement, namely intrinsic values, utility value, and personal importance (Eccles and Wigfield, 1995). Because task values are domain-specific from the early school years on (e.g., Eccles et al., 1993; Eccles and Wigfield, 1995), they are also assessed with reference to specific subjects (e.g., "How much do you like math?") or on a more general level with regard to school in general (e.g., "How much do you like going to school?").

Students' goal orientations are broader cognitive orientations that students have toward their learning and they reflect the reasons for doing a task (see Dweck and Leggett, 1988). Therefore, they fall in the broad category of "value components of motivation." Initially, researchers distinguished between learning and performance goals when describing goal orientations (Nicholls, 1984; Dweck and Leggett, 1988). Learning goals ("task involvement" or "mastery goals") describe people's willingness to improve their skills, learn new things, and develop their competence, whereas performance goals ("ego involvement") focus on demonstrating one's higher competence and hiding one's incompetence relative to others (e.g., Elliot and McGregor, 2001). Performance goals were later further subdivided into performance-approach (striving to demonstrate competence) and performance-avoidance goals (striving to avoid looking incompetent, e.g., Elliot and Church, 1997; Middleton and Midgley, 1997). Some researchers have included work avoidance as another component of achievement goals (e.g., Nicholls, 1984; Harackiewicz et al., 1997). Work avoidance refers to the goal of investing as little effort as possible (Kumar and Jagacinski, 2011). Goal orientations can be assessed in reference to specific

subjects (e.g., math) or on a more general level (e.g., in reference to school in general).

McClelland et al. (1953) distinguish the achievement motives hope for success (i.e., positive emotions and the belief that one can succeed) and fear of failure (i.e., negative emotions and the fear that the achievement situation is out of one's depth). According to McClelland's definition, need for achievement is measured by describing affective experiences or associations such as fear or joy in achievement situations. Achievement motives are conceptualized as being relatively stable over time. Consequently, need for achievement is theorized to be domain-general and, thus, usually assessed without referring to a certain domain or situation (e.g., Steinmayr and Spinath, 2009). However, Sparfeldt and Rost (2011) demonstrated that operationalizing achievement motives subject-specifically is psychometrically useful and results in better criterion validities compared with a domain-general operationalization.

Empirical Evidence on the Relative Importance of Achievement Motivation Constructs for Academic Achievement

A myriad of single studies (e.g., Linnenbrink-Garcia et al., 2018; Muenks et al., 2018; Steinmayr et al., 2018) and several meta-analyses (e.g., Robbins et al., 2004; Möller et al., 2009; Hulleman et al., 2010; Huang, 2011) support the hypothesis of social cognitive motivation models that students' motivational beliefs are significantly related to their academic achievement. However, to judge the relative importance of motivation constructs for academic achievement, studies need (1) to investigate diverse motivational constructs in one sample and (2) to consider students' cognitive abilities and their prior achievement, too, because the latter are among the best single predictors of academic success (e.g., Kuncel et al., 2004; Hailikari et al., 2007). For effective educational policy and school reform, it is crucial to obtain robust empirical evidence for whether various motivational constructs can explain variance in school performance over and above intelligence and prior achievement. Without including the latter constructs, we might overestimate the importance of motivation for achievement. Providing evidence that students' achievement motivation is incrementally valid in predicting their academic achievement beyond their intelligence or prior achievement would emphasize the necessity of designing appropriate interventions for improving students' school-related motivation.

There are several studies that included expectancy and value components of motivation as predictors of students' academic achievement (grades or test scores) and additionally considered students' prior achievement (Marsh et al., 2005; Steinmayr et al., 2018, Study 1) or their intelligence (Spinath et al., 2006; Lotz et al., 2018; Schneider et al., 2018; Steinmayr et al., 2018, Study 2, Weber et al., 2013). However, only few studies considered intelligence and prior achievement together with more than two motivational constructs as predictors of school students' achievement (Steinmayr and Spinath, 2009; Kriegbaum et al., 2015). Kriegbaum et al. (2015) examined two expectancy components (i.e., ability self-concept and self-efficacy) and eight value components (i.e., interest, enjoyment, usefulness, learning goals, performance-approach, performance-avoidance goals, and work avoidance) in the domain of math. Steinmayr and Spinath (2009) investigated the role of an expectancy component (i.e., ability self-concept), five value components (i.e., task values, learning goals, performance-approach, performance-avoidance goals, and work avoidance), and students' achievement motives (i.e., hope for success, fear of failure, and need for achievement) for students' grades in math and German and their GPA. Both studies used relative weights analyses to compare the predictive power of all variables simultaneously while taking into account multicollinearity of the predictors (Johnson and LeBreton, 2004; Tonidandel and LeBreton, 2011). Findings showed that – after controlling for differences in students' intelligence and their prior achievement – expectancy components (ability self-concept, self-efficacy) were the best motivational predictors of achievement followed by task values (i.e., intrinsic/enjoyment, attainment, and utility), need for achievement and learning goals (Steinmayr and Spinath, 2009; Kriegbaum et al., 2015). However, Steinmayr and Spinath (2009) who investigated the relations in three different domains did not assess all motivational constructs on the same level of specificity as the achievement criteria. More precisely, students' achievement as well as motivational beliefs and task values were assessed domain-specifically (e.g., math grades, math self-concept, math task values), whereas students' goals were only measured for school in general (e.g., "In school it is important for me to learn as much as possible") and students' achievement motives were only measured on a domain-general level (e.g., "Difficult problems appeal to me"). Thus, the importance of goals and achievement motives for math and German grades might have been underestimated because the specificity levels of predictor and criterion variables did not match (e.g., Ajzen and Fishbein, 1977; Baranik et al., 2010). Assessing students' goals and their achievement motives with reference to a specific subject might result in higher associations with domain-specific achievement criteria (see Sparfeldt and Rost, 2011).

Taken together, although previous work underlines the important roles of expectancy and value components of motivation for school students' academic achievement, hitherto, we know little about the relative importance of expectancy components, task values, goals, and achievement motives in different domains when all of them are assessed at the same level of specificity as the achievement criteria (e.g., achievement motives in math → math grades; ability self-concept for school → GPA).

The Present Research

The goal of the present study was to examine the relative importance of several of the most important achievement motivation constructs in predicting school students' achievement. We substantially extend previous work in this field by considering (1) diverse motivational constructs, (2) students' intelligence and their prior achievement as achievement predictors in one sample, and (3) by assessing all predictors on the same level of specificity as the achievement criteria. Moreover, we investigated the relations in three different domains: school

in general, math, and German. Because there is no study that assessed students' goal orientations and achievement motives besides their ability self-concept and task values on the same level of specificity as the achievement criteria, we could not derive any specific hypotheses on the relative importance of these constructs, but instead investigated the following research question (RQ):

RQ. What is the relative importance of students' domain-specific ability self-concepts, task values, goal orientations, and achievement motives for their grades in the respective domain when including all of them, students' intelligence and prior achievement simultaneously in the analytic models?

MATERIALS AND METHODS

Participants and Procedure

A sample of 345 students was recruited from two German schools attending the highest academic track (Gymnasium). Only 11th graders participated at one school, whereas 11th and 12th graders participated at the other. Students of the different grades and schools did not differ significantly on any of the assessed measures. Students represented the typical population of this type of school in Germany; that is, the majority was Caucasian and came from medium to high socioeconomic status homes. At the time of testing, students were on average 17.48 years old (SD = 1.06). As is typical for this kind of school, the sample comprised more girls (n = 200) than boys (n = 145). We verify that the study is in accordance with established ethical guidelines. Approval by an ethics committee was not required as per the institution's guidelines and applicable regulations in the federal state where the study was conducted. Participation was voluntarily and no deception took place. Before testing, we received written informed consent forms from the students and from the parents of the students who were under the age of 18 on the day of the testing. If students did not want to participate, they could spend the testing time in their teacher's room with an extra assignment. All students agreed to participate. Testing took place during regular classes in schools in 2013. Tests were administered by trained research assistants and lasted about 2.5 h. Students filled in the achievement motivation questionnaires first, and the intelligence test was administered afterward. Before the intelligence test, there was a short break.

Measures

Ability Self-Concept

Students' ability self-concepts were assessed with four items per domain (Schöne et al., 2002). Students indicated on a 5-point scale ranging from 1 (totally disagree) to 5 (totally agree) how good they thought they were at different activities in school in general, math, and German ("I am good at school in general/math/German," "It is easy to for me to learn in school in general/math/German," "In school in general/math/German, I know a lot," and "Most assignments in school/math/German are easy for me"). Internal consistency (Cronbach's α) of the ability self-concept scale was high in school in general, in math, and in German ($0.82 \leq \alpha \leq 0.95$; see **Table 1**).

Task Values

Students' task values were assessed with an established German scale (SESSW; Subjective scholastic value scale; Steinmayr and Spinath, 2010). The measure is an adaptation of items used by Eccles and Wigfield (1995) in different studies. It assesses intrinsic values, utility, and personal importance with three items each. Students indicated on a 5-point scale ranging from 1 (totally disagree) to 5 (totally agree) how much they valued school in general, math, and German (Intrinsic values: "I like school/math/German," "I enjoy doing things in school/math/German," and "I find school in general/math/German interesting"; Utility: "How useful is what you learn in school/math/German in general?," "School/math/German will be useful in my future," "The things I learn in school/math/German will be of use in my future life"; Personal importance: "Being good at school/math/German is important to me," "To be good at school/math/German means a lot to me," "Attainment in school/math/German is important to me"). Internal consistency of the values scale was high in all domains ($0.90 \leq \alpha \leq 0.93$; see **Table 1**).

Goal Orientations

Students' goal orientations were assessed with an established German self-report measure (SELLMO; Scales for measuring learning and achievement motivation; Spinath et al., 2002). In accordance with Sparfeldt et al. (2007), we assessed goal orientations with regard to different domains: school in general, math, and German. In each domain, we used the SELLMO to assess students' learning goals, performance-avoidance goals, and work avoidance with eight items each and their performance-approach goals with seven items. Students' answered the items on a 5-point scale ranging from 1 (totally disagree) to 5 (totally agree). All items except for the work avoidance items are printed in Spinath and Steinmayr (2012), p. 1148). A sample item to assess work avoidance is: "In school/math/German, it is important to me to do as little work as possible." Internal consistency of the learning goals scale was high in all domains ($0.83 \leq \alpha \leq 0.88$). The same was true for performance-approach goals ($0.85 \leq \alpha \leq 0.88$), performance-avoidance goals ($\alpha = 0.89$), and work avoidance ($0.91 \leq \alpha \leq 0.92$; see **Table 1**).

Achievement Motives

Achievement motives were assessed with the Achievement Motives Scale (AMS; Gjesme and Nygard, 1970; Göttert and Kuhl, 1980). In the present study, we used a short form measuring "hope for success" and "fear of failure" with the seven items per subscale that showed the highest factor loadings. Both subscales were assessed in three domains: school in general, math, and German. Students' answered all items on a 4-point scale ranging from 1 (does not apply at all) to 4 (fully applies). An example hope for success item is "In school/math/German, difficult problems appeal to me," and an example fear of failure item is "In school/math/German, matters that are slightly difficult disconcert me." Internal consistencies of hope for success and fear of failure scales were high in all domains (hope for success: $0.88 \leq \alpha \leq 0.92$; fear of failure: $0.90 \leq \alpha \leq 0.91$; see **Table 1**).

TABLE 1 | Means (*M*), Standard Deviations (*SD*), and Reliabilities (α) for all measures.

Domain	School			Math			German			Intelligence		
Variables	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α
ASC	3.53	0.54	0.82	3.26	1.01	0.95	3.59	0.82	0.92			
Task values	3.72	0.68	0.90	3.38	0.90	0.93	3.67	0.79	0.92			
LG	3.83	0.58	0.83	3.65	0.77	0.88	3.77	0.67	0.86			
P-ApG	2.49	0.82	0.85	3.12	0.84	0.88	2.46	0.81	0.85			
P-AvG	3.24	0.75	0.89	2.41	0.81	0.89	3.17	0.77	0.89			
WA	2.60	0.85	0.91	2.61	0.90	0.91	2.64	0.87	0.92			
HfS	2.71	0.61	0.88	2.65	0.79	0.92	2.64	0.68	0.91			
FoF	1.95	0.66	0.90	1.99	0.71	0.90	1.88	0.68	0.91			
Grade	4.13	0.67		3.98	1.11		4.16	0.87				
g										108.84	17.76	0.90
Numerical										34.59	6.09	0.89
Verbal										40.15	9.38	0.71

N = 345 students. ASC, ability self-concept; LG, learning goals; P-ApG, performance-approach goals; P-AvG, performance-avoidance goals; WA, work avoidance; HfS, hope for success; FoF, fear of failure; g, general intelligence; Numerical, numeric intelligence; Verbal, verbal intelligence. Grades were recoded.

Intelligence

Intelligence was measured with the basic module of the Intelligence Structure Test 2000 R, a well-established German multifactor intelligence measure (I-S-T 2000 R; Amthauer et al., 2001). The basic module of the test offers assessments of domain-specific intelligence for verbal, numeric, and figural abilities as well as an overall intelligence score (a composite of the three facets). The overall intelligence score is thought to measure reasoning as a higher order factor of intelligence and can be interpreted as a measure of general intelligence, *g*. Its construct validity has been demonstrated in several studies (Amthauer et al., 2001; Steinmayr and Amelang, 2006). In the present study, we used the scores that were closest to the domains we investigated: overall intelligence, numerical intelligence, and verbal intelligence (see also Steinmayr and Spinath, 2009). Raw values could range from 0 to 60 for verbal and numerical intelligence, and from 0 to 180 for overall intelligence. Internal consistencies of all intelligence scales were high ($0.71 \leq \alpha \leq 0.90$; see **Table 1**).

Academic Achievement

For all students, the school delivered the report cards that the students received 3 months before testing (t0) and 4 months after testing (t2), at the end of the term in which testing took place. We assessed students' grades in German and math as well as their overall grade point average (GPA) as criteria for school performance. GPA was computed as the mean of all available grades, not including grades in the nonacademic domains Sports and Music/Art as they did not correlate with the other grades. Grades ranged from 1 to 6, and were recoded so that higher numbers represented better performance.

Statistical Analyses

We conducted relative weight analyses to predict students' academic achievement separately in math, German, and school in general. The relative weight analysis is a statistical procedure that enables to determine the relative importance of each predictor in a multiple regression analysis ("relative weight") and to take adequately into account the multicollinearity of the different motivational constructs (for details, see Johnson and LeBreton, 2004; Tonidandel and LeBreton, 2011). Basically, it uses a variable transformation approach to create a new set of predictors that are orthogonal to one another (i.e., uncorrelated). Then, the criterion is regressed on these new orthogonal predictors, and the resulting standardized regression coefficients can be used because they no longer suffer from the deleterious effects of multicollinearity. These standardized regression weights are then transformed back into the metric of the original predictors. The rescaled relative weight of a predictor can easily be transformed into the percentage of variance that is uniquely explained by this predictor when dividing the relative weight of the specific predictor by the total variance explained by all predictors in the regression model (R^2). We performed the relative weight analyses in three steps. In Model 1, we included the different achievement motivation variables assessed in the respective domain in the analyses. In Model 2, we entered intelligence into the analyses in addition to the achievement motivation variables. In Model 3, we included prior school performance indicated by grades measured before testing in addition to all of the motivation variables and intelligence. For all three steps, we tested for whether all relative weight factors differed significantly from each other (see Johnson, 2004) to determine which motivational construct was most important in predicting academic achievement (RQ).

RESULTS

Descriptive Statistics and Intercorrelations

Table 1 shows means, standard deviations, and reliabilities. **Tables 2–4** show the correlations between all scales in school in general, in math, and in German. Of particular relevance here, are the correlations between the motivational constructs and students' school grades. In all three domains (i.e., school in general/math/German), out of all motivational predictor

TABLE 2 | Intercorrelations between all variables in school in general.

Motivation in school	Task values	LG	P-AgG	P-AvG	WA	HfS	FoF	*g*	GPAt0	GPAt2
ASC	0.45	0.41	0.00	0.29	−0.27	0.45	−0.31	0.13	0.53	**0.53**
Task Values		0.57	0.10	0.36	−0.41	0.43	−0.07	−0.03	0.26	**0.25**
LG			0.09	0.36	−0.42	0.51	−0.07	0.06	0.27	**0.24**
P-ApG				0.59	0.00	0.29	0.14	−0.05	0.15	**0.11**
P-AvG					0.33	0.03	0.42	−0.02	−0.03	**−0.04**
WA						−0.41	0.22	0.08	-0.22	**−0.21**
HfS							−0.28	−0.03	0.33	**0.32**
FoF								−0.12	−0.27	**−0.28**
g									0.24	**0.28**
GPAt0										0.84
GPAt2										**—**

N = 345. ASC, ability self-concept; LG, learning goals; P-ApG, performance-approach goals; P-AvG, performance-avoidance goals; WA, work avoidance; HfS, hope for success; FoF, fear of failure; g, general intelligence; GPA, Grade Point Average; t0, before testing; t2, after testing. Correlations reflecting criterion-related validities are printed in bold. $r \geq |0.11|$, $p < 0.05$. $r \geq |0.14|$, $p < 0.01$. $r \geq |0.17|$, $p < 0.001$.

variables, students' ability self-concepts showed the strongest associations with subsequent grades (r = 0.53/0.61/0.46; see **Tables 2–4**). Except for students' performance-avoidance goals ($-0.04 \leq r \leq 0.07$, $p > 0.05$), the other motivational constructs were also significantly related to school grades. Most of the respective correlations were evenly dispersed around a moderate effect size of $|r| = 0.30$.

Relative Weight Analyses

Table 5 presents the results of the relative weight analyses. In Model 1 (only motivational variables) and Model 2 (motivation and intelligence), respectively, the overall explained variance was highest for math grades (R^2 = 0.42 and R^2 = 0.42, respectively) followed by GPA (R^2 = 0.30 and R^2 = 0.34, respectively) and grades in German (R^2 = 0.26 and R^2 = 0.28, respectively). When prior school grades were additionally considered (Model 3) the largest amount of variance was explained in students' GPA (R^2 = 0.73), followed by grades in German (R^2 = 0.59) and math (R^2 = 0.57). In the following, we will describe the results of Model 3 for each domain in more detail.

Beginning with the prediction of students' GPA: In Model 3, students' prior GPA explained more variance in subsequent GPA than all other predictor variables (68%). Students' ability self-concept explained significantly less variance than prior GPA but still more than all other predictors that we considered (14%). The relative weights of students' intelligence (5%), task values (2%), hope for success (4%), and fear of failure (3%) did not differ significantly from each other but were still significantly different from zero ($p < 0.05$). The relative weights of students' goal orientations were not significant in Model 3.

Turning to math grades: The findings of the relative weight analyses for the prediction of math grades differed slightly from the prediction of GPA. In Model 3, the relative weights of numerical intelligence (2%) and performance-approach goals (2%) in math were no longer different from zero ($p > 0.05$); in Model 2 they were. Prior math grades explained the largest share of the unique variance in subsequent math grades (45%), followed by math self-concept (19%). The relative weights of students' math task values (9%), learning goals (5%), work avoidance (7%), and hope for success (6%) did not differ significantly from each other. Students' fear of failure in math explained the smallest amount of unique variance in their math grades (4%) but the relative weight of students' fear of failure did not differ significantly from that of students' hope for success, work avoidance, and learning goals. The relative weights of students' performance-avoidance goals were not significant in Model 3.

Turning to German grades: In Model 3, students' prior grade in German was the strongest predictor (64%), followed by German self-concept (10%). Students' fear of failure in German (6%), their verbal intelligence (4%), task values (4%), learning goals (4%), and hope for success (4%) explained less variance in German grades and did not differ significantly from each other but were significantly different from zero ($p < 0.05$). The relative weights of students' performance goals and work avoidance were not significant in Model 3.

DISCUSSION

In the present studies, we aimed to investigate the relative importance of several achievement motivation constructs in predicting students' academic achievement. We sought to overcome the limitations of previous research in this field by (1) considering several theoretically and empirically distinct motivational constructs, (2) students' intelligence, and their prior achievement, and (3) by assessing all predictors at the same level of specificity as the achievement criteria. We applied sophisticated statistical procedures to investigate the relations in three different domains, namely school in general, math, and German.

Relative Importance of Achievement Motivation Constructs for Academic Achievement

Out of the motivational predictor variables, students' ability self-concepts explained the largest amount of variance in their academic achievement across all sets of analyses and across all

TABLE 3 | Intercorrelations between all variables in math.

Motivation in math	Task values	LG	P-AgG	P-AvG	WA	HfS	FoF	Numerical	Math Gt0	Math Gt2
ASC	0.76	0.57	0.54	0.21	−0.24	0.68	−0.42	0.36	0.68	**0.61**
Task values		0.70	0.60	0.25	−0.36	0.68	−0.32	0.21	0.54	**0.50**
LG			0.62	0.23	−0.45	0.64	−0.26	0.19	0.46	**0.42**
P-ApG				0.59	−0.14	0.52	−0.13	0.19	0.38	**0.28**
P-AvG					0.21	0.21	0.23	0.10	0.13	**0.07**
WA						−0.38	0.24	0.06	−0.29	**−0.34**
HfS							−0.35	0.28	0.51	**0.45**
FoF								−0.23	−0.30	**−0.30**
Numerical									−0.27	**0.22**
Math Gt0										**0.72**
Math Gt2										—

N = 345. ASC, ability self-concept; LG, learning goals; P-ApG, performance-approach goals; P-AvG, performance-avoidance goals; WA, work avoidance; HfS, hope for success; FoF, fear of failure; Numerical, numerical intelligence; Math G, math grade; t0, before testing; t2, after testing. Correlations reflecting criterion-related validities are printed in bold. $r \geq |0.11|$, $p < 0.05$. $r \geq |0.14|$, $p < 0.01$. $r \geq |0.17|$, $p < 0.001$.

TABLE 4 | Intercorrelations between all variables in German.

Motivation in German	Task values	LG	P-AgG	P-AvG	WA	HfS	FoF	Verbal	German G	German G
ASC	0.68	0.58	−0.01	0.38	−0.36	0.55	−0.27	−0.17	0.41	**0.46**
Task Values		0.70	0.08	0.45	−0.37	0.58	−0.10	−0.21	0.30	**0.34**
LG			0.06	0.47	−0.47	0.65	−0.13	−0.12	0.34	**0.34**
P-ApG				0.55	−0.09	0.44	−0.01	−0.05	0.20	**0.23**
P-AvG					0.26	0.11	0.34	0.02	−0.01	**−0.03**
WA						−0.47	0.23	0.18	−0.20	**−0.21**
HfS							−0.30	−0.08	0.28	**0.33**
FoF								−0.16	−0.24	**−0.31**
Verbal									0.19	**0.10**
German Gt0										0.73
German Gt2										—

N = 345. ASC, ability self-concept; LG, learning goals; P-ApG, performance-approach goals; P-AvG, performance-avoidance goals; WA, work avoidance; HfS, hope for success; FoF, fear of failure; Verbal, verbal intelligence; German G, German grade; t0, before testing; t2, after testing. Correlations reflecting criterion-related validities are printed in bold. $r \geq |0.11|$, $p < 0.05$. $r \geq |0.14|$, $p < 0.01$. $r \geq |0.17|$, $p < 0.001$.

investigated domains. Even when intelligence and prior grades were controlled for, students' ability self-concepts accounted for at least 10% of the variance in the criterion. The relative superiority of ability self-perceptions is in line with the available literature on this topic (e.g., Steinmayr and Spinath, 2009; Kriegbaum et al., 2015; Steinmayr et al., 2018) and with numerous studies that have investigated the relations between students' self-concept and their achievement (e.g., Möller et al., 2009; Huang, 2011). Ability self-concepts showed even higher relative weights than the corresponding intelligence scores. Whereas some previous studies have suggested that self-concepts and intelligence are at least equally important when predicting students' grades (e.g., Steinmayr and Spinath, 2009; Weber et al., 2013; Schneider et al., 2018), our findings indicate that it might be even more important to believe in own school-related abilities than to possess outstanding cognitive capacities to achieve good grades (see also Lotz et al., 2018). Such a conclusion was supported by the fact that we examined the relative importance of all predictor variables across three domains and at the same levels of specificity, thus maximizing criterion-related validity (see Baranik et al., 2010). This procedure represents a particular strength of our study and sets it apart from previous studies in the field (e.g., Steinmayr and Spinath, 2009). Alternatively, our findings could be attributed to the sample we investigated at least to some degree. The students examined in the present study were selected for the academic track in Germany, and this makes them rather homogeneous in their cognitive abilities. It is therefore plausible to assume that the restricted variance in intelligence scores decreased the respective criterion validities.

When all variables were assessed at the same level of specificity, the achievement motives hope for success and fear of failure were the second and third best motivational predictors of academic achievement and more important than in the study by Steinmayr and Spinath (2009). This result underlines the original conceptualization of achievement motives as broad personal tendencies that energize approach or avoidance behavior across different contexts and situations (Elliot, 2006). However, the explanatory power of achievement motives was higher in the more specific domains of math and German, thereby also supporting the suggestion made by Sparfeldt and Rost (2011) to conceptualize achievement motives more domain-specifically. Conceptually, achievement motives and ability self-concepts

TABLE 5 | Relative weights and percentages of explained criterion variance (%) for all motivational constructs (Model 1) plus intelligence (Model 2) plus prior school achievement (Model 3).

Predictor	Model 1: Achievement motivation						Model 2: Achievement motivation + Intelligence						Model 3: Achievement motivation + Intelligence + Prior school achievement					
	RW			%			RW			%			RW			%		
	GPA	Math	German	GPA	Math	German	GPA	Math	German	GPA	Math	German	GPA	Math	German	GPA	Math	German
Achievement t0													0.496^{a}	0.259^{a}	0.375^{a}	68.3	45.3	64.1
Specific intelligence							0.059^{b}	0.016^{c}	0.035^{b}	17.0	3.9	12.4	0.037^{c}	0.012	0.022^{c}	5.1	2.1	3.8
Ability self-concept	0.182^{a}	0.172^{a}	0.093^{a}	60.0	41.1	35.9	0.170^{a}	0.162^{a}	0.088^{a}	49.2	38.7	31.2	0.103^{b}	0.106^{b}	0.060^{b}	14.2	18.5	10.3
Task Values	0.018^{b}	0.067^{b}	0.031^{b}	5.9	16.1	11.9	0.021^{c}	0.066^{b}	0.031^{b}	6.1	15.8	10.9	0.016^{c}	0.053^{c}	0.026^{c}	2.2	9.3	4.4
Learning goals	0.014	$0.038^{b,c}$	0.030^{b}	4.7	9.1	11.7	0.013	$0.037^{b,c}$	0.029^{b}	3.7	8.9	10.3	0.011	$0.031^{c,d}$	0.022^{c}	1.5	5.4	3.8
P-ApG	0.005	0.016^{d}	0.015	1.5	3.9	1.4	0.005	0.016^{c}	0.015^{c}	1.3	3.7	5.4	0.003	0.013	0.013	0.2	2.3	2.3
P-AvG	0.002	0.004	0.004	0.6	1.0	5.7	0.002	0.004	0.004	0.6	0.9	1.3	0.001	0.003	0.003	0.5	0.5	0.6
Work avoidance	0.011	$0.047^{b,c}$	0.008	3.7	11.3	3.1	0.015	0.049^{b}	0.009	4.3	11.7	3.2	0.011	$0.038^{c,d}$	0.007	1.5	6.7	1.2
Hope for success	0.034^{b}	$0.047^{b,c}$	0.024^{b}	11.4	11.2	9.2	$0.031^{b,c}$	0.044^{b}	$0.025^{b,c}$	9.1	10.5	8.8	0.025^{c}	$0.036^{c,d}$	0.022^{c}	3.5	6.2	3.8
Fear of failure	0.037^{b}	$0.027^{c,d}$	0.055^{b}	12.3	6.4	21.2	$0.030^{b,c}$	0.025^{c}	0.047^{b}	8.7	5.9	16.5	0.022^{c}	0.020^{d}	0.034^{c}	3.1	3.6	5.7
Explained variance R^2	0.303	0.418	0.259	100	100	100	0.344	0.419	0.284	100	100	100	0.726	0.572	0.585	100	100	100

Criterion, students' achievement after testing; GPA, Grade Point Average; P-ApG, performance-approach goals; P-AvG, performance-avoidance goals. Relative weights with a superscript are significantly different from zero at $p < 0.05$. Values with different superscripts are significantly different at $p < 0.05$.

are closely related. Individuals who believe in their ability to succeed often show greater hope for success than fear of failure and vice versa (Brunstein and Heckhausen, 2008). It is thus not surprising that the two constructs showed similar stability in their relative effects on academic achievement across the three investigated domains. Concerning the specific mechanisms through which students' achievement motives and ability self-concepts affect their achievement, it seems that they elicit positive or negative valences in students, and these valences in turn serve as simple but meaningful triggers of (un)successful school-related behavior. The large and consistent effects for students' ability self-concept and their hope for success in our study support recommendations from positive psychology that individuals think positively about the future and regularly provide affirmation to themselves by reminding themselves of their positive attributes (Seligman and Csikszentmihalyi, 2000). Future studies could investigate mediation processes. Theoretically, it would make sense that achievement motives defined as broad personal tendencies affect academic achievement via expectancy beliefs like ability self-concepts (e.g., expectancy-value theory by Eccles and Wigfield, 2002; see also, Atkinson, 1957).

Although task values and learning goals did not contribute much toward explaining the variance in GPA, these two constructs became even more important for explaining variance in math and German grades. As Elliot (2006) pointed out in his hierarchical model of approach-avoidance motivation, achievement motives serve as basic motivational principles that energize behavior. However, they do not guide the precise direction of the energized behavior. Instead, goals and task values are commonly recruited to strategically guide this basic motivation toward concrete aims that address the underlying desire or concern. Our results are consistent with Elliot's (2006) suggestions. Whereas basic achievement motives are equally important at abstract and specific achievement levels, task values and learning goals release their full explanatory power with increasing context-specificity as they affect students' concrete actions in a given school subject. At this level of abstraction, task values and learning goals compete with more extrinsic forms of motivation, such as performance goals. Contrary to several studies in achievement-goal research, we did not demonstrate the importance of either performance-approach or performance-avoidance goals for academic achievement.

Whereas students' ability self-concept showed a high relative importance above and beyond intelligence, with few exceptions, each of the remaining motivation constructs explained less than 5% of the variance in students' academic achievement in the full model including intelligence measures. One might argue that the high relative importance of students' ability self-concept is not surprising because students' ability self-concepts more strongly depend on prior grades than the other motivation constructs. Prior grades represent performance feedback and enable achievement comparisons that are seen as the main determinants of students' ability self-concepts (see Skaalvik and Skaalvik, 2002). However, we included students' prior grades in the analyses and students' ability self-concepts still were the most powerful predictors of academic achievement out

of the achievement motivation constructs that were considered. It is thus reasonable to conclude that the high relative importance of students' subjective beliefs about their abilities is not only due to the overlap of this believes with prior achievement.

Limitations and Suggestions for Further Research

Our study confirms and extends the extant work on the power of students' ability self-concept net of other important motivation variables even when important methodological aspects are considered. Strength of the study is the simultaneous investigation of different achievement motivation constructs in different academic domains. Nevertheless, we restricted the range of motivation constructs to ability self-concepts, task values, goal orientations, and achievement motives. It might be interesting to replicate the findings with other motivation constructs such as academic self-efficacy (Pajares, 2003), individual interest (Renninger and Hidi, 2011), or autonomous versus controlled forms of motivation (Ryan and Deci, 2000). However, these constructs are conceptually and/or empirically very closely related to the motivation constructs we considered (e.g., Eccles and Wigfield, 1995; Marsh et al., 2018). Thus, it might well be the case that we would find very similar results for self-efficacy instead of ability self-concept as one example.

A second limitation is that we only focused on linear relations between motivation and achievement using a variable-centered approach. Studies that considered different motivation constructs and used person-centered approaches revealed that motivation factors interact with each other and that there are different profiles of motivation that are differently related to students' achievement (e.g., Conley, 2012; Schwinger et al., 2016). An important avenue for future studies on students' motivation is to further investigate these interactions in different academic domains.

Another limitation that might suggest a potential avenue for future research is the fact that we used only grades as an indicator of academic achievement. Although, grades are of high practical relevance for the students, they do not necessarily indicate how much students have learned, how much they know and how creative they are in the respective domain (e.g., Walton and Spencer, 2009). Moreover, there is empirical evidence that the prediction of academic achievement differs according to the particular criterion that is chosen (e.g., Lotz et al., 2018). Using standardized test performance instead of grades might lead to different results.

Our study is also limited to 11th and 12th graders attending the highest academic track in Germany. More balanced samples are needed to generalize the findings. A recent study (Ben-Eliyahu, 2019) that investigated the relations between different motivational constructs (i.e., goal orientations, expectancies, and task values) and self-regulated learning in university students revealed higher relations for gifted students than for typical students. This finding indicates that relations between different aspects of motivation might differ between academically selected samples and unselected samples.

Finally, despite the advantages of relative weight analyses, this procedure also has some shortcomings. Most important, it is based on manifest variables. Thus, differences in criterion validity might be due in part to differences in measurement error. However, we are not aware of a latent procedure that is comparable to relative weight analyses. It might be one goal for methodological research to overcome this shortcoming.

CONCLUSION

We conducted the present research to identify how different aspects of students' motivation uniquely contribute to differences in students' achievement. Our study demonstrated the relative importance of students' ability self-concepts, their task values, learning goals, and achievement motives for students' grades in different academic subjects above and beyond intelligence and prior achievement. Findings thus broaden our knowledge on the role of students' motivation for academic achievement. Students' ability self-concept turned out to be the most important motivational predictor of students' grades above and beyond differences in their intelligence and prior grades, even when all predictors were assessed domain-specifically. Out of two students with similar intelligence scores, same prior achievement, and similar task values, goals and achievement motives in a domain, the student with a higher domain-specific ability self-concept will receive better school grades in the respective domain. Therefore, there is strong evidence that believing in own competencies is advantageous with respect to academic achievement. This finding shows once again that it is a promising approach to implement validated interventions aiming at enhancing students' domain-specific ability-beliefs in school (see also Muenks et al., 2017; Steinmayr et al., 2018).

DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

In Germany, institutional approval was not required by default at the time the study was conducted. That is, why we cannot provide a formal approval by the institutional ethics committee. We verify that the study is in accordance with established ethical guidelines. Participation was voluntarily and no deception took place. Before testing, we received informed consent forms from the parents of the students who were under the age of 18 on the day of the testing. If students did not want to participate, they could spend the testing time in their teacher's room with an extra assignment. All students agreed to participate. We included this information also in the manuscript.

AUTHOR CONTRIBUTIONS

RS conceived and supervised the study, curated the data, performed the formal analysis, investigated the results, developed

the methodology, administered the project, and wrote, reviewed, and edited the manuscript. AW wrote, reviewed, and edited the manuscript. MS performed the formal analysis, and wrote, reviewed, and edited the manuscript. BS conceived the study, and wrote, reviewed, and edited the manuscript.

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Being Smart Is Not Enough: Personality Traits and Vocational Interests Incrementally Predict Intention, Status and Success of Leaders and Entrepreneurs Beyond Cognitive Ability

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Three separate studies demonstrate that socio-emotional skills add incremental validity beyond cognitive ability when predicting leadership and entrepreneurship intention, emergence as well as success. Study 1 uses a longitudinal approach and tests the cognitive ability and vocational interests of 231 students to predict their leadership and entrepreneurship intention. It demonstrates that cognitive ability predicts their intention to become a business leader or entrepreneur 2 years in the future. Importantly, the vocational interests "enterprising" and "social" increase this ability-driven prediction of leadership and entrepreneurship intention ($\Delta R^2_{\text{Lead.Intent.}}$ = 15%, $\Delta R^2_{\text{Entre.Intent.}}$ = 9%). Study 2 investigates 123 business leaders and shows that those with higher cognitive ability more likely emerge as top-level leaders, receive more income and get slightly better supervisor-ratings on their performance. The leaders' Big Five traits (openness, conscientiousness, extraversion, agreeableness, emotional stability) added validity beyond cognitive ability when predicting these criteria ($\Delta R^2_{\text{Income}}$ = 9%, $\Delta R^2_{\text{Lead.Level}}$ = 8%, $\Delta R^2_{\text{Perform.}}$ = 15%). Finally, Study 3 includes 155 participants and demonstrates that cognitive ability predicts a person's entrepreneurial status but not performance. Additionally, considering the Big Five traits improves the prediction of who becomes an entrepreneur and successfully performs as such ($\Delta R^2_{\text{Status}}$ = 7%, $\Delta R^2_{\text{Perform.}}$ = 18%). Importantly, selected Big Five traits and vocational interests boost the importance of cognitive ability in the field of leadership and entrepreneurship. Concluding, this series of studies suggests that it is the combination of personality traits or interests with cognitive ability which is most powerful when predicting leadership and entrepreneurship intention, emergence and success.

Keywords: Big Five, cognitive ability, entrepreneurship, incremental validity, intelligence, leadership, vocational interest

INTRODUCTION

One of the most important predictors of job success is a person's cognitive ability. Higher cognitive ability leads to more success at work and becomes even more relevant when jobs become intellectually challenging (Salgado et al., 2003). In addition to cognitive ability, socio-emotional skills such as conscientiousness or emotional stability also influence success (He et al., 2019). Socio-emotional skills play a particularly crucial role in so-called *weak* situations in which the degree of freedom for individual action is large and thus success strongly relies on a person's character (Seibert et al., 1999).

Responsible jobs in business, such as being a leader or entrepreneur, certainly offer both high intellectual challenge and great freedom for action. Here the question arises as to whether both cognitive ability and socio-emotional skills are conjointly needed to become a successful leader and entrepreneur or whether one can compensate the other. Surprisingly, research is relatively silent about this matter. For instance, the conjoined effect of cognitive ability and socio-emotional skills has received scant attention in the field of entrepreneurship. The few existing findings provide promising insights, yet their generalization seems limited mainly due to two reasons. First, they use proxies rather than reliable tests for measuring ability and second, they refer only to a small number of socio-emotional skills. Our investigation aims at closing this research gap. It focuses on leaders and entrepreneurs as they are powerful players in our society and pursues three goals. The first goal is to examine whether socio-emotional skills increase the validity of cognitive ability when predicting leadership and entrepreneurship *intention*. The second goal refers to the question whether socio-emotional skills add incremental validity over cognitive ability when predicting leadership and entrepreneurship *emergence* and *success*. Finally, the third goal addresses the question in how far socio-emotional skills *interact* with cognitive ability. Here, we examine questions such as 'Can a leader's cognitive ability buffer his/her reduced socio-emotional skills?' or 'Is a certain level of cognitive ability necessary to unleash the potential of an entrepreneur's socio-emotional skills?' To this end, the socio-emotional skills which will be studied in this investigation are vocational interests and personality traits.

To pursue the three goals, we present three separate studies which are connected on the grounds of the Leader–Trait–Emergence–Effectiveness model (Judge et al., 2009). In line with this model, we see leadership and entrepreneurship intention as the first step toward a career in the field of leadership and entrepreneurship. This intention directly enhances the chance of achieving a leadership or entrepreneurship position which, in turn, is a necessity for achieving leadership and entrepreneurship success (Chan and Drasgow, 2001; Judge et al., 2009). In line with this intention–emergence–success logic, the first study focuses on leadership and entrepreneurship *intention* and summarizes results on whether vocational interests (Holland's, 1959 RIASEC model) interact with and add incremental validity beyond cognitive ability when predicting them. The subsequent studies emphasis leadership and entrepreneurship *emergence* and *success* as a consequence of expressing the respective intentions. In brief, the second study examines whether personality traits (Five-Factor Model, Costa and McCrae, 1992) interact with and add incremental validity over cognitive ability when predicting leadership emergence and success. Finally, the third study explores whether the same personality traits interact with and add novel information over cognitive ability when predicting a person's entrepreneurial status and success. **Figure 1** provides an overview of the three studies.

This article contributes to existing research in several ways. First, it offers novel insights into the conjoint effect of cognitive ability and socio-emotional skills on a wide range of outcomes relevant for leadership and entrepreneurship. In the field of entrepreneurship, it is among few studies to examine this conjoint effect using a validated ability measure instead of an ability proxy. Second, it enriches research by offering insights into the interplay between cognitive ability and socio-emotional skills. More detailed, it examines whether cognitive ability moderates the impact of socio-emotional skills on leadership and entrepreneurship intention, emergence and success. Finally, it offers information for recruiting, selecting and developing future leaders or entrepreneurs. Subsequently, we discuss relevant research on the importance of cognitive ability, personality traits and vocational interests for leadership and entrepreneurship a) intention, b) emergence and c) success.

Leadership and Entrepreneurship Intention Is Driven by Cognitive Ability and Interests

The first step toward a successful career in leadership or entrepreneurship is to express intention for such career paths and to actually become a leader or entrepreneur. In fact, intentions are prerequisites of any planned behavior (Ajzen, 1991). Thus, it is not surprising that leadership intention directly predicts a leader's emergence (Badura et al., 2019) and that entrepreneurship intention directly predicts entrepreneurial status (Kautonen et al., 2015). Consequently, we see leadership intention as a prerequisite for reaching leadership positions and further regard entrepreneurship intention as a prerequisite for entrepreneurial status. How these intentions are influenced by cognitive ability and vocational interests is subsequently summarized.

Leadership Intention and Cognitive Ability

People express leadership intention when they show behavior that affects their decision to assume leadership training, roles and responsibilities (Chan and Drasgow, 2001). So far, the impact of ability on leadership intention seems inconclusive. This is particularly true when the focus is set on *cognitive* ability which describes the "ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, [and] to overcome obstacles by taking thought" (Neisser et al., 1996, p. 77). While studies with impressive longitudinal data or large samples conclude that the intention to lead may not be a simple function of cognitive ability (Chan and Drasgow, 2001; Gottfried et al., 2011; Reichard et al., 2011), recent meta-analytic findings suggest that cognitive ability directly relates to leadership intention

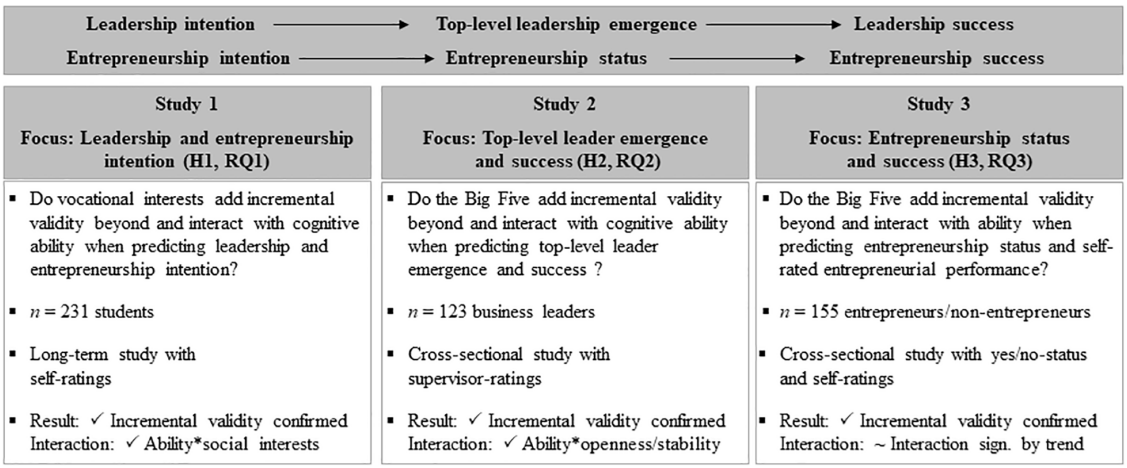

FIGURE 1 | Overview of the three studies within this investigation.

(Badura et al., 2019). Despite these somewhat conflicting findings, it is well documented that leading others is a highly complex job, which includes extensive strategic decisions and risk-taking. Because individuals with higher cognitive ability are attracted by this complexity as it fits their ability level, they should also be more likely to gravitate to careers in leadership (Uhl-Bien et al., 2007).

Leadership Intention and Vocational Interests

Leading others comes with challenges, which cannot always be met by ability-driven actions. This is particularly true for interpersonal challenges. Showing *interest* in their job helps leaders to stay motivated to conquer difficult situations (Bergner et al., 2019). Among different interests, vocational interests are particularly important, which is why we subsequently focus on them (Holland, 1959).

Vocational interests are most prominently connected to Holland's (1959) model, which comprises the six interests Realistic, Investigative, Artistic, Social, Enterprising and Conventional. From a theoretical perspective, "enterprising" is the interest most closely related to leadership as enterprising individuals show high interest in leadership tasks. On the one hand, those with strong enterprising interests favor leading groups, negotiating with and convincing others and are thus interested in the *person-driven* tasks of leading. Yet, they also enjoy organizing events, selling ideas and structuring information and are thus also interested in the *data-driven* tasks of leading. Consequently, enterprising interests should enhance a person's leadership intention, because they are tied to a preference for dealing with both, the person-driven and data-driven leadership tasks (Burke et al., 2006).

Enterprising interests are conceptually closest to social and conventional ones (Holland, 1959), which is why these last two should also influence leadership intention, though to a lesser extent. While individuals with social interests prefer *person-driven* leadership tasks, such as talking to people, giving advice and cooperating with them, individuals with conventional interests rather enjoy *data-driven* leadership tasks, such as checking accounts, checking the observance of guidelines and working with facts and figures. As the three vocational interests enterprising, social and conventional supposedly foster a person's intention to lead, we will focus solely on them.

Entrepreneurship Intention and Cognitive Ability

Those who are determined to set up a new business venture at some point in the future and plan to do so, express entrepreneurship intention (Thompson, 2009). The impact of cognitive ability on entrepreneurship intention seems rather underexplored. However, there is reason to assume that cognitive ability enhances the intent to pursue an entrepreneurial career. First, entrepreneurial jobs are rather complex with less routine and demand strategic thinking and dealing with multifaceted challenges. As previously mentioned, individuals with higher cognitive ability should be drawn to such complexity as it matches their ability level. Second, empirical findings show that skills related to cognitive ability, such as practical intelligence, affect entrepreneurial status (Baum et al., 2011) and it is thus reasonable to assume that cognitive ability also relates to entrepreneurial intention. In the light of these findings, we assume a positive relationship between cognitive ability and entrepreneurship intention.

Entrepreneurship Intention and Vocational Interests

Previous research shows that those with higher entrepreneurial interests express more entrepreneurial career prospects and launch their first business earlier (Schmitt-Rodermund, 2004). Using Holland's (1959) interests, Almeida et al. (2014) further demonstrated that enterprising interests enhance a person's awareness of entrepreneurial possibilities and also relate to entrepreneurial activities, like selling products. Based on these findings and on the assumption that vocational interests in entrepreneurship are needed to pursue an entrepreneurial career, we presume that Holland's enterprising interest enhances a person's entrepreneurship intention. Due to the theoretical

proximity of enterprising, social and conventional interests we further assume that social and conventional interests also increase a person's entrepreneurship intention, although to a lesser extent.

Concluding, cognitive ability and vocational interests ought to drive a person's entrepreneurship and leadership intention. Importantly, this intention is a prerequisite for actually becoming an entrepreneur or leader which, in turn, is a requirement for achieving entrepreneurial or leadership success (Chan and Drasgow, 2001; Judge et al., 2009). The subsequent sections summarize relevant findings on the link between socio-emotional skills and the *emergence* as well as *success* of leaders and entrepreneurs.

At this point it is vital to keep in mind that cognitive ability most likely drives all three, the intentions, emergence *and* success of leaders or entrepreneurs while vocational interests primarily relate to intentions (Thomas et al., 2001). In fact, vocational interests seem less important for the emergence and success of leaders or entrepreneurs while other socio-emotional skills like personality traits more strongly influence them (e.g., Barrick et al., 2001; Zhao and Seibert, 2006). Hence, we will subsequently focus on personality traits and discuss their role alongside cognitive ability when addressing the impact of socio-emotional skills in leadership and entrepreneurship.

A Leader's and Entrepreneur's Emergence as Well as Success Is Driven by Cognitive Ability

Leadership and Cognitive Ability

Leaders with higher cognitive ability are more successful at their job. Meta-analyses confirm this positive relation and further show that the link between cognitive ability and job success is weaker for leaders compared to non-leaders (Judge et al., 2004; Hoffman et al., 2011). In fact, in the long term, the leaders' success[1] seems to depend more strongly on their personality traits than on their cognitive ability (Hunter et al., 2006; Reichard et al., 2011).

However, there are certain situations and circumstances where cognitive ability is of particular importance – for example, when leaders work for a private compared to governmental organization (Hoffman et al., 2011) or they feel less rather than more stressed in their environment (Judge et al., 2004). Additionally, cognitive ability more strongly relates to leadership success when success is measured by objective criteria, such as quantified team performance, compared to subjective criteria like effectiveness ratings (Judge et al., 2004). In summary, cognitive ability positively relates to leadership success but this relation is weaker than for non-leading jobs and further varies among different situations and criteria.

Entrepreneurship and Cognitive Ability

The relevance of cognitive ability for entrepreneurship seems underexplored (Baum et al., 2011). In fact, no meta-analysis on entrepreneurial success has taken cognitive ability into account, and those primary studies that have, rarely used explicit ability measures but rather ability proxies, such as self-ratings on how often cognitive tasks are fulfilled (Demirel, 2012). Our investigation uses a well-known intelligence test for explicitly assessing cognitive ability and further examines its direct link to diverse criteria of entrepreneurial success[1].

Existing research indicates that cognitive ability might be relevant for entrepreneurship. On the one hand, findings show that selected skills, which are related to cognitive ability, influence entrepreneurial status and performance. For instance, the ventures of entrepreneurs with higher practical intelligence show better annual growth rates (Baum et al., 2011) and entrepreneurs with higher divergent-thinking skills report more success and venture creation (Ames and Runco, 2005). On the other hand, cognitive ability might be vital for entrepreneurs in dealing with the relatively high complexity of their job (Busenitz and Barney, 1997). In that regard, Hartog et al. (2010) state that among different cognitive abilities, mathematical and technical ones are particularly valuable for entrepreneurs. Additionally, Sternberg (2004) argues that a combination of analytical, creative and practical intelligence is predominantly important in entrepreneurship. Finally, Roberts et al. (2007) conclude in their review that general mental ability is important for any occupational outcomes while Judge et al. (1999) highlight that cognitive ability predicts occupational status even across the life span. Based on these findings we assume cognitive ability to directly relate to entrepreneurial outcomes.

A Leader's and Entrepreneur's Emergence as Well as Success Is Driven by Personality Traits

Most of the research focusing on the importance of personality traits has used the Five Factor Model of personality. It is undoubtedly the most common taxonomy to structure personality and comprises the five relatively stable traits Openness, Conscientiousness, Extraversion, Agreeableness and Emotional Stability (also known as Big Five; Costa and McCrae, 1992). To compare our findings to previous ones, we will also refer to the Big Five traits and subsequently summarize findings on their relevance for success in leadership and entrepreneurship.

Leadership and Big Five Traits

Leadership success clearly relates to the Big Five traits. Judge et al. (2004) demonstrated that the Big Five traits conjointly explain 23% of the variance in leadership performance. Their finding that not all traits are equally important is supported by other meta-analyses (e.g., Barrick et al., 2001). Extraversion relates strongest to the diverse criteria of leadership success, followed by conscientiousness, emotional stability and openness. Only agreeableness displays a relatively weak link, indicating that modesty, tact or sensitivity is not of high importance for a leader's success. Even though these findings are relatively stable across cultures (Silverthorne, 2001), there are certain situations where the Big Five traits more strongly influence leadership success than in others. In essence, the link between the Big Five traits and

[1]The term leadership success or entrepreneurship success is used as an umbrella term and refers to both objective (e.g., income, venture growth) and subjective success criteria (e.g., performance-ratings).

success is most consistently moderated by the leader's autonomy level, industry sector and success criterion. Personality traits like the Big Five are particularly important for a leader's success when the leader operates in a highly autonomous work setting with a subjectively low stress level (Ng et al., 2008) and in private rather than governmental organizations (Hoffman et al., 2011). Moreover, personality traits more strongly relate to success when it is subjectively evaluated (e.g., performance ratings) compared to objectively measured (Hoffman et al., 2011). In summary, the Big Five traits relate to leadership success, but this relation differs across the five traits and is moderated by various situational and methodical aspects.

Entrepreneurship and Big Five Traits

The importance of the Big Five traits is clearly less examined in the context of entrepreneurship than leadership. The only two relevant meta-analyses show that entrepreneurs are more conscientious, emotionally stable and open but less agreeable than managers (Zhao and Seibert, 2006) and that the Big Five conjointly explain 37% of a person's entrepreneurial status (Zhao et al., 2010). Moreover, they also relate to entrepreneurial success and venture growth, whereby conscientiousness and openness are, therefore, of particular importance (Zhao and Seibert, 2006).

Recent primary studies are largely in line with these meta-analytic findings and further demonstrate that the Big Five traits relate to a wider range of entrepreneurial success criteria, including sales and profitability growth or return on equity (Hachana et al., 2018). In this investigation, we build upon the reported findings and assume a direct link between the Big Five traits and entrepreneurial status as well as performance.

This Investigation

This investigation examines whether socio-emotional skills add incremental validity over and interact with cognitive ability when predicting leadership and entrepreneurship (1) intention, (2) emergence, and (3) success. To this end, the socio-emotional skills we focus on are vocational interests and personality traits. To pursue the goals of this investigation, we present three studies which are tied together on the grounds of the Leader–Trait–Emergence–Effectiveness model (LTEE; Judge et al., 2009).

In line with the LTEE model, we see leadership and entrepreneurship intention as the first step toward a career in the field of leadership and entrepreneurship. Thus, the first study focuses on leadership and entrepreneurship intention and examines whether vocational interests add incremental value over and interact with cognitive ability when predicting it. Leadership and entrepreneurship intention enhance the chance of achieving a leadership or entrepreneurship position which, in turn, is a necessity for achieving leadership and entrepreneurship success (Judge et al., 2009). In line with this sequential connection between leadership and entrepreneurship intention, emergence and success, the two remaining studies focus on leadership and entrepreneurship emergence as well as success. Here it is worth mentioning that Study 2 and 3 focus on the incremental validity of personality traits rather than vocational interests because personality traits seem more forceful socio-emotional skills for leadership and entrepreneurship emergence and success than vocational interests. In brief, Study 2 examines the incremental validity of the Big Five personality traits over cognitive ability when predicting leadership emergence and success while Study 3 investigates the incremental validity and interaction with regard to entrepreneurship status and success. For the sake of clarity, **Figure 1** summarizes the key aspects of all three studies.

With respect to Study 1 we derive our hypotheses in accordance to the LTEE model. Thus, we assume that cognitive ability enhances a person's leadership and entrepreneurship intention because jobs in leadership and entrepreneurship offer cognitive complexity, which should particularly attract persons with higher ability levels. At the same time the person–environment fit theory (Kristof, 1996) suggests that individuals search for careers that match their vocational interests (Holland, 1959). As we assume a certain fit for leadership and entrepreneurship careers with enterprising, conventional and social interests, we assume that persons with these interests express higher leadership and entrepreneurship intention. Moreover, because becoming a leader or entrepreneur naturally comes with problems that challenge the person's cognitive ability as well as their career aspiration, both cognitive ability and vocational interests are simultaneously needed to sustain the respective career intention. Thus, we assume that a person's cognitive ability predicts his/her leadership and entrepreneurship intention while this prediction is enhanced by simultaneously considering this person's enterprising, social and conventional interests. In a more explorative manner we further assume that these vocational interest interact with cognitive ability when predicting leadership and entrepreneurship intention as vocational interest show reciprocal influence in the career choice process (Ackerman and Beier, 2003). Thus, the following hypothesis (H) and explorative research question (RQ) are stated:

> **H1: The vocational interests enterprising, social and conventional conjointly add incremental value beyond cognitive ability when predicting a) leadership intention and b) entrepreneurial intention.**
>
> **RQ1: The vocational interests enterprising, social and conventional moderate the link between cognitive ability and a) leadership intention and b) entrepreneurial intention.**

Leadership and entrepreneurship intention enhance the chance of emerging as a leader or entrepreneur and achieving success as such (Chan and Drasgow, 2001; Judge et al., 2009). The prediction of leadership and entrepreneurship emergence as well as success is examined in Study 2 and 3. In line with the LTEE model, we argue that cognitive ability and the Big Five traits are *both* predictors of success and as such are *both* important for reaching and effectively fulfilling jobs in leadership and entrepreneurship. As previously summarized, empirical evidence supports this assumption for leadership and entrepreneurship (e.g., Judge et al., 2004; Zhao and Seibert, 2006).

Importantly, on the grounds of the person–environment fit theory (Kristof, 1996), we further claim that the Big Five traits are particularly important when leading or founding a business as both require interpersonal behavior, which is strongly influenced

by them. In fact, success in leadership and entrepreneurship jobs may rely even more strongly on interpersonal behavior than success in other jobs as interpersonal interactions are part of everyday business in leadership and entrepreneurship (Burke et al., 2006; Elmuti et al., 2012). Because successfully managing interpersonal interactions is determined by a person's Big Five traits rather than by his/her cognitive ability (Ackerman and Heggestad, 1997), we assume that the Big Five traits add valid information beyond cognitive ability when predicting leadership success and entrepreneurial success. Even though the incremental validity of the Big Five traits over cognitive ability has been proven for success in a variety of contexts (e.g., school performance; Bratko et al., 2006), only little is known in the leadership context and even less is recognized in the entrepreneurship context. However, as leadership jobs resemble entrepreneurial ones (Czarniawska-Joerges and Wolff, 1991), we assume for both job-types that the Big Five traits add valid information beyond cognitive ability when forecasting success. Some studies even suggest that cognitive ability moderates the link between the Big Five traits and occupational outcomes (see for an overview Mount et al., 1999) for why it is also explored whether the Big Five traits interact with cognitive ability when predicting the emergence of top-level leadership and entrepreneurship as well as leadership and entrepreneurship success. Thus, the following hypotheses and research questions are stated:

H2: The Big Five personality traits conjointly add incremental value beyond cognitive ability when predicting a) top-level leader emergence and the success criteria b) income and c) supervisor-rated leadership performance.

RQ2: The Big Five personality traits moderate the link between cognitive ability and a) top-level leader emergence and the success criteria b) income and c) supervisor-rated leadership performance.

H3: The Big Five personality traits conjointly add incremental value beyond cognitive ability when predicting a) entrepreneurial status and b) the success criterion self-rated entrepreneurial performance.

RQ3: The Big Five personality traits moderate the link between cognitive ability and a) entrepreneurial status as well as b) self-rated entrepreneurial performance.

STUDY 1: LEADERSHIP AND ENTREPRENEURSHIP INTENTION AND THEIR LINK TO COGNITIVE ABILITY AND INTERESTS

Method of Study 1

Sample and Data Collection

In Study 1, a total of 420 Austrian students (61% female, 39% male) took part and were assessed twice online (T1, T2). A certain drop had to be dealt with due to incomplete datasets for the last wave of this long-term study. Altogether, 231 students (58% female, 42% male) provided complete data for both timepoints and were subsequently used to examine the hypotheses. These participants were on average 17 years old (SD = 4.14), had one sibling (SD = 0.84) and 40% of them had parents who were self- employed.

All participants were contacted during an informative event on career choices. These events are nationwide initiatives for students at the end of their scholastic education organized by the Federal Ministry of Education to inform them about potential jobs and job training. The events are free of charge, participation is voluntary, and students are usually encouraged by their schools to attend them. For study participation, students were offered two vouchers for an online retailer (one at each testing time). Participants provided data on their cognitive ability and vocational interests at T1 and agreed to be contacted again. Two years later (T2), participants were again contacted and completed questions on their leadership intention and entrepreneurship intention.

Measures

Predictors: Cognitive ability and vocational interests

Cognitive ability

The ability measure administered was the German Intelligence Structure Test 2000-R (IST-R; Amthauer et al., 2001), which includes items on verbal, numerical and figural intelligence in a basic module. All correctly answered items were summed up to form the cognitive ability score. This score was then converted into IQ-values with a mean of 100 and a standard deviation of 15. The cognitive ability score is thought to measure reasoning as a higher order factor of intelligence and is also referred to as general mental ability (GMA).

Vocational interests

Interests were assessed with the General Interest Structure Test (German version; Bergmann and Eder, 2005), which measures Holland's (1959) interest model. Thirty items represented activities that matched either enterprising, social or conventional interests. All items were completed on a five-point scale ranging from 1 (*I am not interested in this at all; I do not enjoy doing this at all*) to 5 (*I am very interested in this; I enjoy doing this very much)*. Internal consistencies are presented in **Table 1**. In this study, vocational interests represent socio-emotional skill which are thought to influence leadership and entrepreneurship intention beyond cognitive ability.

Control variables

Gender (dummy-coded; 0 = female, 1 = male) and age were control variables as they relate to vocational interests and leadership as well as entrepreneurship intention (e.g., Hirschi and Läge, 2007; Lippa, 2010; Lechner et al., 2018). Additionally, we controlled for parental role modeling as this too correlates with vocational interests and the intention for leadership or entrepreneurial roles (e.g., Palmer et al., 2019). Parental role modeling was measured by whether at least one parent was self-employed or an entrepreneur at the beginning of the study (0 = no entrepreneur among parents, 1 = entrepreneur among parents).

TABLE 1 | Means (M), standard deviations (SD), Cronbach's α (diagonal), and intercorrelations among variables (Study 1).

	M	*SD*	Age	Gender	Back-ground	Leader. Intent.	Entrep. Intent.	Cogn. Ability	Enter-prising	Social	Conven-tional
Age	16.60	4.14	–								
Gender	–	–	−0.20**	–							
Family Background	–	–	0.02	0.02	–						
Leadership Intent.	3.41	1.25	−0.08	0.18**	0.09	–					
Entrepreneurship Intent.	2.84	1.39	−0.02	0.19**	0.10	0.54**	–				
Cognitive Ability	98.74	14.93	0.34**	0.01	−0.01	0.14*	0.14*	–			
Enterprising	3.18	0.83	0.11†	−0.05	0.10	0.37**	0.29**	0.08	0.83		
Social	3.23	0.86	0.13*	−0.51**	−0.01	−0.03	0.01	0.02	0.38**	0.75	
Conventional	2.68	0.72	0.30**	0.10	0.08	0.14∗	0.08	0.24**	0.36**	−0.03**	0.85

*n = 231; **p ≤ 0.01, *p ≤ 0.05, †p ≤ 0.10.*

Criteria: leadership and entrepreneurship intention

Future leadership intention. A German translation of Singer's (1991) single-item scale "I am motivated to take over a leadership position at work" was completed on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to assess leadership intention 2 years after measuring cognitive ability and the Big Five traits.

Future entrepreneurship intention. Entrepreneurial intention was measured by a single-item scale adapted from Liñán and Chen (2009): "I have the firm intention to start a firm some day." Responses were given on a five-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*) 2 years after measuring cognitive ability and the Big Five traits.

Results of Study 1

Table 1 shows the descriptive statistics, reliabilities and correlations for all variables in Study 1. Internal consistencies range from 0.75 to 0.85 and show good reliability for the respective measurements. General mental ability (GMA) correlates with leadership intention and entrepreneurship intention (both $r = 0.14$, $p \leq 0.05$). Additionally, enterprising and conventional interests relate to leadership intention ($r_{enterp.} = 0.37$, $p \leq 01$; $r_{conv.} = 0.14$, $p \leq 05$), while enterprising is also linked to entrepreneurship intention ($r = 0.29$, $p \leq 01$).

To test hypothesis 1, we studied the incremental validity of vocational interests over general mental ability when predicting leadership intention and entrepreneurship intention. A stepwise hierarchical regression was used and GMA was entered first, followed by the interests enterprising, social and conventional in a next step. To consider age-related, gender-related and background-driven differences in interests and leadership or entrepreneurship intention, we controlled for study participants' age, gender and entrepreneurial family background. Regression results are summarized in **Table 2** and confirm hypotheses 1a and 1b. Thus, vocational interests add incremental validity over GMA when predicting future leadership intention (H1a: $\Delta R^2 = 15\%$, $p \leq 0.01$) and future entrepreneurship intention (H1b: $\Delta R^2 = 9\%$, $p \leq 0.01$).

The direction of the effects and the relative importance of the three vocational interests is represented by the β-values in **Table 2**. Results show that higher enterprising interests predict a person's intention to take on future leadership roles best (β = 0.45, $p \leq 0.01$). Additionally, the higher a person's social interests, the lower is his/her intention to take on leadership positions in the future (β = −0.15, $p \leq 0.05$). With respect to entrepreneurship intention, similar results were found. Higher enterprising interests predict a person's future entrepreneurship intention best (β = 0.34, $p \leq 0.01$). With respect to these regression results, it is worth mentioning that after considering the control variables, GMA only predicted 5% of the variance in future leadership intention, while GMA and the three vocational interests conjointly explained 20%. Regarding the entrepreneurship intention, GMA predicted 5% of its variance, while GMA and the three vocational interests conjointly explained a total of 12%.

To test the research question 1, we examined whether vocational interests and cognitive ability interact when predicting leadership and entrepreneurship intention. Interaction effects were studied using regression analyses which are summarized in **Table 2**. All predictors were centered around their means (Aiken and West, 1991) before computing the interaction terms and entering the variables into the regression model. The results indicate a significant interaction only for social interests and cognitive ability when predicting future leadership intention (β = 0.16, $p \leq 0.05$, $\Delta R^2 = 3\%$, $p \leq 0.05$). To probe the interaction, simple effect coefficients were computed using three levels of social interests, one *SD* below the mean, at the mean and one *SD* above the mean. **Figure 2** graphs the interaction, showing the change in leadership intention through cognitive ability at the different levels of social interest. The interaction suggests that when individuals report high social interests then their intention to take on a leader role is more strongly influenced by cognitive ability than when they express low social interests. In fact, those with the highest leadership intention show both, high social interests and high cognitive ability. Thus, research question 1 gets support for social interests.

Brief Discussion of Study 1

Study 1 demonstrates that those with higher cognitive ability are drawn to careers in both leadership and entrepreneurship. Importantly, vocational interests improve the cognitive-based prediction of who intends to become a business leader or

TABLE 2 | Hierarchical regression predicting leadership and entrepreneurship intention from control variables, cognitive ability, and vocational interests (Study 1).

		Leadership intention			Entrepreneurship intention		
		Linear regression			Linear regression		
Block	**Predictors**	$R^2_{adj.}$	ΔR^2	β	$R^2_{adj.}$	ΔR^2	β
1	Control Variables	0.03*	0.04*		0.03*	0.05*	
2	$Block_1$ + Ability	0.05**	0.03**		0.05**	0.02*	
	Cognitive Ability			0.15*			0.15*
3	$Block_2$ + Interests	0.20**	0.15**		0.12**	0.09**	
	Enterprising			0.45**			0.34**
	Social			−0.15*			−0.05
	Conventional			−0.07			−0.10
4	$Block_3$ + Interaction	0.21**	0.03*		0.12**	0.00	
	Ability*Enterprising			−0.07			−0.04
	Ability*Social			0.16*			0.07
	Ability*Conventional			−0.05			−0.01

*n = 231; **$p \leq 0.01$, *$p \leq 0.05$, †$p \leq 0.10$. Control variables include age, gender and entrepreneurial family background.*

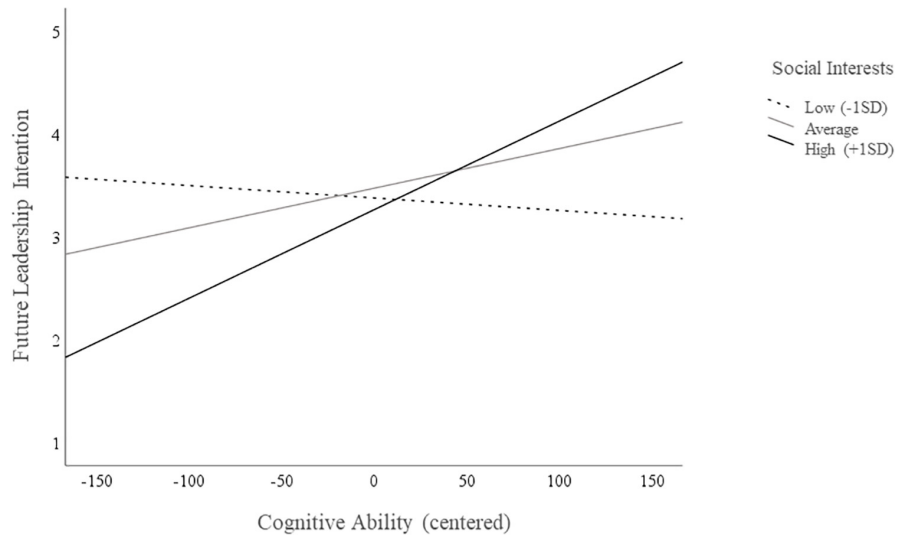

FIGURE 2 | Relationship of cognitive ability to leadership intention for three levels of social interest.

entrepreneur by up to 15 percent. With regard to the former, individuals with higher enterprising interest report higher intention to take on a leadership role in the future while those with higher social interests show less intention for such a role. Interestingly and anew, the interaction results show that social interests enhance the leadership intention of those with higher cognitive ability while they reduce the intention of those with lower cognitive ability. While social interests only predict leadership intention, enterprising interests relate to both, leadership and entrepreneurship intention. Individuals with higher enterprising interests also report higher intention to found their own business.

With regard to the importance of enterprising interests, it might be argued that their effect on leadership and entrepreneurship intention is based on certain personality traits that are linked to both enterprising and leadership or entrepreneurship intention. This assumption builds on findings showing a positive link between enterprising interests and traits such as self-efficacy, extraversion, achievement-orientation and personal initiative (Chan and Drasgow, 2001; Bergmann and Eder, 2005). As these traits, for instance, also relate to leadership intention (Stiehl et al., 2015), the observed effect might be due to the circumstance that people with stronger enterprising interests are also more extraverted and achievement-oriented, which in turn goes hand in hand with higher intentions to lead and found a business.

In brief, it can be summarized that the future intention to take on leadership or entrepreneurship roles is only marginally

based on a person's cognitive ability, yet it is clearly influenced by vocational interests and also partly by the interaction of these with cognitive ability. Finally, it is worth mentioning that this study set its focus on leadership and entrepreneurship intention as a prerequisite of actually emerging and successfully acting as a leader or entrepreneur while the following studies will address the emergence and success of leaders as well as entrepreneurs.

STUDY 2: LEADERSHIP LEVEL AND SUCCESS AND THEIR LINK TO COGNITIVE ABILITY AND THE BIG FIVE TRAITS

Method of Study 2

Sample and Data Collection

In Study 2, a total of 142 leaders from Austria (49% female, 51% male) took part. Participation was possible during a leadership development program. Once the participation started, intermitting it was possible in case the leaders had to fully concentrate on the development program. This possibility for intermission led to the circumstance that a selected number of leaders did not fully complete their study participation but lacked data (mainly with respect to the ability score) for why they were excluded from the sample. Overall, 123 leaders (50% ♀) with a mean age of 40 years (SD = 7.68) provided complete information on their cognitive ability, Big Five traits and the three criteria (1) leadership level, (2) income, and (3) supervisor-rated leadership performance.

The leaders came from the service industry (logistics, delivery services, parcel delivery), had served, on average, for 5 years (SD = 26.91) in their current employment, and were responsible for 1 to 300 subordinates (Mdn = 5, M = 14.90, SD = 32.91). Participation was voluntary, anonymous and for research purposes only. The participants were contacted during a company-wide leadership development program. Those who chose to take part in the survey completed an online version of the subsequent measures. Furthermore, participants named their direct supervisor who was then contacted to evaluated the participant's leadership performance. All questionnaires were provided in German as this was the participants' first language. Participants received written feedback on their personality scores to compensate them for their efforts.

Measures

Predictors: Cognitive ability and personality traits

Cognitive ability

The Wonderlic Personnel Test (German version; Wonderlic and Associates, 1992) was used to assess general mental ability (GMA). This 50-item test is administered in 12 min and the ability score is calculated by summing the number of correct answers given in the allotted time. This score is then converted into IQ-values with a mean of 100 and a standard deviation of 15.

Personality traits

The Big Five traits were assessed using the NEO-Five-Factor Inventory (Costa and McCrae, 1992; German version: Borkenau and Ostendorf, 1993) which comprises 60 items that are rated on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Each of the five personality traits is assessed by 12 items. Internal consistencies are presented in **Table 3**. In this study, the Big Five traits represent socio-emotional skill which are thought to influence leadership level and success beyond cognitive ability.

Control variables

Gender (dummy-coded: 0 = male, 1 = female), age and number of years in the current employment were used as control variables because they are known to relate to both personality traits and diverse leadership success criteria (e.g., Weichselbaumer and Winter-Ebmer, 2005; Weisberg et al., 2011).

Criteria: leadership level and success

Leadership level. The higher a leader's position in the hierarchy, the higher is this person's leadership level. In accordance with Tharenou et al. (1994), leaders were asked to provide their level in the organization's hierarchy. They had to choose from the following six categories, which adequately represented the organizations' management structure: 1 (*project leader*); 2 (*team leader*); 3 (*department leader*); 4 (*division leader*); 5 (*branch leader*); 6 (*board member, (vice-) president or CEO*).

Income as a criterion for objective leadership success. The amount of a leader's income is commonly used to measure this leader's success in a rather objective way. In line with Judge et al. (1999), the participants of this study were asked to rate their yearly income (after tax). Six categories ranging from "less than 12,000 euros" to "more than 66,000 euros" were used and subsequently coded from 1 to 6, with higher scores reflecting higher income.

Supervisor-rated leadership performance as a criterion for subjective success

In accordance with research measuring leadership success with both objective and subjective success criteria, this study uses performance ratings in addition to the objective criteria. As is common in leadership research, we used ratings of the target leader's direct supervisor. Each supervisor provided ratings on the target leader's task and contextual performance. Following Scullen et al. (2003), leadership task performance refers to task-specific behaviors, including technical and administrative core responsibilities of leaders (e.g., accounting, planning, organizing work). Leadership contextual refers to a leader's interpersonal performance, particularly motivational behavior and maintaining interpersonal relationships (e.g., supporting, cooperating). Task and contextual performance were measured with four items each, adapted from Bergner et al. (2010). The items were rated on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) and were averaged to form a composite score on supervisor-rated leadership performance. **Table 3** shows the internal validity of the composite score.

Results of Study 2

Table 3 displays the descriptive statistics, reliabilities and correlations for all variables in Study 2. Cronbach's α values range from 0.66 to 0.79 and show acceptable-to-good reliability for the

TABLE 3 | Means (M), standard deviations (SD), Cronbach's α (diagonal), and intercorrelations among variables (Study 2).

	M	*SD*	Gender	Age	Years in position	Income	Leadership level	Perfor-mance	Cogn. Ability	O	C	E	A	Est
Gender	–	–	–											
Age	39.49	7.68	−0.17†	–										
Years in position	44.90	45.90	−0.09	0.41**	–									
Income	4.12	1.08	−0.31**	0.17†	−0.01	–								
Leadership Level	2.85	1.45	−0.26**	0.30**	−0.06	0.43**	–							
Performance	3.71	0.59	−0.11	−0.11	−0.04	0.15†	0.14	0.84						
Cognitive Ability	100.02	15.00	−0.18*	−0.26**	−0.20*	0.22*	0.14†	0.24**	–					
Openness (O)	2.77	0.46	0.25**	−0.10	−0.05	−0.16†	−0.11	0.03	0.08	0.75				
Conscientiousness (C)	3.16	0.43	0.20*	−0.24**	0.32	0.03	−0.11	0.24**	−0.03	0.15†	0.79			
Extraversion (E)	2.86	0.43	0.09	−0.03	0.05	0.19*	0.07	0.28**	−0.08	0.24**	0.32**	0.70		
Agreeableness (A)	2.84	0.38	−0.02	−0.02	−0.07	0.04	−0.05	0.00	0.01	0.30**	0.04	0.13	0.68	
Emo. St-bility (Est)	3.73	0.55	0.06	−0.06	0.09	0.08	−0.22*	0.29**	−0.04	0.09	0.37**	0.38**	0.19*	0.85

n = 123 leaders. Gender is dummy-coded (0 = male, 1 = female). $^{**}p \leq 0.01$, $^{*}p \leq 0.05$, $^{\dagger}p \leq 0.10$.

respective measurements. GMA correlates with the leadership success criteria income ($r = 0.22$, $p \leq 0.05$), leadership level ($r = 0.14$, $p \leq 0.10$) and supervisor-rated leadership performance ($r = 0.24$, $p \leq 0.01$). Among the Big Five traits, openness, extraversion and emotional stability are related to at least one leadership success criterion.

To test hypothesis 2 and thus examine the incremental validity of the Big Five traits over cognitive ability when predicting top-level leader emergence and success, stepwise hierarchical regressions were used. **Table 4** summarizes the regression results and also shows that analyses are controlled for age-related, gender-related and experience-related effects. With respect to the Big Five's incremental value, the results support hypotheses 2a, 2b and 2c. The Big Five traits add validity beyond GMA when predicting leadership level (H2a: $\Delta R^2 = 8\%$, $p \leq 0.05$), income (H2b: $\Delta R^2 = 9\%$, $p \leq 0.05$) and supervisor-rated leadership performance (H2c: $\Delta R^2 = 15\%$, $p \leq 0.05$). The β-values in **Table 4** show that emotional stability negatively and extraversion positively correlate with leadership level ($\beta_{stability} = -0.23$, $p \leq 0.01$; $\beta_{extraversion} = 0.22$, $p \leq 0.05$) while extraversion positively and openness negatively relate to income ($\beta_{extraversion} = 0.27$, $p \leq 0.01$; $\beta_{openness} = -0.21$, $p \leq 0.05$). Finally, emotional stability and extraversion both positively relate to supervisor-rated leadership performance ($\beta_{stability} = 0.22$, $p \leq 0.01$; $\beta_{extraversion} = 0.24$, $p \leq 0.01$). When considering the control variables, Big Five and GMA conjointly, then they explain 22% of the variance in leadership level, 19% of the variance in income and 16% of the variance in supervisor-rated leadership performance.

To test the research question 2, it was studied whether the Big Five traits interact with cognitive ability when predicting leadership level, income and supervisor-rated leadership performance. Interaction effects were examined using regression analyses which are summarized in **Table 4**. All predictors were centered around their means (Aiken and West, 1991) for the analyses. The results show significant interactions when predicting leadership level (Emotional Stability*Ability: $\beta = -0.19$, $p \leq 0.05$, $\Delta R^2 = 4\%$, $p > 0.05$) and income (Emotional Stability*Ability: $\beta = -0.24$, $p \leq 0.05$ and Openness*Ability: $\beta = 0.23$, $p \leq 0.05$, $\Delta R^2 = 7\%$, $p \leq 0.10$). **Figure 3** graphs the interactions and shows that when leaders are emotionally instable their leadership level and income more strongly depend on their cognitive ability. The same holds true for a leader's income when he/she shows high openness to new experiences. Thus, research question 2 gets partial support.

Brief Discussion of Study 2

Study 2 shows that the Big Five traits enhance the ability-driven prediction of a leader's hierarchical level, income and performance. While extraversion is of importance for all these success criteria, openness and emotional stability improve the prediction only of selected criteria. The particular importance of extraversion is in line with previous studies, which show that on the long run, the leaders' success rather depends on their extraversion than on their cognitive ability (Reichard et al., 2011). Moreover, the current findings support the importance of personality

TABLE 4 | Hierarchical regression predicting leaders' income, leadership level, and supervisor-rated leadership performance from control variables, cognitive ability, and the Big Five traits (Study 2).

		Leadership level			Income			Supervisor-rated leadership performance		
		Linear regression			Linear regression			Linear regression		
Block	**Predictors**	$R^2_{adj.}$	ΔR^2	β	$R^2_{adj.}$	ΔR^2	β	$R^2_{adj.}$	ΔR^2	β
1	CV	0.15**	0.17**		0.09**	0.11**		0.00	0.03	
2	$Block_1$ + Ability	0.17**	0.03†		0.13**	0.04*		0.04†	0.04*	
	Cognitive Ability			0.20*			0.25**			0.23*
3	$Block_2$ + Big Five	0.22**	0.08*		0.19**	0.09*		0.16**	0.15**	
	Openness			−0.10			−0.21*			−0.04
	Conscientiousness			0.09			0.07			0.11
	Extraversion			0.22*			0.27**			0.24*
	Agreeableness			−0.01			0.05			−0.07
	Emo. Stability			−0.23**		−0.04	−0.04			0.22*
4	$Block_3$ + Interaction	0.23**	0.04		0.23**	0.07†		0.16**	0.02	
	Openness*Ability			0.13			0.23*			0.13
	Conscientious.*Ability		−0.11			0.08			0.05	
	Extraversion*Ability			0.11			0.06			0.05
	Agreeableness*Ability			0.06			−0.08			0.02
	Emo. Stability*Ability			−0.19*		−0.24*				0.10

*n = 123 leaders. CV = Control variables (age in years, gender dummy-coded, years in current position). **p ≤ 0.01, *p ≤ 0.05, †p ≤ 0.10.*

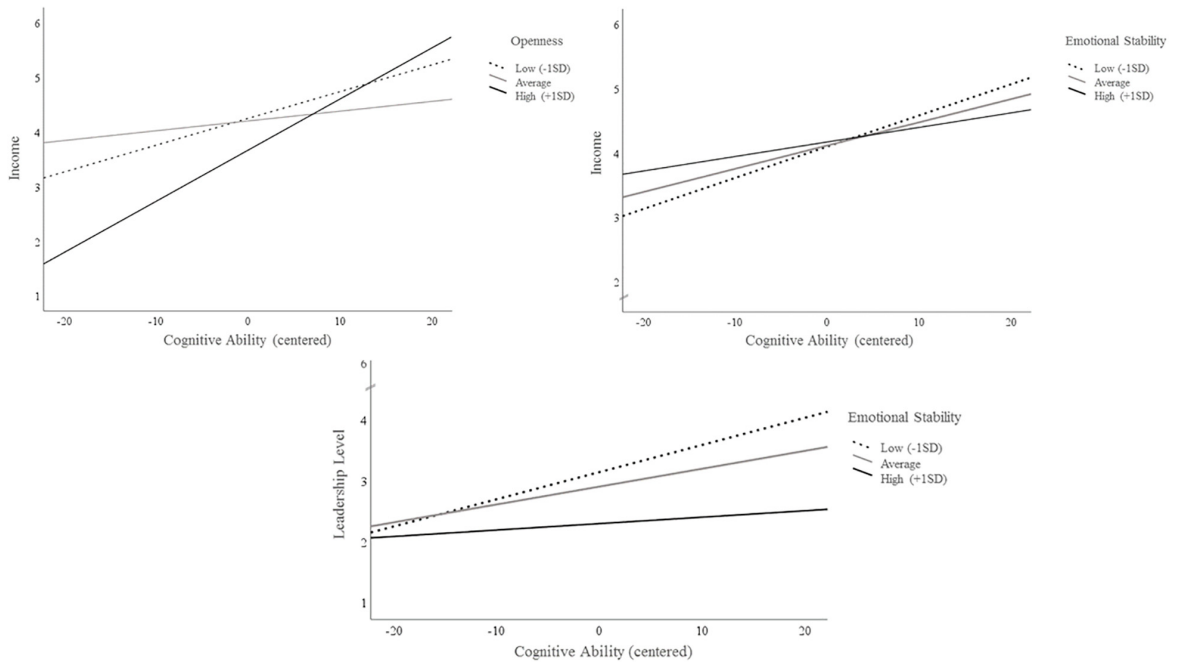

FIGURE 3 | Relationship of cognitive ability to leadership level and success for three levels of emotional stability and openness.

traits beyond cognitive ability in a wider context, as they confirm results from South Korea where personality traits were seen to add moderate incremental validity beyond cognitive ability for the contextual performance of military leaders (Oh et al., 2014).

Importantly and anew, emotional stability and openness interact with cognitive ability when predicting selected leadership outcomes. Openness seems to facilitate the impact of cognitive ability on a leader's income: highly open-minded leaders profit more from their cognitive ability when it comes to their income

compared to less open-minded ones. In contrast, emotional stability seems to buffer the effect of cognitive ability on a leader's income so that emotionally stable leaders with higher ability report lower income than their more neurotic but equally clever colleagues. Emotional stability also marginally interacts with cognitive ability when predicting a leader's hierarchical level. Interestingly, leaders with similar cognitive ability end up in higher positions when they are more neurotic.

In conclusion, being smart seems not enough for achieving high leadership positions and success as a leader. Importantly, the Big Five traits enhance a leader's success irrespective of his/her cognitive ability and some traits even buffer or enhance the effect of cognitive ability. The subsequent Study 3 extends these findings to the field of entrepreneurship.

STUDY 3: ENTREPRENEURSHIP STATUS AND SUCCESS AND THEIR LINK TO COGNITIVE ABILITY AND THE BIG FIVE TRAITS

Method of Study 3

Sample and Data Collection

In Study 3, a total of 162 Austrian participants (38% female, 62% male) from various working fields including business, law, technology, arts and social science took part. Of those, seven had to be excluded due to incomplete ability data (they completed less than 10 ability items). The remaining 155 participants (35% female, 65% male) were on average 29 years old (SD = 6.84) and varied regarding their educational background. Overall, 60% held a university degree and 34% an A-level, 6% served an apprenticeship or vocational training. Out of these 155 participants, 47% had already founded a business, which they currently managed, which is why they are referred to as entrepreneurs. In contrast, 53% were employed and had neither founded nor run a business on their own, which is why they are termed non-entrepreneurs in this study. Contrary to and more beneficial than in other studies, our non-entrepreneurial sample does not encompass university students but includes individuals who are employed. The entrepreneurs and non-entrepreneurs were matched regarding gender; thus, men and women were equally distributed across the groups. However, entrepreneurs were older than non-entrepreneurs (M_E = 31.89, SD_E = 6.99 vs. M_{non-E} = 26.13, SD_{non-E} = 5.43, t_{153} = 5.74, $p \leq 0.01$).

Data were collected in Austria through an online survey, which was sent out to participants of business talks, trade fairs and vocational networking events. All these events were organized by the chamber of commerce and targeted individuals who aim to extend their vocational network. Participation in these events and in our study was voluntary. Participants provided information on their cognitive ability, Big Five traits and their entrepreneurial status (yes/no) by completing a German version of the subsequent measures. Those who were entrepreneurs further rated their entrepreneurial performance within the last 12 months. All received written feedback on their personality scores to compensate them for their efforts and consented to the use of their data for research purposes; they were guaranteed that no personalized data would be passed on.

Measures

Predictors: Cognitive ability and personality traits

Cognitive ability

The Wonderlic Personnel Test (German version; Wonderlic and Associates, 1992) was used to assess general mental ability (GMA). Its 50 items refer to verbal, numerical and figural tasks. The ability score is calculated by summing the number of correct answers given within 12 min. This score is converted into IQ-values with a mean of 100 and a standard deviation of 15.

Personality traits

The Big Five traits were assessed using the Big Five Inventory (Rammstedt and John, 2005), which consists of 21 German items that are completed on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Scores for all trait dimensions show satisfactory-to-good internal consistencies (see **Table 5**). Here, the Big Five traits represent socio-emotional skill which are thought to influence entrepreneurship status and success beyond cognitive ability.

Control variables

Gender (dummy-coded; 0 = female, 1 = male), age and educational background (1 = university, 2 = A-level, 3 = specific vocational training, 4 = apprenticeship, 5 = compulsory education) were control variables as they relate to both personality traits and cognitive ability as well as assorted criteria of entrepreneurship success (e.g., Weisberg et al., 2011; Thorgren et al., 2016).

Criteria: entrepreneurship status and success

Entrepreneurship status. Entrepreneurship status was defined as being active as an entrepreneur at the time of the investigation (yes = 1; no = 0). Our definition of entrepreneurs is based on the one used by Zhao and Seibert (2006) and considers somebody as an entrepreneur who is the founder, owner and manager of a business. Entrepreneurs were asked to provide their VAT-number to prove that they currently owned and managed their named business.

Entrepreneurship success. The fact that there is no commonly accepted measure for entrepreneurial success (Herman and Renz, 2004) led to the use of various measures like profit margin, employee turnover or job generation. Because business owners tend not to reveal their business financial data, and objective performance criteria are known to be contaminated (Naman and Slevin, 1993), research suggests also considering subjective performance ratings (Binder and Coad, 2013). We follow this suggestion and use self-report measures of entrepreneurial performance like previous research did (e.g., Axtell et al., 2006). Drawing on Jong et al. (2015), entrepreneurial performance was assessed with four items indicating the entrepreneur has improved current products/services, proactively acquired new customers, increased profit, and felt they had been performing well within the past 12 months. Items were completed on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*)

TABLE 5 | Means (M), standard deviations (SD), Cronbach's α (diagonal), and intercorrelations among variables (Study 3).

	M	*SD*	Age	Gender	Edu-cation	Entre. Perform.	Entre. Status	Cogn. Ability	O	C	E	A	Est
Age	28.81	6.84	–										
Gender	–	–	−0.23**	–									
Educational Background	1.45	0.63	0.02	0.13†	–								
Entrepreneurial Perform.	3.89	0.93	0.03	0.10	0.22†	0.89							
Entrepreneurial Status	–	–	0.42**	−0.03	−0.04	–	–						
Cognitive Ability	100.52	14.23	0.02	0.11	0.01	−0.01	0.17*	–					
Openness (O)	3.85	0.61	0.16*	−0.09	0.06	−0.02	0.26**	−0.03	0.60				
Conscientiousness (C)	3.87	0.61	0.16*	0.06	−0.01	0.32**	0.13†	−0.03	0.08	0.67			
Extraversion (E)	3.58	0.79	−0.05	−0.08	−0.02	−0.20†	0.04	0.07	0.10	0.09	0.82		
Agreeableness (A)	3.08	0.75	0.04	−0.09	−0.03	−0.14	−0.05	0.06	0.07	0.04	0.31**	0.70	
Emo. Stability (Est)	3.66	0.79	0.12	0.21**	−0.04	−0.23*	0.16*	0.13	0.02	0.15*	0.30**	0.20**	0.70

n = 162 except for entrepreneurial performance where n = 72 entrepreneurs. Entrepreneurial status is dichotomously coded (yes/no) and thus values represent point-biserial correlations. $^{**}p \leq 0.01$, $^{*}p \leq 0.05$, $^{\dagger}p \leq 0.10$.

and finally averaged for calculating a composite score (see **Table 5** for Cronbach Alpha value).

Results

Table 5 shows the descriptive statistics, reliabilities and correlations for all variables in Study 3. Overall, entrepreneurs show higher scores on cognitive ability ($M_E = 103.03$, $SD_E = 13.82$ vs. $M_{non-E} = 98.03$, $SD_{non-E} = 14.48$, $t_{160} = -2.26$, $p \leq 0.05$), emotional stability ($M_E = 3.84$, $SD_E = 0.70$ vs. $M_{non-E} = 3.46$, $SD_{non-E} = 0.75$, $t_{153} = -2.50$, $p \leq 0.05$) and openness ($M_E = 4.02$, $SD_E = 0.57$ vs. $M_{non-E} = 3.70$, $SD_{non-E} = 0.60$, $t_{153} = -3.35$, $p \leq 0.01$).

To test hypothesis 3, we studied the incremental validity of the Big Five traits beyond cognitive ability when predicting entrepreneurship status (yes/no) and self-perceived entrepreneurial performance. The analyses were controlled for participants' age, gender and educational background. The hierarchical logistic regression in **Table 6** shows that the Big Five traits add 7% over cognitive ability when predicting a person's entrepreneurial status. Thus, H3a is confirmed. However, only openness was a significant predictor, indicating that more open individuals are also more likely to become entrepreneurs (*Exp(B)* = 2.62, $p \leq 0.01$). The predicted probabilities further show that the entrepreneurship status (yes/no) of 71% was correctly classified when solely considering their cognitive ability and control variables. When the Big Five traits were added, the number of correctly classified participants significantly increased to 73%.

In addition, the linear hierarchical regression in **Table 6** revealed that the Big Five traits added incremental validity over cognitive ability when predicting self-rated entrepreneurial performance (H3b: $\Delta R^2 = 18\%$, $p \leq 0.05$). Thus, H3b was also supported. The more conscientious and emotionally stable somebody was, the more successful they perceived their performance as an entrepreneur ($\beta_{conscientious.} = 0.29$, $p \leq 0.05$; $\beta_{stability} = 0.24$, $p \leq 0.10$). Interestingly, cognitive ability did not predict self-rated entrepreneurial performance in this study.

To test the research question 3, it was studied whether the Big Five traits interact with cognitive ability when predicting entrepreneurial status and success. Interaction effects were studied using regression analyses which are summarized in **Table 6**. All predictors were centered around their means (Aiken and West, 1991) for these analyses. The results show significant interactions when predicting entrepreneurial status (Emotional Stability*Ability: *Exp(B)* = 1.12, $p \leq 0.05$, $\Delta R^2 = 8\%$, $p > 0.10$) and entrepreneurial performance (Conscientiousness*Ability: $\beta = -0.28^*$, $p \leq 0.05$, $\Delta R^2 = 7\%$, $p > 0.10$). **Figure 4** graphs the interactions and shows that high emotional stability enhances the chance of becoming an entrepreneur in those with higher cognitive ability. Additionally, those who are already entrepreneurs perceive themselves as less performing when they are highly conscientious and clever. Concluding, the interaction assumption is partly supported.

Brief Discussion of Study 3

Study 3 shows that the Big Five traits add novel information on whether a person successfully founds a business which

TABLE 6 | Hierarchical regression predicting entrepreneurial status and performance from control variables, cognitive ability, and the Big Five traits (Study 3).

		Entrepreneurial status			Self-rated entrepreneurial performance		
		Log. regression (n = 162)			Linear regression (n = 72)		
Block	**Predictors**	$R^2_{Nag.}$	ΔR^2	*Exp(B)*	$R^2_{adj.}$	ΔR^2	β
1	CV	0.25**	0.25**		0.01	0.05	0.00
2	$Block_1$ + Ability	0.28**	0.03*		0.00	0.00	
	Cognitive Ability			1.10*			0.06
3	$Block_2$ + Big Five	0.35**	0.07*		0.13*	0.18*	
	Openness			2.62**			0.05
	Conscientiousness			1.25			0.29*
	Extraversion			1.16			−0.13
	Agreeableness			0.70			−0.09
	Emo. Stability			1.16			0.24†
4	$Block_3$ + Interaction	0.35**	0.08		0.14*	0.07	
	Openness*Ability			1.07			−0.05
	Conscientious*Ability			0.94			−0.28*
	Extraversion*Ability			0.96			−0.17
	Agreeableness*Ability			1.01			−0.01
	Emo. Stability*Ability			1.12∗			0.00

$^{**}p \leq 0.01$, $^{*}p \leq 0.05$, $^{\dagger}p \leq 0.10$. CV = Control variables (age, gender dummy-coded, educational background).

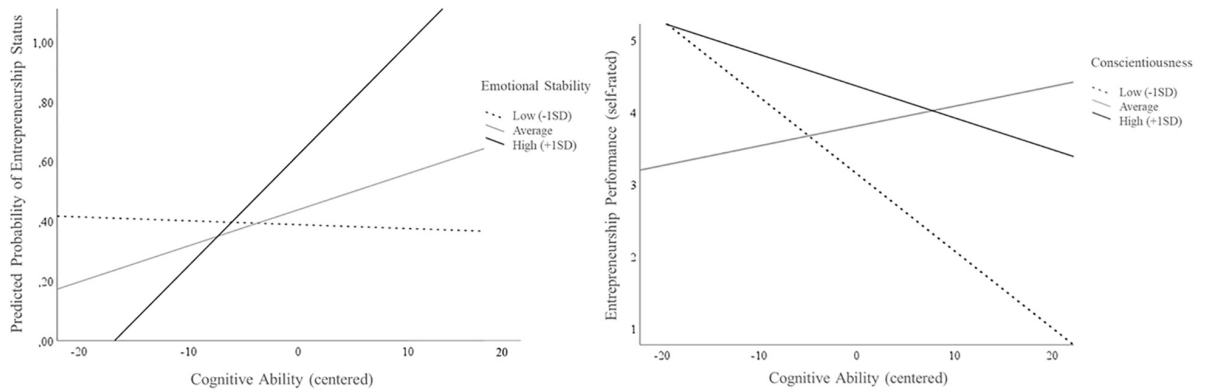

FIGURE 4 | Relationship of cognitive ability to entrepreneurship status and success for three levels of emotional stability and conscientiousness.

cannot be derived from this person's cognitive ability level. Additionally, more conscientious and (by trend) more emotionally stable entrepreneurs think that they perform better than less conscientious and stable colleagues. Notably, the current finding adds to existing research in two ways. First, it adds to the scant research on the importance of cognitive ability for becoming and performing as an entrepreneur. Second, it adds novel information as it shows that the Big Five traits add incremental validity over and partly interact with ability in the field of entrepreneurship. Therefore, it advances the psychology of entrepreneurship as suggested by Gorgievski and Stephan (2016). The fact that cognitive ability, the Big Five traits and their interaction explain little variance of a person's entrepreneurial status and performance – even when considered conjointly – might be due to a generally strong influence of situational factors in entrepreneurship. For instance, political funding, a city's infrastructure or current economic trends might be more impactful in entrepreneurship than in other contexts. Concluding, being smart is not necessarily enough for successfully launching and managing one's own business. As shown by the current findings, traits like conscientiousness or emotional stability enhance the chance of successfully becoming and acting as an entrepreneur.

GENERAL DISCUSSION

This investigation examined whether socio-emotional skills add incremental validity over and interact with cognitive ability when

predicting (1) the intention to become a business leader or entrepreneur, (2) the subsequent chance of actually becoming a top-level leader or entrepreneur, and (3) the success which is achieved by actual leaders or entrepreneurs. The socio-emotional skills we focus on are vocational interests and personality traits. Three main findings are highlighted. First, the vocational interest enterprising and social enhance the ability-based prediction of a person's intention to become a leader or entrepreneur in the future. Social interests even interact with cognitive ability when predicting this intention (in the field of leadership). Second, the Big Five traits add incremental value beyond and can even interact with cognitive ability when predicting the position of leaders within the organizational hierarchy and the entrepreneurial status of a person. Finally, the success of actual leaders and entrepreneurs can be predicted by both, cognitive ability and the Big Five traits. Again, the latter add incremental validity beyond and interact with cognitive ability. Consequently, implications of these findings will be discussed in the light of the Leader–Trait–Emergence–Effectiveness model (LTEE; Judge et al., 2009) and the person–environment fit theory (Kristof, 1996).

The Intention to Become a Leader or Entrepreneur Is Best Predicted by Considering Cognitive Ability and Vocational Interests Conjointly

Leadership and entrepreneurship intention are important prerequisites of becoming a leader or entrepreneur which, in turn, is a necessity for achieving leadership and entrepreneurship success (Judge et al., 2009). Our longitudinal findings are among the few to demonstrate that those with higher cognitive ability report higher intention to become a leader or entrepreneur. Even though this link is rather weak, it is in line with assumptions from the person–environment fit theory and shows that individuals with higher cognitive ability are more strongly drawn to jobs with higher complexity. Even more important, additionally considering a person's enterprising and social interests adds considerable information to the question, who aims at becoming a leader or entrepreneur in the future. In fact, a person's enterprising and social interests tell more about the future intentions than this person's ability. More precisely, while higher enterprising interest enhance both, leadership and entrepreneurship intention, it is lower social interest that increase leadership aspiration. Remarkably, this finding of ours partly contradicts previous research which shows that social-oriented values rather predict higher leadership but lower entrepreneurship intention (Lechner et al., 2018). However, due to the young age of our study participants in Study 1 – they were on average only 17 years old – we argue that their vocational interests do not yet differentiate in such a strong manner as they might not be fully developed in this age group.

Interesting and anew is the finding that low social interests impede the intention to become a leader irrespective of this person's cognitive ability whereas high social interests enhance this intention when the respective person shows high cognitive abilities. Thus, it obviously needs a certain interest level for developing the intention to take on a leading role or launch a business. What might be the mechanisms beyond this result? We assume that people with certain vocational interests seek out environments that fit their interests and thus more often find themselves in roles that match these. For instance, because enterprising individuals are interested in leadership and entrepreneurship duties, they seek out leadership and entrepreneurship roles more often. As shown by previous research, having more experience in such roles decreases personal reservations about being a leader or entrepreneur and in turn enhances the future leadership and entrepreneurship intention (Chan and Drasgow, 2001). In accordance with the trait activation theory (Tett and Guterman, 2000), we further argue that once individuals are presented with interest-matching situations, they more strongly express their interests and even develop them further. As such we speculate that once enterprising individuals get a first impression of what it is like being a leader or entrepreneur, their interest and intention for these jobs will further grow.

Based on the interaction between social interests and cognitive ability on leadership intention, we argue that those who appear clever enough to actually become leaders should get additional support to build up leadership-specific confidence, particularly when their social interest-level is only medium. If they are not supported it might be those with low social interests and low ability who most clearly express their intention to take on leading roles (and it is probably their intention which is heard best when potential leaders are needed). Importantly, this result demonstrates that higher social interests do not generally result in lower leadership intention (Bergner et al., 2019).

Becoming a Top-Level Leader and Being Successful Is Best Predicted by Conjointly Considering Cognitive Ability and the Big Five Traits

Our results clearly show that a leader's cognitive ability and the Big Five traits *conjointly* influence whether he/she reaches a top-level position and receives high income as well as good performance ratings. Notably, cognitive ability is linked to these criteria in a similar strength as the Big Five traits. According to Judge et al.'s (2009) LTEE model, we suppose that both cognitive ability and the Big Five traits are distal predictors and as such influence top-level positions and success not only in a direct manner but also in an indirect one via more proximal predictors. As we did not include proximal predictors, the question remains unanswered whether ability and the Big Five traits show a comparable indirect effect on success via such proximal predictors.

Importantly, our findings clearly demonstrate that being smart is not enough for becoming a top-level leader with high income and good performance ratings. In fact, a leader's Big Five profile impacts his/her income, management level and performance rating independently of the leader's cognitive ability. Our findings further show that personality traits can actually double the ability-based variance of top-level leadership emergence and

success and therefore not only significantly but also meaningfully enhance their prediction. However, among the Big Five traits it is mainly extraversion, emotional stability and openness which are important. Some of these traits also interact with cognitive ability. For instance, openness facilitates the impact of ability on a leader's income: high openness enhances a leader's income only when this leader is rather smart. In contrast, emotional stability buffers the effect of ability on a leader's income so that more neurotic and clever leaders report higher income than emotionally stable ones with a similar ability level. The same effect is found for top-level positions: leaders with similar cognitive ability end up in higher positions when they are more neurotic. Consequently, it might be argued that a certain level of ability is needed to boost the importance of openness and stability in leadership.

As previous research primarily focused on explaining the direct link between leadership success and *either* cognitive ability *or* the Big Five traits (e.g., Barrick et al., 2001; Judge et al., 2004), this study enriches literature by demonstrating their conjoined and interaction effect. In that regard it is important to keep in mind that working as a leader means dealing with cognitive and interpersonal complexity. While cognitive complexity arises for instance in situations where leaders have to deal with strategic decisions, interpersonal complexity can be observed when interacting with others, for instance in critical negotiations (Burke et al., 2006). To be most successful as a leader, cognitive and interpersonal complexity has to be managed and therefore cognitive ability and personality traits are required. This reasoning is in line with the person–environment fit theory (Kristof, 1996), which suggests that those whose abilities and personality traits meet the required tasks more likely complete the tasks successfully. As both are needed to successfully meet leadership tasks, the fit theory offers a valid explanation for why a person's cognitive ability cannot compensate for this person's Big Five traits.

Becoming an Entrepreneur and Being Successful as Such Is Best Predicted by Conjointly Considering Cognitive Ability and the Big Five Traits

We reveal two important findings with regard to the impact of individual differences in entrepreneurship. First, a person's cognitive ability may be used to predict who will found and manage a business. As this investigation is among few which test the direct link between cognitive ability and entrepreneurial status using in fact a validated ability measure, it can further be summarized that the impact of cognitive ability is rather small. Applying the LTEE model to the field of entrepreneurship, the inferior importance of cognitive ability might be due to the fact that it is a distal predictor of entrepreneurial status which unfolds its importance rather indirectly through more proximal predictors such as strategic thinking or recognizing business opportunities.

The second novel finding is that the Big Five traits contribute unique information to the question, who will found and manage his/her own business. In fact, it is solely the trait openness that improves the prediction of entrepreneurial status while the remaining Big Five traits seem less important in our study. Consequently, being smart is not enough for successfully founding a business but a person also needs to be open-minded, curious and fond of unconventional ideas and viewpoints (i.e., open). The same holds true for the entrepreneur's self-perceived performance, which can be explained by his/her cognitive ability but is more precisely predicted when additionally considering the entrepreneur's conscientiousness and emotional stability. With respect to the Big Five traits the results partly confirm a reoccurring Big Five profile for entrepreneurs. Even though not all effects became significant in the current study, the findings support an established profile which suggests that entrepreneurs compared to non-entrepreneurs show higher openness, conscientiousness, extraversion and stability, yet lower agreeableness (Obschonka and Stuetzer, 2017; Obschonka et al., 2017).

Importantly and anew, a person's cognitive ability interacts with the Big Five traits when predicting his/her entrepreneurial status. The chance of successfully launching a business is highest for those with high emotional stability *and* cognitive ability. Neurotic individuals with similar ability have a smaller chance to successfully launch their venture. Cognitive ability also interacts with the Big Five traits when predicting entrepreneurship success. Our findings suggest that conscientiousness impedes the effect of ability on self-perceived success. Highly conscientious and smart individuals perceive themselves as less successful compared to those with an average level of conscientiousness. Consequently, it might be argued that a certain level of emotional stability is needed to boost the positive effect of cognitive ability on becoming an entrepreneur while being too conscientious impedes high (self-rated) entrepreneurial performance.

Even though previous meta-analyses clearly showed that the Big Five traits successfully differentiate between entrepreneurs and non-entrepreneurs (Brandstätter, 2011), the mechanisms beneath these findings are underexplored. We argue on the basis of the person–environment fit theory that becoming and successfully being an entrepreneur means dealing with cognitive complexity (e.g., analyzing market conditions, organizing the business) as well as interpersonal complexity (e.g., dealing with difficult customers, negotiating with deliverymen). To cope with both forms of complexity both – the cognitive ability level and the openness/conscientiousness level – have to be relatively high. In addition, we speculate that the Big Five traits enhance a person's chance to found and successfully run a business due to his/her opportunity–recognition skills. Recognizing opportunities to make profit is essential for entre-preneurs as it directly influences venture performance (Sambasivan et al., 2009). According to the individual–opportunity nexus (Shane, 2007), certain traits enhance people's chance of recognizing business opportunities and, because they do so, they are (1) more inclined to launch a business and (2) they are more successful entrepreneurs as they easily enlarge their product/service portfolio. On the grounds of the individual–opportunity

nexus, we speculate that Big Five traits like openness enhance a person's opportunity recognition skills and thus also indirectly influence entrepreneurial status and performance. We even extend this speculation to cognitive ability and argue that those with higher cognitive ability more likely recognize new business opportunities because they more easily "connect the dots" and see the same things they see every day with new eyes.

Implication and Limitation

Our investigation has theoretical and practical implications. The most important theoretical implications are that being smart is not necessarily enough for aiming at a career in leadership or entrepreneurship, for emerging as top-level leader or entrepreneur and for receiving success as leader or entrepreneur. In fact, our findings reveal that there are some criteria – like entrepreneurship status – for which the impact of cognitive ability seems inferior. Second, our results imply that considering personality traits or vocational interests in addition to cognitive ability offers a more powerful prediction of success in leadership and entrepreneurship as well as leadership and entrepreneurship intention. From a theoretical point of view, these results support the person–environment fit theory for the leadership and entrepreneurship context and further extend the Leader–Trait–Emergence–Effectiveness model to the field of entrepreneurship. The third implication refers to the distinct importance of the different Big Five traits and vocational interests. Based on our findings, not all Big Five traits and vocational interests are equally important when increasing the ability-driven prediction. With regard to the Big Five traits, emotional stability, openness and conscientiousness are of particular importance for leadership/entrepreneurship emergence and success while enterprising is the most important vocational interest when predicting a person's leadership or entrepreneurship intention. The final implication might also be the most insightful one. In an explorative manner it was shown that selected Big Five traits and vocational interests interact with cognitive ability when predicting leadership and entrepreneurship intention, emergence and success.

Practical implications of this investigation refer to personnel selection, development of leaders and entrepreneurs and career counseling for want-to-be leaders and entrepreneurs. Regarding personnel selection and development, the current findings clearly suggest considering personality aspects in addition to cognitive ones. Doing so should improve the prediction of who becomes successful and should further prevent from the circumstance that somebody is hired for ability but fired for personality. Moreover, when offering leader development programs or entrepreneurship education this investigation suggests including courses for the development of socio-emotional skills and not only focusing on knowledge-based skills. With regard to career counseling for want-to-be leaders and entrepreneurs, it is suggested to strengthen entrepreneurial interests, for instance, by exposing particularly those individuals to leadership and entrepreneurial tasks that show enterprising interests. By doing so they can deepen their interests which should then enhance their intention to take the lead or found a business in the future.

As with any study there are limitations to consider. First, the current findings refer to the most widely accepted personality model – the Big Five – but do not offer insights into which of the 30 Big Five sub-facets are particularly important. Therefore, future research should examine which sub-facets improve the ability-driven prediction of leadership and entrepreneurship emergence and success best. Moreover, it might be interesting to study whether other personality models like the HEXACO model or the Dark Triad also add incremental validity beyond cognitive ability in the field of leadership and entrepreneurship. Second, only one of the included studies uses longitudinal data. Continuing research clearly has to collect more longitudinal data to confirm the importance of socio-emotional skills beyond cognitive ability in a longer perspective. Worth mentioning is also that some outcomes in the current investigation were measured solely by self-perceptions, which are known to underlie certain biases that can result in more favorable ratings. Consequently, it might be interesting to examine a wider range and a more diverse set of outcomes, for instance, whether entrepreneurs fail or how their growth rate develops after several years. Doing so could provide better insights as the entrepreneurial sample would be more representative. Moreover, it might be worth examining the interaction effects between vocational interests/Big Five traits and cognitive ability in a more profound and theory-driven manner as this investigation offers only explorative insights. Finally, future research should use different ability measures, assess specific cognitive abilities (e.g., numerical intelligence) and refer to more profound ability tests for checking the stability of the current findings.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Graz. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Self-Control Outdoes Fluid Reasoning in Explaining Vocational and Academic Performance—But Does It?

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Trait self-control, the ability to interrupt undesired behavioral tendencies and to refrain from acting on them, is one of the most important socio-emotional skills. There had been some evidence that it outperforms intelligence in predicting students' achievement measured as both school grades and standardized achievement tests. However, recent research has shown that the relationships between trait self-control and measures of achievement are more equivocal, emphasizing the importance of the respective outcome of the test to the individual. On the one hand, high-stakes school achievement measures such as GPA repeatedly showed strong relationships with trait self-control. On the other hand, findings on the relationships between trait self-control and performance in mostly low-stakes standardized achievement tests were more heterogeneous. The substantial positive relationship between intelligence and both achievement measures is uncontested. However, the incremental value of trait self-control beyond intelligence when investigating their relationships with achievement remains uncertain. To investigate the relationships of self-control with school achievement and two standardized achievement tests (school mathematics and physics) beyond fluid reasoning, we drew on a large heterogeneous sample of adults in vocational training (N = 3,146). Results show differential patterns of results for fluid reasoning and trait self-control and the achievement measures. Trait self-control and fluid reasoning showed similar relationships with school achievement, whereas only fluid reasoning was significantly associated with standardized achievement test scores. For both achievement measures, no significant interaction effects between trait self-control and fluid reasoning were found. The results highlight the utility of trait self-control for performance in high-stakes school assessment beyond fluid reasoning, but set limits to the overall value of trait self-control for achievement in standardized assessments—at least in low-stakes testing situations.

Keywords: trait self-control, fluid reasoning, school achievement, standardized tests, interaction effects

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INTRODUCTION

One of the most prominent constructs in research on socio-emotional skills (sometimes called socio-emotional competencies or non-cognitive skills) is trait self-control. It can be defined as the ability to inhibit or overrule immediate urges to attain a long-term goal (De Ridder et al., 2012). However, recent research implies a more resource-oriented conception of trait self-control

suggesting that individuals high in trait self-control may use more effortless strategies to exert self-control in addition to impulse inhibition (Gillebaart and De Ridder, 2015).

A broad body of research on the construct cumulated over the past decades, most probably due to its potential relevance for success in school and in the workplace (Gottfredson, 2004; Kuncel et al., 2010). The meta-analysis by De Ridder et al. (2012) showed that having high trait self-control is relevant to a variety of behaviors and outcomes such as happiness and school grades. The authors concluded that the effects of trait self-control are mostly beneficial and adaptive and, thus, that self-control is one of the most beneficial traits in psychology.

The promising findings and the great attention paid to self-control in research, but also in society, led to its consideration in educational policy as one of the most important 21st-century skills (U. S. Department of Education, 2013; UK Department of Education, 2014). However, criticism emerged arguing that the trend toward implementing policies focusing on identifying and fostering socio-emotional skills—such as self-control—and their implementation as relevant constructs in the educational system (e.g., high-stakes character assessment in school) are premature due to a considerable lack of knowledge regarding the utility of these skills (Farrington et al., 2012; Saltman, 2014).

With this study, we aim to contribute to the discussion on the utility of trait self-control, measured using the Brief Self-Control Scale (Tangney et al., 2004). We investigated the incremental validity of trait self-control over fluid reasoning for high-stakes scholastic achievement and low-stakes domain-specific standardized tests. We thereby revisit the notion that trait self-control is a better predictor of school success than intelligence (Duckworth and Seligman, 2005) with a more nuanced design. Recent research indicates that the assumption on the added value of trait self-control over intelligence from earlier studies may have been premature. The relationship may be more complex than previously suggested in so far as that the stakes involved in the achievement outcomes investigated, and the type of the achievement indicators used, can have an impact on the relative importance of trait self-control and intelligence (Bertrams and Dickhäuser, 2009; Lindner et al., 2017; Galla et al., 2019; Lindner and Retelsdorf, 2019). We thus incorporate both standardized tests and grades in our investigation. We argue that these achievement indicators additionally vary in how important they are to the individuals investigated.

THE TRAIT SELF-CONTROL MODE OF ACTION

Trait self-control is considered to be a personality trait that remains relatively stable across situations and time (Gillebaart and De Ridder, 2015). Duckworth and Gross (2014) define trait self-control as the ability to avoid impulsive behavior that enables fulfilling more immediate or short-term obligations. The underlying behavioral mechanism explaining the positive effects of trait self-control has traditionally been assumed to be higher effort investment (Duckworth et al., 2015). Studies found, for example, that individuals with high levels of trait self-control generally invest more personal effort in achievement situations (e.g., Lindner et al., 2018).

The theorizing about how trait self-control affects behavior changed in recent years from focusing on the inability to inhibit impulses to a more resource-oriented approach. Central to this conception is the way in which individuals deal with response conflicts (i.e., competing behavioral tendencies) as introduced by Myrseth and Fishbach (2009). In general, response conflicts arise when a discrepancy exits between activities to reach one's highly valued overarching goals (e.g., learning to achieve good grades at school to have better opportunities for studying at university) and alternative behaviors that have short-term rewarding values (e.g., watching movies instead of learning for exams). Gillebaart and De Ridder (2015) argue that the success rate of dealing with response conflicts is what distinguishes high and low self-controlled individuals. Individuals with higher self-control are more sensitive to detecting response conflicts, use more effortless strategies to deal with these conflicts, seem to experience these conflicts to a lesser degree, utilize adaptive habitual behavior, and are efficient in downregulating response conflicts before they even become an obstacle. Hence, in contrast to previous assumptions of trait self-control as an effort investment trait (Duckworth et al., 2015), focusing on how individuals with differing levels of trait self-control deal with response conflicts seems promising for understanding the relationships between trait self-control and different achievement outcomes.

It has to be noted that constructs subsumed under the currently popular label socio-emotional skills such as trait self-control or grit tend to fall victim to the jingle and jangle fallacies (e.g., Schmidt et al., 2018). The broad and heterogeneous research on self-control shows similar patterns. We therefore want to be clear that in this study, we explicitly use the term *trait self-control* to refer to the personality trait in the conscientiousness domain and, thus, do not incorporate other relevant topics in psychological research such as metacognitive strategies (Zimmerman and Kitsantas, 2005) or state self-control capacity (Lindner et al., 2019). On a theoretical level, trait self-control and conscientiousness are closely related. Roberts et al. (2005) argue that trait self-control can best be viewed as a lower-order facet in their hierarchical conscientiousness model. The relevance of conscientiousness for scholastic achievement and achievement later in life is uncontested (Poropat, 2009; Spengler et al., 2014, 2015). Researchers found similar results to the findings presented by Duckworth and Seligman (2005) with regard to the incremental relationship of conscientiousness over intelligence for scholastic achievement (e.g., Barton et al., 1972; Chamorro-Premuzic and Furnham, 2008; Furnham and Monsen, 2009; Spengler et al., 2016). With the present investigation, we aimed, on the one hand, to expand on the findings by Duckworth and Seligman (2005). On the other hand we wanted to shed light on trait self-control, as a popular construct among the socio-emotional skills. This approach is in line with the recent trend toward investigating

facets in contrast to broad domains (Mõttus et al., 2017; Schmidt et al., 2020). However, we included a measure to assess conscientiousness to broaden the perspective of the presented research.

TRAIT SELF-CONTROL AND ACADEMIC ACHIEVEMENT

Research shows that trait self-control is an important predictor of students' achievement-related learning behavior (e.g., Zimmerman and Kitsantas, 2005) at school (e.g., Bertrams and Dickhäuser, 2009), in university (e.g., Tangney et al., 2004), and in vocational education and training (Lindner et al., 2015). Researchers explain this relationship on different levels. Duckworth et al. (2012) claim that being self-controlled is advantageous in school when studying the contents of what is formally taught, leading to an increase in GPA through higher-valued learning outcomes and, in addition, through behavior in the classroom that may be factored into report card grades by teachers directly (Brookhart, 1994; Cizek et al., 1995; McMillan et al., 2002). In a similar vein, findings show that more self-controlled individuals behave better in the classroom (Valiente et al., 2008), show better completion of sometimes strenuous homework assignments, and show overall more effortful behavior in school (Duckworth and Seligman, 2005).

Up until now, studies only rarely recognized the differences in the relevance of the achievement measures that were used. We assume that the influence of trait self-control on an achievement outcome varies with the subjective importance an individual subscribes to that very outcome. Derived from the considerations on the differential impact of trait self-control on the perception and handling of response conflicts in high-stakes and low-stakes situations, it seems essential to address this issue in trait self-control research. In contrast to low-stakes standardized assessments for the purposes of research, school grades are of great importance for the start of work life or post-compulsory education (Brookhart, 1991). Hence, the perception of response conflicts may partly explain the stronger positive relationships between trait self-control (i.e., defined as a trait that enables individuals to sensitively detect and handle response conflicts) and personal highly valued grades. On the other hand, the findings on the relationship with achievement outcomes in standardized tests may be explained by the absence of response conflicts (i.e., test results have no personal consequences for individuals' future).

TRAIT SELF-CONTROL AND STANDARDIZED ACHIEVEMENT TESTS

Studies that investigated the impact of trait self-control when individuals are required to invest effort in order to solve items in standardized achievement tests are scarcer than studies focusing on the relationship between trait self-control and GPA. Studies investigating the relationships with domain-specific achievement tests—especially tests that aim to assess curriculum-derived competencies relevant to the tested individuals—are scarce as well.

The findings on the relationships between trait self-control and achievement in standardized achievement tests vary to a certain degree. Whereas some studies found positive relationships between trait self-control and achievement in standardized tests (Duckworth and Seligman, 2005; Bertrams and Dickhäuser, 2009), other studies did not find a significant relationship between trait self-control and achievement (Lindner et al., 2017; Lindner and Retelsdorf, 2019). Interestingly, achievement in a mathematics tests showed positive relationships with trait self-control when the students were graded for their performance in the test (Bertrams, 2012). These findings imply that the importance of the outcome of a standardized test has an impact on the way trait self-control interacts with the way the test is completed.

Hence, response conflicts may play a role in the way that the importance of the consequences of the test results may influence the tested individual. The effects response conflicts can have on the achievement in standardized tests in low-stakes situations may be negligible and vice versa for high-stakes situations. Gillebaart and De Ridder (2015) argue that trait self-control is associated with a higher sensitivity for detecting response conflicts. Since no or only small response conflicts need to be overcome in low-stakes assessment, the impact of trait self-control on the performance in achievement tests should be limited. The effortless self-control strategies that highly self-controlled individuals possess would not necessarily be utilized due to the non-existent response conflicts and thus, in theory, have no impact on the low-stakes assessment performance. In high-stakes achievement situations, individuals have to prepare themselves for reaching highly valued overarching goals (e.g., getting good grades in the upcoming exam) instead of following more rewarding and less effortful activities (i.e., watching movies). Therefore, trait self-control is required to overcome such response conflicts.

However, findings also support the notion of trait self-control defined as an effort investment trait (Duckworth et al., 2015). Studies, for example, found that more self-controlled students show more perseverance in time-consuming, controlled information processing when working on standardized low-stakes achievement tests (Lindner et al., 2018). In another study, trait self-control has been found to stand in positive relationship to the amount of effort and time-on-task invested in an achievement test in mathematics (Lindner et al., 2017), whereas no relations were found between trait self-control and test performance in mathematics. Similar results were found in another study by Lindner and Retelsdorf (2019), who investigated the relations between trait self-control and achievement-related outcomes (test taking effort, motivation, and performance) in a low-stakes test for assessing English as a foreign langue. All in all, the presented findings indicate support for both approaches to trait self-control. With this study, we aim to shed light on the degree to which one or the

other approach may be more suitable to explain the differential relationships between trait self-control and high-stakes and low-stakes achievement indicators.

RELATIVE INFLUENCES OF TRAIT SELF-CONTROL AND INTELLIGENCE ON ACHIEVEMENT

Duckworth et al. (2012) showed that school grades stand in closer relationship to trait self-control than to intelligence, whereas standardized achievement stands in closer relationship to intelligence than to trait self-control. The authors argue that these differences in relationships reflect the differing competencies assessed in GPA versus standardized tests. Grades in school are influenced not only by the teachers' assessment of the contents the students actually learned but, in addition, by the behavior inside the classroom (e.g., participation or attendance) and outside the classroom (e.g., homework completion). School grades thus represent an amalgamation of multiple factors that are influenced by the assessment of curricular competence *and* scholastic behaviors, which are in turn influenced by socio-emotional skills (Farrington et al., 2012). A recent study by Galla et al. (2019) showed not only that school grades are better than high-stakes admission test scores in predicting on-time college graduation but also that 40% of the variance of the grades can be explained by measures of self-regulation in contrast to only 3% of the high-stakes SAT scores. These findings can be explained by the teachers' explicit and implicit inclusion of socio-emotional skills in their grading process. Furthermore, and central to the present investigation, school grades are highly important achievement outcomes for the individual (Galla et al., 2019). More self-controlled individuals are held to be better prepared to perceive and tackle response conflicts that arise in high-stakes situations (Gillebaart and De Ridder, 2015). Hence, trait self-control factors into the grading process in more than one way.

With the application of standardized achievement tests, policy makers, administrators, and researchers alike aim to acquire a purer reflection of competence rather than to test for the competence acquired of the curricula that students were actually exposed to. In addition, the research on the relationship between standardized tests and school achievement—or trait self-control for that matter—mostly uses composite measures of a broad set of competencies. Thus, school grades and standardized achievement tests differ in not only the competencies they aim to assess but to what end they are administered. In addition, standardized tests for the purposes of research mostly represent low-stakes testing situations. It appears obvious that intelligence can be expected to show stronger relationships with standardized achievement tests, as both refer specifically to the performance on a set of cognitive tests directly (as intended by tests of cognitive ability) or indirectly (through testing a broad set of competencies that are not necessarily part of the curriculum the students came in contact with). The findings by Duckworth et al. (2012) confirm these assumptions. Notably, it cannot be ruled out that these results to a degree stemmed from shared method variance (mono-method-bias) to the degree that the strength of relationships is in part a result of similar methods used.

To circumvent this problem to a certain extent, we used a domain-specific standardized low-stakes achievement test that reflects a curriculum-bound assessment of competencies relevant to the individuals in the vocational training. To the best of our knowledge, no empirical studies have analyzed the relationship between school grades and domain-specific tests on the one hand and trait self-control as well as fluid reasoning on the other hand, with the exception of Duckworth et al. (2012).

THE PRESENT INVESTIGATION

Is trait self-control more strongly associated with achievement than fluid reasoning, or does it only stand out in situations that are more important to the individual as recent conceptual changes in trait self-control research imply? To address these issues, we used a large and heterogeneous sample of young adults at the beginning of their vocational training and investigated the incremental validity of trait-self-control over fluid reasoning for not only school achievement but also domain-specific standardized achievement test scores (mathematics and physics) that reflect relevant domains of competence for the individuals in the sample. In line with the novel conceptualization of trait self-control, we would further argue that school achievement could be conceptualized as high-stakes and the standardized tests as lower-stakes, a conceptualization we discuss down below. Our research thus enables us to get a better understanding of the socio-emotional skill as well as the differential relationships between trait self-control and two relevant indicators of achievement. Our research also contributes to the ongoing discussion on the utility of the social–emotional skill.

Derived from the theoretical assumptions with regard to trait self-control and response conflicts, we would assume that trait self-control is more important for high-stakes scholastic achievement than the lower-stakes achievement in the standardized tests. We would assume to find positive relationships between fluid reasoning and school achievement and even stronger relationships with the standardized tests, in part due to the higher methodological similarity. Derived from earlier research on the added value of trait self-control over intelligence, we assume trait self-control to be at least as important as fluid reasoning with regard to grades. In contrast, we do not hypothesize that trait self-control outdoes fluid reasoning with regard to the standardized tests in mathematics and physics, even though the tests are domain-specific, and thus, the methodological similarity can be assumed to be less relevant than in earlier studies that used standardized assessments of broad school achievement.

In addition, we assume that individuals higher in fluid reasoning may profit more from being more self-controlled. Following the argumentation by Gillebaart and De Ridder (2015), individuals high in trait self-control handle response conflicts more advantageously. Subsequently, they should profit more from better fluid reasoning. Thus, we assume to find a positive interaction effect for high-stakes school achievement. For the

low-stakes achievement tests, we were not able to derive a concrete hypothesis from the scarce literature on the topic. Therefore, we keep the investigation of the interaction effect on the standardized tests exploratory in nature. However, it seems less plausible to find an interaction effect for the low-stakes testing situation, as we would assume to have less pronounced response conflicts.

MATERIALS AND METHODS

Sample

The data stemmed from the study Mathematics and Science Competencies in Vocational Education and Training (ManKobE; cf. Retelsdorf et al., 2013). The sample consisted of trainees in different vocational fields, namely industrial clerks and technicians, with the latter consisting of car mechatronics, industrial, and electrical technicians as well as chemical and biological laboratory assistants. The final sample comprised N = 3,146 trainees. Participants' average age was 18.58 (SD = 2.77), and 38.5% of the participants were female. In the sample, 20% reported having at least one parent born outside of Germany. The data were assessed in five German federal states (Bavaria, Hesse, Lower Saxony, North Rhine-Westphalia, and Baden-Württemberg).

This study was carried out in accord with the ethical guidelines for research with human participants as proposed by the American Psychological Association (APA). The study materials and procedures were approved by the Ministries of Education and Cultural Affairs of the Federal States of Hesse, Bavaria, North Rhine-Westphalia, Lower Saxony, and Baden-Württemberg. The data were collected by qualified research assistants under the administration of the Data Processing and Research Center in Hamburg, which is part of the International Association for the Evaluation of Educational Achievement (IEA). Before data collection, the Data Processing Center in Hamburg obtained written informed consent from all participants and—if not of legal age—their parents. The analysis scripts of our reported results, the relevant data to reproduce these results, and a list of publications using data from the ManKobE project are open and available to download (Schmidt, 2020).

Measures

Trait Self-Control

Trait self-control was assessed using the adapted German version (α = 0.82; Bertrams and Dickhäuser, 2009) of the Brief Self-Control Scale (Tangney et al., 2004). All 13 items (e.g., "I say inappropriate things.") were rated on a five-point Likert scale, anchored at 1 "not at all like me" and 5 "very much like me."

Conscientiousness

We assessed conscientiousness with the Big Five Inventory-2 (BFI-2; α = 0.76; Soto and John, 2017; German version: Lang et al., 2001). The BFI-2 facets were constructed to strike a balance between bandwidth and fidelity using 12 items to assess the personality trait (e.g., "I am someone who is systematic, likes to keep things in order"). The same five-point Likert-type scale as for trait self-control was used as the response format.

Fluid Reasoning

Domain-general fluid reasoning was assessed by three subtests of the Cognitive Ability Test (Heller and Perleth, 2000). These subtests examine reasoning in the verbal (20 items), numerical (20 items), and figural (25 items) domains. In the present study, weighted likelihood estimates (WLEs; WLE reliability = 0.90) from a composite one-dimensional model were used as individual scores for further analyses. Reasoning subtests are considered a fair indicator of general intelligence (Neisser et al., 1996).

Mathematics and Physics Achievement

We assessed mathematics and physics achievement with tests developed by the Institute for Educational Quality Improvement in Berlin. The tests are based on the German Educational Standards in mathematics and physics (Pant et al., 2013) and thus assess curriculum-derived proficiency in the two domains, which are important in vocational training. The tests were administered using a matrix design in which trainees worked only on a subset of the items (mathematics, 34 items, and physics, 40 items). Again, individual scores were calculated in the form of WLEs with acceptable reliabilities of 0.65 (mathematics) and 0.67 (physics) due to the heterogeneity of the competencies measured.

Major GPA

The major GPA (mGPA) is an aggregate of the grades in the first and second languages as well as the grades in mathematics and the compulsory optional subjects. In our study, we used the grades in the main subjects that are compulsory and the grades in the optional subjects that the students are required to take (but can choose from a set of subjects). The German grading system ranges from 1 (outstanding) to 6 (fail). To facilitate the interpretation of our results, school grades were reverse-coded so that higher scores reflected more positive outcomes.

Control Measures

Trainees' socioeconomic status was indicated by the highest parental score (either mother or father) on the International Socio-Economic Index of Occupational Status (HISEI; Ganzeboom et al., 1992). Because large variances lead to convergence problems, the HISEI was divided by 100. This transformation only affects the variable's raw metric and has no influence on the standardized results reported below. Migrant status was dummy-coded (0 = both parents born in Germany, 1 = one or both parents born outside Germany). Finally, participants' age and gender (female = 1, male = 2) were used in the present study.

Analyses

All multiple regressions were estimated in Mplus, Version 8.1 (Muthén and Muthén, 1998). Because students were clustered in vocational school classes, we accounted for potential dependencies by obtaining cluster robust standard errors via the Mplus option "TYPE = COMPLEX." We probed all interactions using the Johnson–Neyman method

(Johnson and Neyman, 1936; Hayes, 2013) to identify regions of significance. All dependent variables (mGPA, mathematics achievement, and physics achievement) were estimated simultaneously (see **Appendix Table A1** for the stepwise regression for trait self-control, conscientiousness, and fluid intelligence). We controlled for the effects of gender, age, HISEI migration status, and conscientiousness in our analyses. Missing data were handled via full information maximum likelihood estimation accounting for missing data (on average, 11.4% of the data were missing). We estimated the models again using listwise deletion to obtain an indicator of the robustness of the results. The resulting relationship patterns were virtually identical to those reported below (see Schmidt, 2020, to find the analysis scripts and results). Moreover, no *a priori* analysis of statistical power was conducted. However, a *post hoc* power analysis for the final model with a small effect size reveals a power of 1-β = 0.99 using the given sample size with GPower (Faul et al., 2007).

RESULTS

The correlations between all dependent and independent variables as well as all control measures used in the study can be found in **Table 1**. As expected, fluid reasoning as assessed in our study showed strong relationships with the standardized test results for mathematics and physics and a weaker but statistically significant correlation with mGPA. Trait self-control, on the other hand, showed the expected strong relationships with mGPA but no statistically significant relationships with either standardized achievement test. The relationship between trait self-control and conscientiousness was substantial (shared variance 34%).

To test for the incremental validity of trait self-control over fluid reasoning as assessed in our study, we estimated a simultaneous multiple regression with the covariates named earlier. The regression coefficients of the standardized solution from the regression model with trait self-control, fluid reasoning, and the interaction between the two can be found in **Table 2**. For all dependent measures, significant associations for fluid reasoning emerged. On average, higher trait self-control was associated with higher mGPA but not with higher test scores in mathematics and physics. Combined, the constructs explained substantially more variance of the achievement tests (math, 29%; physics, 37%) than they did for mGPA (12%). The inclusion of conscientiousness did not change the amount of explained variance for all three outcomes (see **Appendix Table A1** for the

TABLE 1 | Descriptive statics and observed correlations of study variables.

	M	*SD*	1	2	3	4	5	6	7	8	9	10
(1) Gender			–									
(2) Age	18.58	2.77	−0.08*	–								
(3) Migration status			0.08*	0.11*	–							
(4) HISEI	48.69	18.16	−0.05*	0.06*	−0.21*	–						
(5) mGPA	4.44	0.58	−0.22*	−0.15*	−0.09*	0.03	–					
(6) Math score	0.81	1.31	−0.05*	0.07*	−0.16*	0.11*	0.13*	(0.65)				
(7) Physics score	0.79	1.17	−0.08*	0.10*	−0.21*	0.17*	0.14*	0.49*	(0.67)			
(8) Fluid rea.	0.05	0.97	−0.21*	0.17*	−0.19*	0.14*	0.14*	0.53*	0.60*	(0.90)		
(9) TSC	3.27	0.62	−0.12*	0.03	−0.04*	−0.03	0.16*	0.03	0.01	0.05*	(0.81)	
(10) Conscientiousness	3.56	0.47	−0.18*	0.10*	−0.04*	−0.01	0.17*	0.06*	0.05*	0.08*	0.58*	(0.76)

*TSC, trait self-control; HISEI, Highest International Socio-Economic Index of Occupational Status; mGPA, major grade point average; fluid rea., fluid reasoning. Reliabilities in parentheses. *p < 0.05.*

TABLE 2 | Standardized slope estimates of the multivariate regression analyses.

	mGPA			Mathematics test score			Physics test score		
	Est.	**95% CI**	***p***	**Est.**	**95% CI**	***p***	**Est.**	**95% CI**	***p***
Gender	−0.17	[−0.21, −0.13]	0.000	0.07	[0.03, 0.10]	0.000	0.05	[0.01, 0.08]	0.009
Age	−0.23	[−0.28, −0.18]	0.000	−0.01	[−0.05, 0.03]	0.625	0.01	[−0.02, 0.04]	0.589
HISEI	0.01	[−0.03, 0.05]	0.539	0.03	[0.00, 0.07]	0.036	0.07	[0.04, 0.11]	0.000
Migration Status	−0.02	[−0.06, 0.03]	0.408	−0.06	[−0.10, −0.03]	0.000	−0.09	[−0.12, −0.06]	0.000
BFI-2 Con.	0.11	[0.06, 0.15]	0.000	0.03	[−0.01, −0.07]	0.122	0.03	[−0.01, 0.06]	0.161
TSC	0.07	[0.02, 0.11]	0.008	−0.01	[−0.05, 0.03]	0.710	−0.02	[−0.06, 0.01]	0.187
Fluid Rea.	0.12	[0.07, 0.17]	0.000	0.52	[0.48, 0.56]	0.000	0.58	[0.55, 0.61]	0.000
TSC x Fluid Rea.	0.03	[−0.01, 0.07]	0.134	0.00	[−0.03, 0.04]	0.822	0.01	[−0.02, 0.04]	0.460
	R^2 = 0.12 (adjusted R^2 = 0.12)			R^2 = 0.29 (adjusted R^2 = 0.29)			R^2 = 0.37 (adjusted R^2 = 0.37)		

TSC, BSCSTrait Self-control; HISEI, Highest International Socio-Economic Index of Occupational Status; BFI-2 Con., BFI-2 Conscientiousness; mGPA, major grade point average; est., estimate; CI, confidence interval; fluid rea., fluid reasoning.

results from a stepwise regression approach). The results thus indicate that for mGPA, conscientiousness and trait self-control are equally important predictors, even though conscientiousness overall showed stronger relationships with mGPA than trait self-control in the final model (see **Table 2**).

In line with previous research, fluid reasoning proved to be relatively more important for achievement in standardized tests; the coefficients for fluid reasoning were overall larger than those for trait self-control. For mGPA, on the other hand, trait self-control emerged to be equally important. For all three indicators of achievement, no significant interaction effects (fluid reasoning × trait self-control) emerged.

A follow-up Johnson–Neyman procedure for plotting interactions (Johnson and Neyman, 1936; Hayes, 2013) can reveal regions of significance even if the overall interaction effect is non-significant or small, as they typically are (Nagengast et al., 2011). The Johnson–Neyman procedure revealed that the association of trait self-control with mGPA was significantly positive among individuals scoring higher than −1.5 *SD* below average on the fluid reasoning measure (see **Figure 1**). These findings imply that the individuals higher in fluid reasoning profit with regard to scholastic achievement by being more self-controlled. In other words, apart from the individuals scoring on the very low end on the fluid reasoning scale, individuals higher in fluid reasoning profit more from higher scores in trait self-control. No such interactions were found in the follow-up Johnson–Neyman analysis for physics (**Figure 2**) and mathematics (**Figure 3**) achievement.

DISCUSSION

Socio-emotional skills have become popular among researchers as well as practitioners and politicians, as they offer a new perspective on pathways to achievement in education and in the workplace. To replace cognitive skills to a degree with socio-emotional skills as crucial prerequisites for achievement is a prominent idea not only due to the notion of their potential higher malleability but also because these constructs have been offered as a potential gateway to more equal opportunity to success (Farrington et al., 2012). However, critics pointed to a number of unresolved issues and questioned the *de facto* utility of the so-called socio-emotional skills. Which of the current conceptualizations of trait self-control is more suitable to explain achievement? Is trait self-control superior to intelligence in explaining high-stakes teacher assessment of proficiency as measured by grades? Does trait self-control show stronger associations with achievement in curriculum-based lower-stakes standardized achievement tests than intelligence?

Trait self-control is one of the most prominent socio-emotional skills that attracted attention based on the promise to explain achievement above intelligence. The conceptualization of the construct trait self-control, however, changed in the recent years, and open questions on the underlying mechanisms of the construct emerged. Research showed it to stand in positive relationship, for example, with school performance, income, and employment (De Ridder et al., 2012; Duckworth and Carlson, 2013). Duckworth et al. (2015) explained these findings with the

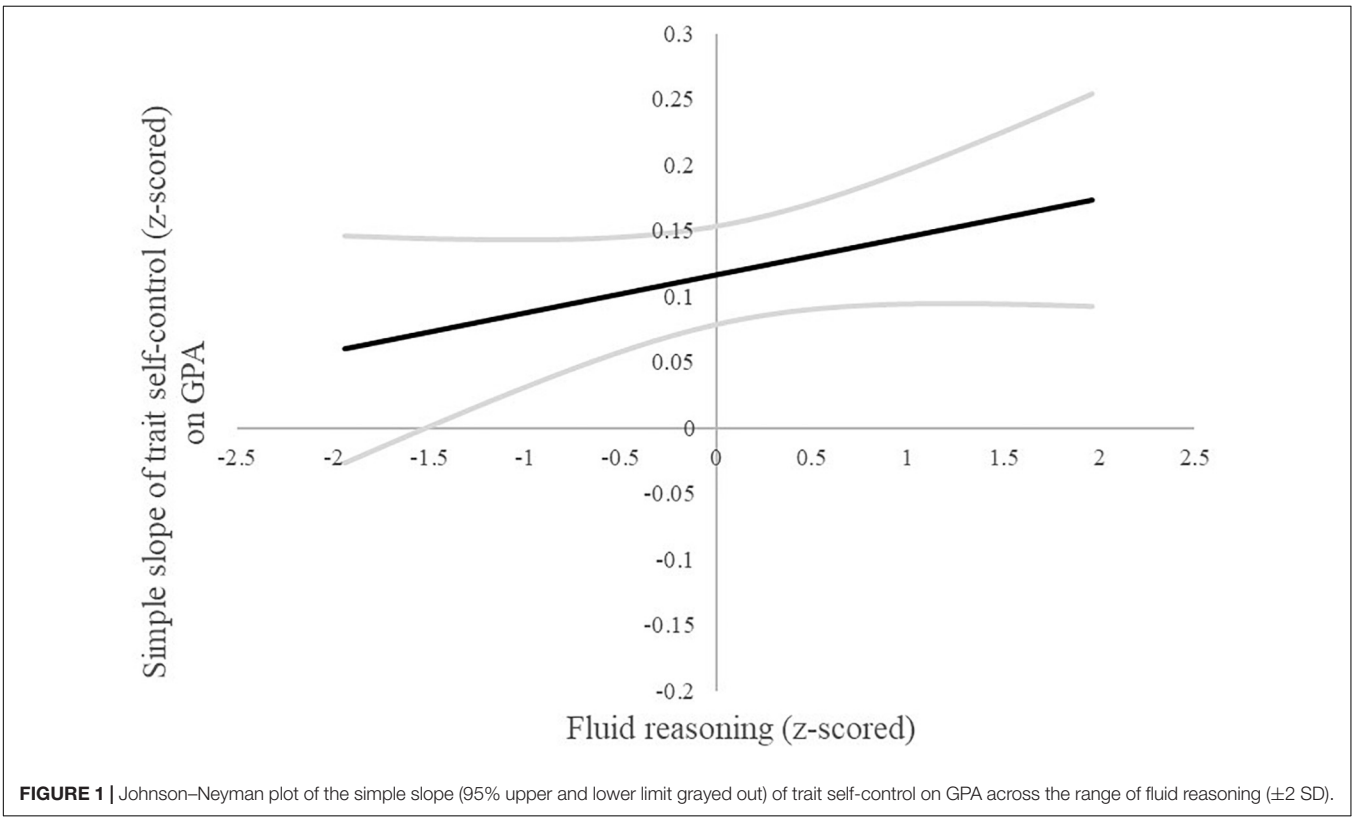

FIGURE 1 | Johnson–Neyman plot of the simple slope (95% upper and lower limit grayed out) of trait self-control on GPA across the range of fluid reasoning (±2 SD).

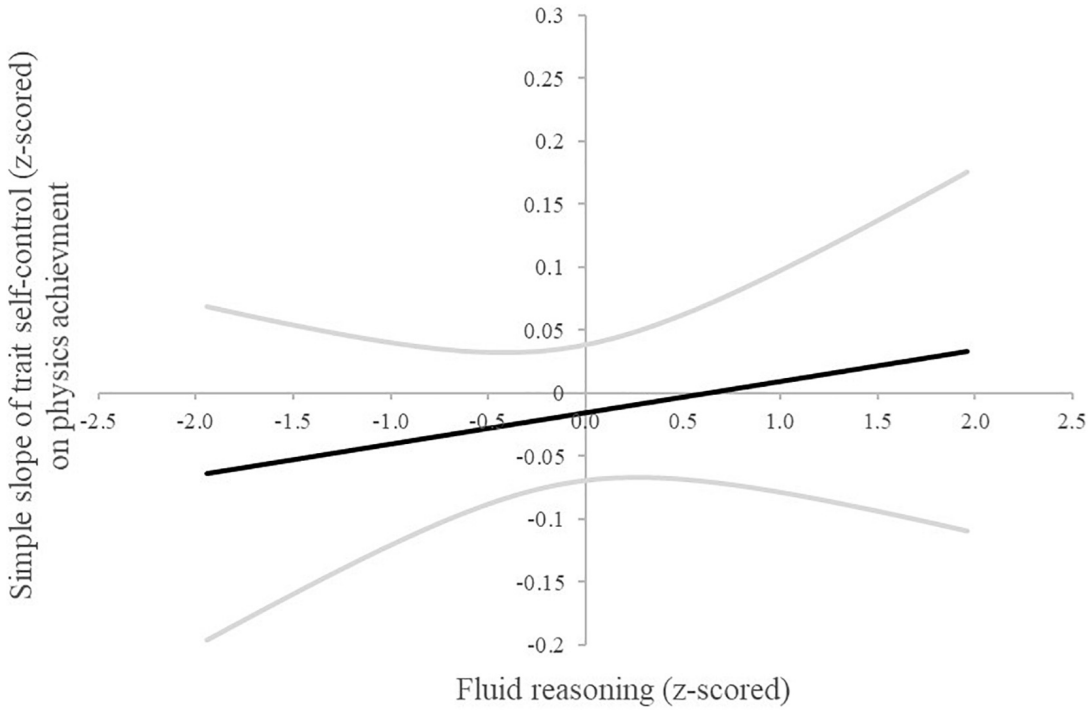

FIGURE 2 | Johnson–Neyman plot of the simple slope (95% upper and lower limit grayed out) of trait self-control on physics achievement across the range of fluid reasoning (±2 SD).

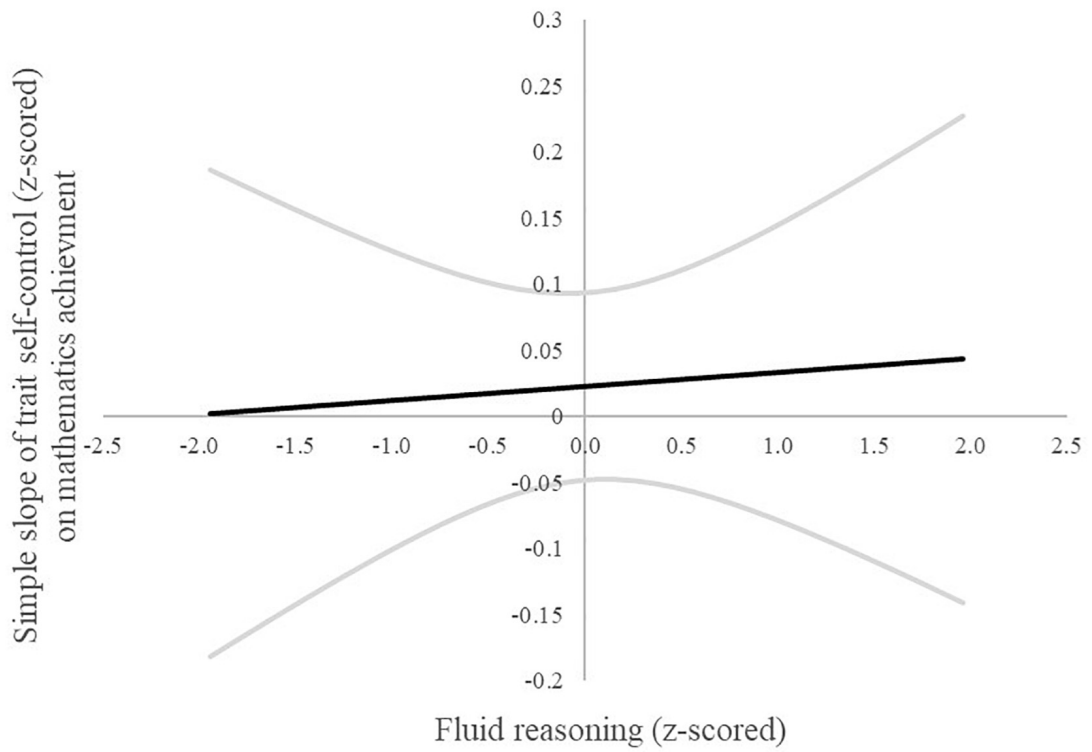

FIGURE 3 | Johnson–Neyman plot of the simple slope (95% upper and lower limit grayed out) of trait self-control on mathematics achievement across the range of fluid reasoning (±2 SD).

higher effort individuals invest in pursuing their goals in addition to the better inhibition of falling victim to alluring alternative behavioral tendencies. Recent research brings the importance of the consequences of the tests taken into focus. Gillebaart and De Ridder (2015) argue that highly self-controlled individuals are more able to avoid and regulate response conflicts and therefore achieve their pursued goals more successfully.

With the present study, we aimed to add to the ongoing debate on the conceptualization and utility of trait self-control and investigated the associations of trait self-control with high-stakes school achievement as measured by mGPA and two low-stakes standardized achievement tests beyond fluid reasoning using a broad and heterogeneous sample. The utility of fluid reasoning outweighs trait self-control for the domain-specific standardized achievement tests in mathematics and physics. Other than in previous studies (e.g., Duckworth and Seligman, 2005), the achievement tests were not domain-general measures of broad scholastic proficiency. We used tests to assess mathematics and physics achievement that were developed with the aim to assess curriculum-relevant achievement. Thus, the relevance of fluid reasoning is uncontested, and trait self-control does not add when comparing these constructs head-to-head.

Trait self-control did significantly show associations with mGPA over fluid reasoning (and conscientiousness) but, in contrast to earlier findings, did not surpass fluid reasoning, restricting its relevance as a socio-emotional skill to a degree. However, the results of our study hint on the relevance of response conflict resolution ability of more self-controlled individuals (Gillebaart and De Ridder, 2015) rather than the effort investment hypothesis (Duckworth et al., 2015). We were able to show that trait self-control plays a role in school achievement as measured by grades as opposed to achievement in the low-stakes standardized tests. We can only assume that the significant relationships between trait self-control and mGPA result at least partly from the higher stakes involved and the resulting more effortless strategies to show self-controlled behavior. In situations in which response conflicts occur (high-stakes situations), trait self-control seems to give individuals the edge in showing their true potential, whereas in low-stakes situations, trait self-control seems to be less relevant. Notably, the associations between trait self-control and mGPA remained statistically significant when controlling for conscientiousness, even though the relationship was weaker after conscientiousness was introduced. Trait self-control can be seen as a facet in the conscientiousness domain (Roberts et al., 2005). Thus, our results are in line with the reasoning by Mõttus et al. (2017), who argues that it can be worthwhile to investigate lower-order facets such as trait self-control. However, our results show that conscientiousness in part outperformed trait self-control, as it showed overall slightly stronger associations with mGPA.

Even though the results of this study imply that the stakes involved stand in relationship with the impact trait self-control can have on achievement, and thus serve as an argument for the importance of response conflicts, this study cannot explain if the response conflict resolution is just a preliminary step in achieving valued goals and the subsequent higher-effort investment actually explains the results. Furthermore, the results by Galla et al. (2019) show the substantial overlap between grades and measures of self-regulatory competencies, indicating common method variance that may exaggerate the differential findings to a degree. In a similar vein, Duckworth et al. (2012) argue that self-control shows differing relationships with GPA and standardized tests because these indicators reflect different competencies. It has to be noted that in contrast to the study by Duckworth et al. (2012), the standardized tests we used are more ecologically valid. In addition, it is still unclear to what degree the higher social acceptance of the academic behavior or, for example, the more habitualized learning behavior the more self-controlled students show impacts the grading of the teachers or if the behavior shown in class may even be more or less independent from personality factors (Spengler et al., 2018). It thus seems worthwhile to investigate the factors influencing the grading process more closely in future research. In addition, our findings on the differential relationship between fluid reasoning and trait self-control and mGPA may in part be explained by the more heterogeneous sample we used. Most previous studies investigating the incremental validity of trait self-control over intelligence for academic achievement used highly selected samples of university students for which a restriction in the variance of intelligence can be expected. This may result in an unwanted deflation of the associations between intelligence and achievement and in turn lead to an overestimation of the association between academic achievement and trait self-control in comparison to intelligence.

Fluid reasoning and trait self-control did not interact statistically significantly; however, the *post hoc* Johnson–Neyman analysis revealed some interesting information on the associations with mGPA. They suggest that students higher in fluid reasoning may profit more from higher scores in trait self-control. Only the students on the very low end of the fluid reasoning spectrum in our sample did not profit significantly from higher scores in trait self-control. These findings to a degree question the usefulness of efforts to foster trait self-control in students in need as suggested by the policy decisions named earlier (U. S. Department of Education, 2013; UK Department of Education, 2014), as they imply that students would not benefit equally from these endeavors. Further research should consider taking a closer look at the interplay between socio-emotional skills, intelligence, and other relevant factors for success when investigating their impact on academic achievement to determine if our *post hoc* analyses are in fact meaningful. In addition, the consideration of facets is useful not only with regard to non-cognitive personality traits as mentioned above but also with regard to cognitive personality traits (Kretzschmar et al., 2018). An investigation on the facet level of intelligence would therefore be a welcomed addition to the literature.

All in all, our results highlight the utility of trait self-control, as it shows significant relationships with broader measures of high-stakes school performance to a degree, but set limits to more objective and lower-stakes assessments of achievement. The findings thus replicate the study by Duckworth et al. (2012) only in part, as we did not find trait self-control to

show substantially higher associations to achievement than fluid reasoning. However, our results are in accordance with the more recent conceptualization of trait self-control emphasizing response sensitivity rather than effort investment to explain the association of trait self-control with achievement.

Limitations and Future Directions

Finally, some limitations of the present study need to be addressed. First, our samples only comprised students from vocational training, limiting the generalizability of the findings. Second, we were only able to use cross-sectional data; longitudinal surveys are needed to confirm the findings. Third, we only used self-report measures to assess trait self-control, the limits of which are well documented (Lucas and Baird, 2006). Furthermore, we did not correct for measurement error in our analyses. The results thus may represent a conservative estimation of the actual effect sizes. Finally, the measure we used to assess school achievement (mGPA) should not be mistaken for the widely used GPA. The mGPA consists of the compulsory subjects including optional subjects. Thus, the mGPA is a less broad measure of scholastic achievement than the GPA. This is a limitation that needs to be kept in mind when interpreting our results, such as the comparatively weak relationship between mGPA and fluid reasoning and the overall lower percentage of variance explained in mGPA in the regression analyses.

It must be noted that the explanatory power of our findings is limited to the degree that common method variance may have influenced the results (for a discussion, see Lechner et al., 2017). In an earlier study, Duckworth and Seligman (2005) similarly suspected that the common variance between intelligence and the achievement test score was due to shared method variance. They went on to argue that independent from actual knowledge or ability, some students may perform well in multiple-choice items under time constraints regardless of their content. However, in the present investigation, we decided to include domain-specific tests that were developed to assess curriculum-relevant content for adults in vocational training. We therefore would assume that the effect the common method variance has on our results may in fact at least be smaller than in the previous studies. In addition, the results with regard to the differential associations of fluid reasoning and trait self-control with achievement in high-stakes and low-stakes situations cannot be compared head-to-head with the data we used. A more elaborate approach would be to find more similar indicators of achievement or competence in high-stakes and low-stakes situations that would make it possible to, for example, investigate foreign language competence in high-stakes and low-stakes situations in parallel. Such a design would enable giving a better indication on the impact of fluid reasoning and trait self-control with regard to the relevance of the outcome of the test.

Furthermore, it has to be noted that we used a domain-general operationalization of fluid reasoning. Previous research showed that different facets of intelligence can lead to differing relationships with personality traits such conscientiousness (Kretzschmar et al., 2018). The results of our investigation might change considerably when investigating the facets separately; thus, our results need to be interpreted with this restriction in mind. We would encourage further research in this domain (e.g. Schmidt et al., 2019).

Finally, we cannot be certain that our presumption on the subjective perception of high-stakes and low-stakes situations is correct. We can only assume that the subjective relevance of mGPA is higher to the individuals in our sample than the results of the standardized tests. The tests were not used to give feedback to the individuals in vocational training, nor were the individual results submitted to the teachers or other stakeholders. The students were reimbursed for their participation but were not specifically incentivized for higher achievement or higher effort. Nevertheless, studies investigating the impact of the stakes involved in a testing situation on trait self-control should preferably include explicit measures to assess the relevance of the testing situations. Such approaches would enable getting a more in-depth grasp on the mechanisms behind trait self-control, for example, whether there exists a differential or even a combined sequential impact of response sensitivity and effort investment on achievement.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author. The analysis scripts of our reported results, the relevant data to reproduce these results, and a list of publications using data from the ManKobE project are open and available to download (Schmidt, 2020).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ministries of Education and Cultural Affairs of the Federal States of Bavaria, Hesse, Lower Saxony, North Rhine-Westphalia, and Baden-Württemberg. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

FS: conceptualization, formal analysis, writing original draft, and editing. CL: conceptualization, editing, and review. JE: data curation, formal analysis, and methodology. JR: conceptualization, editing, and review.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX

TABLE A1 | Standardized slope estimates of the multivariate regression analyses.

	M1			M2			M3			M4		
	Est.	**95% CI**	***p***	**Est.**	**95% CI**	***p***	**Est.**	**95% CI**	***p***	**Est.**	**95% CI**	***p***
Outcome: mGPA												
Gender	−0.22	[−0.26, −0.18]	0.000	−0.18	[−0.22, −0.14]	0.000	−0.18	[−0.22, −0.14]	0.000	−0.17	[−0.21, −0.13]	0.000
Age	−0.20	[−0.24, −0.15]	0.000	−0.22	[−0.27, −0.17]	0.000	−0.23	[−0.28, −0.18]	0.000	−0.23	[−0.28, −0.18]	0.000
HISEI	0.02	[−0.02, 0.05]	0.431	0.01	[−0.03, 0.05]	0.604	0.01	[−0.03, 0.05]	0.596	0.01	[−0.03, 0.05]	0.539
Migration Status	−0.05	[−0.09, 0.00]	0.027	−0.02	[−0.06, 0.02]	0.366	−0.02	[−0.06, 0.02]	0.361	−0.02	[−0.06, 0.03]	0.408
BFI-2 Con.		–			–		0.14	[0.10, 0.18]	0.000	0.11	[0.06, 0.15]	0.000
TSC		–		0.13	[0.08, 0.16]	0.000		–		0.07	[0.02, 0.11]	0.008
Fluid Rea.		–		0.12	[0.07, 0.17]	0.000	0.12	[0.07, 0.17]	0.000	0.12	[0.07, 0.17]	0.000
TSC x Fluid Rea.		–		0.03	[−0.01, 0.07]	0.139		–		0.03	[−0.01, 0.07]	0.134
	R^2 = 0.09 (adjusted R^2 = 0.09)			R^2 = 0.12 (adjusted R^2 = 0.12)			R^2 = 0.12 (adjusted R^2 = 0.12)			R^2 = 0.12 (adjusted R^2 = 0.12)		
Outcome: Mathematics Test Score												
Gender	−0.02	[−0.07, 0.02]	0.257	0.07	[0.03, 0.10]	0.000	0.07	[0.03, 0.10]	0.000	0.07	[0.03, 0.10]	0.000
Age	0.09	[0.05, 0.13]	0.000	−0.01	[−0.05, 0.03]	0.709	−0.01	[−0.05, 0.03]	0.633	−0.01	[−0.05, 0.03]	0.625
HISEI	0.08	[0.04, 0.12]	0.000	0.03	[0.00, 0.06]	0.037	0.03	[0.00, 0.06]	0.035	0.03	[0.00, 0.07]	0.036
Migration Status	−0.15	[−0.19, −0.12]	0.000	−0.06	[−0.10, −0.03]	0.000	−0.06	[−0.10, −0.03]	0.000	−0.06	[−0.10, −0.03]	0.000
BFI-2 Con.		–			–		0.03	[−0.01, 0.06]	0.117	0.03	[−0.01, −0.07]	0.122
TSC		–		0.01	[−0.02, 0.04]	0.522		–		−0.01	[−0.05, 0.03]	0.710
Fluid Rea.		–		0.52	[−0.48, 0.56]	0.000	0.52	[0.48, 0.56]	0.000	0.52	[0.48, 0.56]	0.000
TSC x Fluid Rea.		–		0.00	[−0.03, 0.04]	0.814		–		0.00	[−0.03, 0.04]	0.822
	R^2 = 0.04 (adjusted R^2 = 0.04)			R^2 = 0.29 (adjusted R^2 = 0.29)			R^2 = 0.29 (adjusted R^2 = 0.29)			R^2 = 0.29 (adjusted R^2 = 0.29)		
Outcome: Physics Test Score												
Gender	−0.06	[−0.10, −0.01]	0.013	−0.04	[0.01, 0.08]	0.014	−0.04	[0.01, 0.08]	0.009	0.05	[0.01, 0.08]	0.009
Age	0.11	[0.08, 0.15]	0.000	−0.01	[−0.02, 0.04]	0.489	−0.01	[−0.02, 0.04]	0.550	0.01	[−0.02, 0.04]	0.589
HISEI	−0.12	[0.09, 0.16]	0.000	−0.07	[0.04, 0.10]	0.000	−0.07	[0.04, 0.10]	0.000	0.07	[0.04, 0.11]	0.000
Migration Status	−0.19	[−0.23, −0.16]	0.000	−0.09	[−0.12, −0.06]	0.000	−0.09	[−0.12, −0.06]	0.000	−0.09	[−0.12, −0.06]	0.000
BFI-2 Con.	–	–	–	–	–	–	−0.01	[−0.02, 0.04]	0.398	0.03	[−0.01, 0.06]	0.161
TSC	–	–	–	−0.01	[−0.04, 0.02]	0.570	–	–	–	−0.02	[−0.06, 0.01]	0.187
Fluid Int.	–	–	–	−0.58	[0.55, 0.61]	0.000	−0.58	[0.55, 0.61]	0.000	0.58	[0.55, 0.61]	0.000
TSC x Fluid Int.	–	–	–	−0.01	[−0.02, 0.04]	0.453	–	–	–	0.01	[−0.02, 0.04]	0.460
	R^2 = 0.08 (adjusted R^2 = 0.08)			R^2 = 0.37 (adjusted R^2 = 0.37)			R^2 = 0.37 (adjusted R^2 = 0.37)			R^2 = 0.37 (adjusted R^2 = 0.37)		

M1, only covariates; M2, covariates, IQ, and TSC; M3, covariates, conscientiousness, and IQ; M4, all variables. TSC, trait self-control; HISEI, Highest International Socio-Economic Index of Occupational Status; con., conscientiousness; mGPA, major grade point average; est., estimate; CI, confidence interval; fluid rea., fluid reasoning.

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ORIGINAL RESEARCH
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A Randomized Field Experiment Using Self-Reflection on School Behavior to Help Students in Secondary School Reach Their Performance Potential

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Recent policy reports documented that a growing group of students in secondary education could perform better given their expected performance. Studies showed that school performance is related to a range of social–emotional factors, including self-awareness, self-management, social awareness, and responsible decision making. However, experimental studies in schools on the relation between these factors and school performance are scarce, and results are mixed. This study used a randomized field experiment to examine whether self-reflection on school behavior of underperforming secondary school students affected their school performance [grade point average (GPA)], school engagement, and self-concept. The sample comprised 337 ninth-grade students (M = 15.74 years old; SD = 0.58) from 18 secondary schools in Netherlands. The intervention was designed in co-creation with teachers, to be as close to school practice as possible. Underperformance was measured using achievement test scores from both primary and secondary school, supplemented with teacher and parental assessments. Different model specifications were estimated to perform the analyses and test for robustness of findings. The results showed that, for treatment compliance, students with higher school motivation were approximately 29% more likely to comply. Students who reported higher levels of self-concept of school tasks were 17% less likely to comply. No significant effects of the treatment were observed on students' GPA, school motivation, hours spent on homework, or self-concept of school tasks. The treatment showed a negative effect on self-concept of leadership skills.

Keywords: underperformance, social–emotional skills, randomized field experiment, school engagement, school performance, secondary education

INTRODUCTION

The Importance of Social–Emotional Skills for School Performance

School performance is about more than just cognitive ability in the domains of, for example, math and reading. It includes the development of social–emotional skills, or the ability to regulate one's thoughts, emotions, and behavior. This includes empathy, self-efficacy, motivation, self-concept, collaboration, and leadership skills (OECD, 2018). Several psychological theories addressed the relation between such skills and school performance. For example, social cognition models, among which expectancy-value models and achievement-motivation models, argue that students' achievement motivation and school performance are affected by their goal-setting behavior, as well as their expectations and perceptions or beliefs about their competences and about the difficulty of the tasks they are confronted with (see Wigfield and Cambria, 2010 for an elaborate overview of such models). When students have positive beliefs about their own capabilities in relation to the task they are confronted with and are able to set realistic achievement goals, they are more likely to be motivated to start with the task and to persist when they encounter any difficulties. Consequently, they are expected to perform better at the task, compared to students who have negative beliefs about their own capabilities, or those that set unrealistic goals. This also relates to theories about self-regulatory mechanisms that address aspects of school performance related to students' task preparation, including goal setting and schematic organization, or students' performance monitoring and evaluation behavior (cf. Karoly, 1993). Setting realistic goals and reflective monitoring of progress is likely to have positive effects on students' performance.

Theories of emotional intelligence state the importance of perceiving emotions, using emotions to facilitate thought, and understanding and managing emotions, when explaining variance in students' performance (cf. Mayer et al., 2004; Talvio and Lonka, 2013). The cognitive activation theory of stress, developed by Ursin and Eriksen (2004), argues that individuals deal differently with stimulations (e.g., an examination in school). They can respond in an active problem-solving manner, or they can respond in a passive way, resulting in avoidance and procrastination. Such coping strategies are likely related to students' learning behavior in school, their school performance, and school engagement. Using a metatheoretical perspective, Ziegler and Heller (2000) argue that indeed not only factors such as coping with stress, test anxiety, and expectations, but also achievement motivation and learning and work strategies, are among the social–emotional factors that affect the process of school performance.

A number of empirical studies showed that students' school performance and behavior in later life not only were related to their abilities and knowledge, but was also driven by personality and social–emotional skills (Heckman, 2000; Heckman and Rubinstein, 2001; Carneiro and Heckman, 2003; Heckman et al., 2006, 2014; Heckman and Masterov, 2007; Poropat, 2009, 2014; Cunha et al., 2010; Kautz et al., 2014; Spengler et al., 2015, 2018; Zajacova and Montez, 2017). For example, Cunha et al. (2010) showed that 34% of variation in educational attainment was explained by ability and social–emotional factors (e.g., temperament, social development, behavioral problems, and self-competence), with 16% accounted for by ability and 12% by the social–emotional factors. In addition, Kautz et al. (2014) showed that social–emotional factors predict school performance above and beyond ability.

Empirical studies in the field of educational sciences and psychology yield more information on the exact aspects within social–emotional skills that relate to higher school performance. Several studies showed that aspects such as being able to plan and organize tasks, self-discipline, future goal orientation, self-confidence, daily learning routines, and being able to focus on important tasks were positively related to school performance (Deci and Ryan, 2000; Andriessen et al., 2006; Dietz et al., 2007; Dignath and Büttner, 2008; Lee et al., 2010; Hodis et al., 2011; McClure et al., 2011; Corker and Donnellan, 2012; Spengler et al., 2015). Some studies also explicitly showed that such factors predicted school performance above and beyond cognitive factors (Steinmayr and Spinath, 2009; Kriegbaum et al., 2015; Steinmayr et al., 2019). For example, Steinmayr et al. (2019) showed that, after controlling for students' intelligence and grades, students' self-concept of their ability accounted for at least 10% of the variance in academic achievement.

Although many of the empirical studies were of a correlational nature, a limited number of (quasi-)experimental approaches revealed evidence that there is a positive causal relation between social–emotional factors (such as motivation, self-confidence, aspirations, goal orientation, academic self-concept) and student performance (Heckman and Rubinstein, 2001; Eisen et al., 2003; Spinath and Stiensmeier-Pelster, 2003; Machin et al., 2004; Fryer, 2013; Paunesku et al., 2015). Spinath and Stiensmeier-Pelster (2003), for example, showed that having a realistic, rather than a high, academic self-concept mattered for performance. Especially for students with low levels of academic self-concept, learning could be enhanced by focusing and reflecting on individual learning progress and task enjoyment, rather than setting (competitive) performance goals in terms of results.

Social–Emotional Factors and Underperformance in School

A growing group of students in secondary education could perform better given their learning potential; that is, they show signs of underperformance. This could be related to a multitude of, often interrelated, factors at different levels, such as the student level, teacher level, school level, or factors stemming from the outside-school context (cf. West and Pennell, 2003; Montgomery, 2020). A range of studies reported that underperforming students often showed lower levels of motivation, lower future expectations, and more behavioral problems, compared to students who performed up to their expected level (Matthews and McBee, 2007; Mulder et al., 2007; Mercer and Pullen, 2009; Uno et al., 2010; Ziegler et al., 2012; Walkey et al., 2013). Underperformance in school was also observed to be negatively related to outcomes in later life. Underperforming students were

at higher risk of dropping out of school and had lower wages and more health problems at later ages, compared to other students (Heckman and Rubinstein, 2001; Lan and Lanthier, 2003; Dianda, 2008).

In recent years, a range of social and emotional learning (SEL) programs were implemented in schools, targeted at the development of social–emotional skills among students, including those that underperform. These programs usually focused on self-awareness, self-management, social awareness, relationship skills, and responsible decision making, using the psychological theories mentioned before as guiding frameworks (Elias et al., 1997; Payton et al., 2000; Talvio and Lonka, 2013; Weissberg et al., 2015). There is an ongoing debate on whether these in-school programs are targeted at the right skills and whether it is at all possible to train social–emotional skills. Shriver and Weissberg (2020) recently provided an overview of the criticism. Students naturally have different dispositions in social and emotional skills. These skills are also shown to be variable and evolve over the life cycle as people age and (changes to) the environment influences the development of social and emotional skills. Childhood and adolescence are key periods of adolescent development. The magnitude of demands on social, regulatory, emotional, and moral capacities of children aged 6 to 18 years leads to pronounced changes in a number of their personality characteristics. This clearly demonstrates that personality is malleable during this period (Chernyshenko et al., 2018).

Whereas there is some general consensus that SEL programs should be targeted at intrapersonal and interpersonal skills and attitudes (Blyth et al., 2019), in-school programs were questioned on whether they targeted the right type of social–emotional skills among adolescents. Whitehurst (2019), for example, noted that some of the existing programs are too much focused on the development of abstract personality traits such as conscientiousness and should be more focused on specific skills, in line with cognitive development theory, which are directly linked to classroom practices. Another set of concerns was raised about the perceived role of using SEL programs as a "hyped" solution to more deeply rooted problems among adolescents such as violence and racism, but also the achievement gap between groups of students. It was stressed that although evidence showed positive effects on school performance in general, more empirical evidence was necessary to see whether SEL programs could be effective for specific problems or specific target groups, and more research was necessary to see how the development of social–emotional skills can best be assessed and monitored.

Several meta-analyses have examined the impact of school-based interventions to enhance SEL. For example, Durlak et al. (2011) performed a meta-analysis of 213 school-based SEL programs involving more than 270,000 students in primary and secondary schools. They found a moderately high standardized effect size showing that these programs can be effective. Other studies such as Martin (2005) showed that school motivation and school engagement of students could be improved by means of active workshops targeted at students' planning, task management, persistence, self-efficacy, disengagement, valuing, mastery orientation, failure avoidance, and uncertainty control. By means of a randomized experiment where underperforming students in the treatment group received special sports activities targeted to boost their self-confidence and motivation, Heller et al. (2013) showed that such a program improved schooling outcomes. They observed a 0.14 standard deviation increase in an index comprising absenteeism, grades, and participation in the program during the intervention period. The Seven Habits of Highly Effective Teens, developed by Covey (2002), demonstrated the importance of certain habits among students for school performance, such as having a proactive attitude toward studying, prioritizing, goal orientation, and being able to respond to and manage changes in life (Prevoo, 2013).

In addition, positive effects were observed in the program, Lions Quest Skills for Adolescence (Laird and Roden, 1991; Laird et al., 1998; Eisen et al., 2003; Talvio and Lonka, 2013; Gol-Guven, 2016). This program was originally targeted to help students cope with difficulties in their lives, such as to prevent or free them from using drugs or violence, and developed into a more general SEL program in schools (Talvio and Lonka, 2013). The program aimed, among other things, to teach students cognitive–behavioral skills for building self-esteem and personal responsibility, communicating effectively, making better decisions, and resisting social influences among adolescents. It was designed for school-wide as well as classroom implementation in grades 6 to 8. Evaluation studies, using group-randomized trials, showed that the program led to higher self-esteem and assertiveness among girls, lower absenteeism during and after the intervention period, and on average an increase in students' grade point average (GPA), from 2.1 to 2.3 on a scale from 0 to 4 (Laird and Roden, 1991; Laird et al., 1998; Bauer, 2004). These studies indicate that systematic interventions can change social and emotional skills of students in a desired direction and that these programs can be effective.

Most of these experimental studies were not specifically targeted at underperforming students, but at the entire student population. Results might be driven by the students who do not underperform. Because lack of motivation is commonly associated with underperformance, a challenge for interventions targeted at underperforming students is to keep students involved in the activities of the intervention. The question is whether those students who could benefit the most from a program targeted at social–emotional skills have a higher likelihood of dropping out of the program and whether observed effects of the program differ between those students who have most to gain and the others.

The Current Study: Defining Underperformance

The current study focuses on underperforming students in secondary education. No standardized definition of underperformance has been used in the literature or in educational policy or practice. The concept might have different connotations to different persons, and it is not always clear what kind of definition or measurement is used. This might complicate the debate on underperformance. In general, underperformance refers to a discrepancy between a student's (expected) performance potential and his/her actual or observed school performance (Smith, 2003; Phillipson, 2008;

Veas et al., 2016). In the literature, underperformance was defined both on the individual and on the group level. Most studies using the individual-level definition of underperformance focused on gifted students, where it was commonly referred to as underachievement, yet some studies focused on the non-gifted as well (Phillipson, 2008). In such studies, either IQ tests or achievement tests were used to define the expected performance potential (Reis and McCoach, 2000). In other studies, underperformance was defined in terms of groups of students underperforming in relation to other groups, for example, boys versus girls (Burns and Bracey, 2001; Myhill, 2002; Watson et al., 2010; Bertrand and Pan, 2013), or students from lower socioeconomic backgrounds versus those from higher socioeconomic backgrounds (cf. Croizet and Claire, 1998), or differences between various ethnic groups in a country (Reisel, 2011).

Some studies on students' school performance in Netherlands reported that both performance and school motivation of Dutch secondary school students were inadequate (Onderwijsraad, 2007; OECD, 2016). In line with these findings, teachers from Dutch secondary schools expressed their concern to us about underperformance of students especially in the early years of secondary school, in relation to low school motivation and engagement, and a lack of self-concept of their ability. Several studies showed that the transition from primary to secondary school was associated with an increased cognitive demand of students, as students were confronted with a larger variety of subjects and teachers, a higher difficulty of the content to be learned, deadlines and homework, and more normative and more frequent types of assessment (e.g., Anderman, 2013). Studies also showed that this transition was likely associated with a decline in motivation, achievement, and school engagement (Anderman, 2013; Martin, 2009, 2015). In our conversations with the teachers, we talked about what they meant with underperformance among their students, and we learned that they seemed to mix the two types of definitions given above. They compared a student's performance to that of others in class (i.e., the group comparison), yet they also compared it to the expectations they themselves had of the student (i.e., individual-level). Research showed that teacher expectations commonly included not only expectations derived from observed performance, for example, by using achievement tests, but also more subjective expectations based on beliefs, stereotypes, or prejudices (cf. Brophy, 1983; Good, 1987; Weinstein, 2002; Babad, 2009; Rubie-Davies, 2010).

The Dutch teachers frequently mentioned things, such as "I expected more of this student, given the performance (s)he showed on the exit test in primary education. We know (s)he can do it, but (s)he does not show it." In the Dutch education system, students are tracked when they move from primary to secondary school[1]. At the time of the current study, an exit test was used as the main determinant for track allocation. It was supplemented with a more subjective recommendation from the teacher, but this was conditional upon the exit test score. The impact of the exit test score on expectations about students' school performance in secondary school was large, not only from teachers but also from parents and students themselves. To some extent, this was also driven by the fact that one of the quality indicators for secondary schools was whether students in ninth grade were still on the level of their track recommendation (Inspectorate of Education, 2017). In the operationalization of our underperformance measure, we derived students' learning potential or expected performance from the exit test at the end of primary education, that is, in terms of achievement abilities. This expected performance was compared with both objective performance indicators in ninth grade, and with subjective performance indicators from teachers and parents.

The Current Study: A Field Intervention in Education in a Research–Practice Partnership

In order to raise the performance of underperforming students, some Dutch teachers already experimented with changes in their instruction methods. They either used their own ideas, or they were also inspired by programs they had heard or read about, such as the abovementioned Lions Quest and the Seven Habits of Highly Effective Teens. They were curious to find out whether the use of these programs would prove to be effective when using proper research methods, that is, beyond the positive effects they experienced in class. They approached us as researchers to help design a classroom intervention and add to our knowledge on whether and how educational interventions could foster the development of social–emotional skills. This fits with the growing demand for evidence-based education and the use of field experiments in schools that support more ecologically valid causal analyses, compared to laboratory experiments (cf. Brown, 2015; Brown et al., 2017). Some studies have shown that experiments in schools that were targeted at improving academic achievement were mostly research-oriented; that is, they involved a lot of support by, or even depended on, researchers (Dignath and Büttner, 2008; Levin, 2013; Paunesku et al., 2015). This could raise difficulties when the intervention must be transferred to school practice by teachers that might not understand all the important features of the interventions, or in schools with different environments that do not fit the design of the intervention (Borghans et al., 2016). Designing an intervention together with schools minimizes application problems in practice and increases scalability (De Wolf and Borghans, 2012). However, designing interventions in co-creation between research and educational practice, that is, in research–practice partnerships, is complex. Consensus must be found between scientific rigor and practical relevance and applicability (cf. Penuel and Gallagher, 2017; Destin, 2018). It is not always feasible to use standardized research designs in educational practice, because every classroom is run differently, and the research design must allow for this variation. In addition, often a compromise must be made between the use of standardized scientific measures and measures available in educational practice.

As shown in the literature above, underperforming students could have problems in multiple domains of social–emotional skills. We asked the teachers to choose the most important

[1]Section A1 of the **Supplementary Material** provides more information on the Dutch education system.

domains, as we wanted to connect the intervention to the classroom problems they struggled with. In the end, the program was expected to become part of the curriculum, if proven effective. As a result, targeted outcomes of the current intervention are school performance (GPA), school engagement (school motivation and hours spent on homework), and self-concept (of school tasks and leadership skills). The chosen assignments of the intervention were aimed at raising students' self-awareness about their school attitude and study behavior, and at encouraging them to think about future goals and aspirations.

Teachers impacted the choice of domains to include in the intervention and which outcomes to focus on. However, the researchers defined other elements of the research design. For example, it was stressed that randomization of treatment and control groups was necessary to establish (reliable) effects and circumvent any selection biases. For the final operationalization of the measures used in the intervention, that is, measures to establish the target group of students or to assess the outcomes of the program, both teacher experiences and researchers' demands were balanced. To ensure the scientific validity of the field intervention, first a pilot study was executed to test and further shape the design of the treatment. Second, the design of the intervention, including the pilot study and the measures, was judged by a scientific committee. This approval was a prerequisite to receive funding for the intervention. The details of the intervention are explained in the following section.

Following the expectancy-value models and self-regulatory mechanisms explained before, the idea for the intervention program was that when students generally have a better idea of how they study, they are more able to organize their study tasks; they are more able to define realistic goals in advance; they are more able to monitor their progress; and they are more likely to be motivated to perform, persist when they encounter difficulties, have more realistic beliefs about their own capabilities, and in the end perform better. This is likely to be especially beneficial for underperforming students, as they more often have difficulties in these domains. Therefore, we investigated the following research question: To what extent does an in-school program aimed at students' self-reflection on their study behavior, the organization, planning and monitoring of their study tasks, and the formulation of more realistic study goals affect GPA, school engagement and social and academic self-concept of underperforming students in secondary education?

MATERIALS AND METHODS

Participants

The Sample of Schools and Tracks

The intervention targeted students in 9th and 10th grade (i.e., approximately age 15–16 years) who attended either the theoretical stream of the pre-vocational education track or the pre-higher education track in secondary education[1]. These two tracks were selected for the intervention, as underperformance and low student motivation were most common in these two tracks (Onderwijsraad, 2007). Students in these tracks are generally concentrated in the middle of the overall ability distribution and comprise a more heterogeneous group in terms of performance than students in the lowest and highest tracks. Earlier studies showed that some behavioral and performance-related problems were likely related to the transition from primary to secondary school (Driessen et al., 2005; Anderman, 2013; Martin, 2009, 2015). Participants were selected in ninth grade as transition-specific problems were expected to have disappeared within the first 2 years of secondary school.

To determine the number of students needed for the intervention, a power analysis was conducted[2]. This power analysis showed that a sample size of 200 students was sufficient to find an effect of 0.4-point increase in students' GPA. The schools were recruited from secondary schools that were part of an ongoing regional research–practice partnership. This partnership included Maastricht University, primary and secondary schools, schools for vocational and higher education, and government bodies in the south of Netherlands (the Educatieve Agenda Limburg)[3]. This partnership supports schools in evidence-informed decision-making, whereby strong collaboration between educational research and practice and a regional monitor are key ingredients. Since 2010, approximately 90% of Dutch secondary schools in the region have been involved in the regional monitor. The 2012 cohort, from which we selected students, included 28 schools offering pre-vocational education (with 2,406 students) and 25 schools offering pre-higher education (with 2,405 students). Eighteen secondary schools participated in the intervention study: 10 pre-vocational education schools (with 992 students) and 8 pre-higher education schools (with 901 students). The regional monitor provided basic information about the non-participating schools as well, which allowed a check to what extent schools that participated in the intervention study constituted a selective sample. This is followed up in the *Discussion*. Additionally, the regional monitor provided information on students' test scores that were used for the target group selection procedure, which is explained below.

Defining the Target Group of Underperforming Students

The selection of students for the intervention was aimed at students who showed underperformance in ninth grade in relation to their expected performance based on their primary school exit test score. This definition of underperformance is therefore based on achievement ability. The target group of underperforming students was determined using a two-step approach. In step 1, objective test scores from primary and secondary school were combined to determine the discrepancy between expected and observed performance. To validate this selection process, in step 2 additional subjective information from teachers and parents on students' school performance was used. This procedure was also used in previous studies (e.g., Lavy and Schlosser, 2005; Holmlund and Silva, 2014). Feron

[2]Section A2 of the **Supplementary Material** provides more information on the power analysis.

[3]For more information see https://www.educatieveagendalimburg.nl/onderwijsmonitor-p/english.

et al. (2016) showed that the information provided by teachers complemented the assessment of students' ability through standardized tests.

For step 1, we needed an objective measure for students' school performance in ninth grade. Grades were not collected for the regional monitor and were generally not comparable across schools. Nor was a standardized test available to compare students from different schools, so a test was developed for the regional monitor. This was done in close cooperation with ninth-grade teachers and according to them served as a good proxy for the observed school performance of their students[4]. The reliability score (EAP) of the ninth-grade test score was 0.78 in both tracks. For 13% of the students at the participating schools in this study, no test data were available. These students were likely absent on the test day or completed too few questions on the test for a reliable score to be calculated, or their parents did not give consent for them to participate in the regional monitor. Information about the school performance for this group of students was gathered in step 2 of our approach.

To derive students' expected performance, their primary school exit test scores, that is, in sixth grade, were used. This exit test score was suitable to test a student's performance potential, because it was used for the track recommendation for secondary school (Feron et al., 2016). Therefore, students were expected to show their maximum performance[5]. The reliability score (KR20) for the 2009 exit test was 0.91 (CITO, 2009).

Table 1 shows descriptive statistics of the test scores and the number of students in the participating schools. For 861 students in the pre-vocational education track and 779 students in the pre-higher education track, information on both tests was available.

[4]Section A3 of the **Supplementary Material** provides more information on the 9th-grade test scores for the students in the participating and non-participating schools.

[5]Section A3 of the **Supplementary Material** provides more details on the test content and shows some information on the mean test scores for the students in the participating and non-participating schools.

TABLE 1 | Number of observations (N), means (M) and standard deviations (SD) of tests used to define the target group for the intervention.

	Pre-vocational education track	Pre-higher education track
Students at participating schools		
N	992	901
Ninth-grade test score[1]		
N	861	779
Mean	0.48	0.53
SD	0.18	0.15
Sixth-grade test score[1]		
N	861	779
Mean	0.57	0.74
SD	0.15	0.13

[1]Test scores are put on a 0- to 1-point scale. The ninth-grade test score is a sum score. The sixth-grade test score is determined by Cito and ranges from 500 to 550 but is transferred to a 0- to 1-point scale here. Section A3 of the ***Supplementary Material*** *provides more details on the tests used.*

To finish step 1 of our selection method and to determine the discrepancy between the students' expected and observed school performance, both scores were divided in percentiles, by school and by study track. The percentile groups were composed at the school (and track) level, because when assessing students' performance, teachers tended to compare students to their peers, as explained before. In most schools in the sample, students from different classes within the same track had the same teacher for a given subject. Accordingly, we did not compose the percentile groups at the classroom level. Finally, the difference between the two percentile distributions was calculated for all students. A negative difference implies that students had a higher relative position in the sixth-grade test compared to the ninth-grade test. **Figure 1** shows the distribution of these percentile differences for students in both tracks.

For the intervention study, students who were among the 25% of those who showed the largest discrepancy in percentiles between the two tests (i.e., lowest quartile) were selected as underperformers. The 25% cutoff was chosen to target a relatively broad group of underperforming students and to have enough power for the analyses. Moreover, some schools preferred to participate in the experiment only if they knew that at least a certain number of students were able to participate. Step 1 of the selection procedure resulted in a sample of 421 students (220 students in the pre-vocational education track and 201 students in the pre-higher education track).

Step 2 of the selection procedure aimed to validate the selection process of step 1, using additional subjective information from teachers and parents on the students' school performance. The full list of selected students was discussed with teachers who served as mentor in ninth grade. Parents were also involved in the validation process. At all schools, information evenings were held, where parents were informed about the details of the intervention, and beforehand they were informed whether their child was considered to be an underperforming student or not. In some cases, teachers and parents argued that certain students should not be eligible for treatment, because their observed underperformance was only of a temporary nature or because of personal circumstances. In addition, teachers and parents added other students to the sample that did not emerge from the first step of the selection procedure. These were mainly students for whom no achievement test scores were available in step 1. In total, 363 students were identified for the final sample population (209 students in the pre-vocational education track and 154 students in the pre-higher education track). According to power analysis, this was sufficient to perform the analyses. Whereas this group of students might not necessarily be recognized as underperformers when using conventional methods, they were students who could do better in class, considered by their teachers and parents, and shown by test scores.

Within each educational track, schools were randomly assigned to the treatment or the control group, resulting in five treatment schools and five control schools for the pre-vocational education track and four treatment schools and four control schools for the pre-higher education track. Randomization at the school level was chosen because students within one school

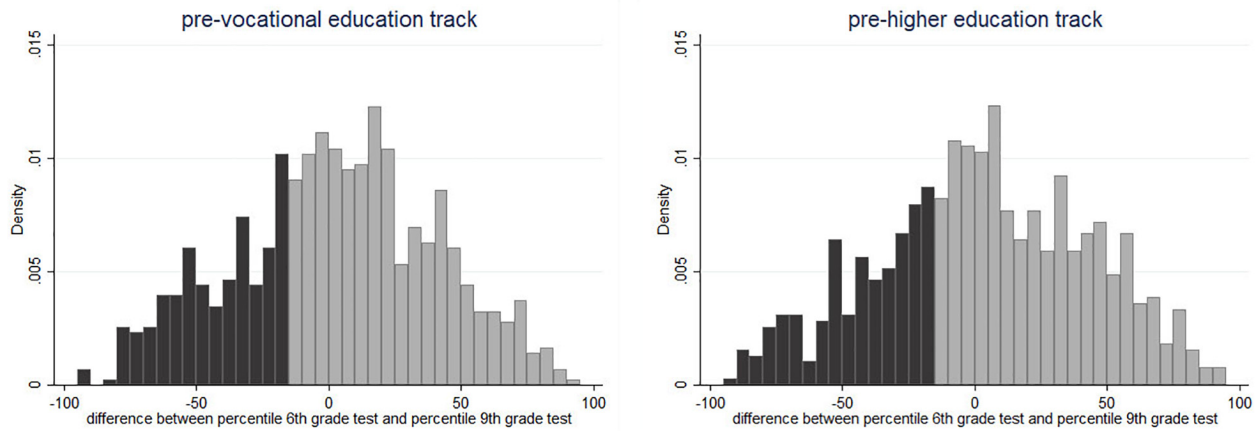

FIGURE 1 | Difference in relative position in test scores between ninth and sixth grade. The figure shows the difference between the percentile in which the student was in the ninth-grade test (current performance) and the percentile in which the student was in the sixth-grade test (expected performance). The dark-colored group is the 25% of students who were selected for the intervention.

and educational track are likely to be in contact with each other, which might lead to spillover effects between treated and non-treated students. Between-school contacts were less likely in our sample, because the schools were located in different cities. The randomized assignment to treatment or control group was performed by Netherlands Bureau for Economic Policy Analysis as an external party. In total, 202 students were in the treatment group, and 161 students were in the control group.

Intervention Design and Procedures

Pilot Study

A small pilot study was executed before the start of the actual experiment. The pilot study was held at two schools. The pilot was intended to test specific aspects of the intervention design, such as the selection method, the appropriateness of the assignments, and the feasibility of the intervention in schools. The intention of the pilot study was not to complete the full treatment; thus, no treatment effects were measured. At the end of the pilot phase, two feedback rounds were organized. One feedback round was held with the students who participated in the pilot, and the other feedback round was organized with the teachers.

Several lessons were learned from the pilot study. First, we learned that the procedure we used for selecting the underperforming students worked. Teachers and parents agreed with the selected list of students, and even students themselves argued that they could do better in class. Second, the pilot showed that designing an experiment in co-creation with teachers resulted in teachers' better understanding of the experimental design and created more willingness for them to participate. The teachers from the pilot study also helped to explain the design of the study to teachers from other schools in the actual intervention. Third, intensive communication with teachers appeared crucial for the proper execution of the intervention. This influenced the logistic feasibility of the intervention and the accuracy of the effect measurement. Finally, the pilot study contributed to the creation of the assignments within the intervention. Parts of the content, as well as the language used in the assignments, were adjusted based on the feedback we received from students and teachers.

Actual Intervention

The selection of students for the intervention took place in 9th grade, and the intervention was executed in 10th grade. **Figure 2** shows the intervention timeline. During the intervention period, students in the treatment group were offered seven monthly assignments. These assignments aimed at raising students' self-awareness about their school attitude and study behavior and encouraging them to think about future goals and aspirations. The assignments were motivated by the psychological theories explained in the introduction and the existing SEL programs of the Lions Quest and Seven Habits of Highly Effective Teens. The assignments were adapted to the Dutch school context by teachers and students in the pilot study[6]. The assignments were completed online and supervised by the responsible teacher or mentor. Students also had to reflect on the assignments with their teacher. The treatment took part during school hours, either in hours in which no classes were scheduled (so-called study hours at school within the curriculum), or in hours devoted to time with the mentor. We argued that this was likely to increase participation in the treatment, because it ensured that students received the treatment in a known and fostering learning environment and allowed them to ask questions. Teachers could remind students to participate in the intervention, but they did not force them to complete the assignments. They believed that forcing unwilling students did not contribute to their school motivation and their school performance. To prevent students from dropping out of the program, a small monetary incentive was used. Students in the treatment group who completed at least five of the seven assignments in the intervention received 25 Euros for their participation. They were told so at the start of

[6]Section A4 of the **Supplementary Material** provides a detailed description of the assignments.

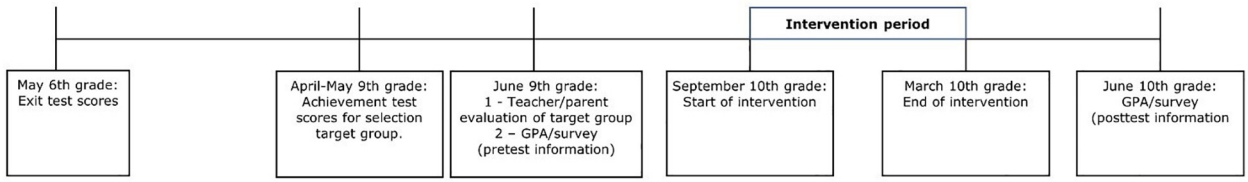

FIGURE 2 | Timeline of the intervention.

the program. Students in the control groups did not receive any treatment (i.e., they did not complete any of these assignments); they followed their regular curricular courses.

Before and after the intervention period, students in both the treatment and the control group completed a survey. The pre-intervention survey was part of the regional monitor. While this limited the questions that could be chosen for measurement of the concepts that we were interested in, it enabled the use of questions that previously had been used for students in this age group, in a regular school context. For the schools' participation in the intervention, it was important to not conduct an additional survey, as schools were overwhelmed with the number of (research) surveys. The post-intervention survey was taken at the very end, so the information from this survey was available only for those students who completed the full treatment. Consequently, for some outcome variables, the number of observations was too low to assess reliable effects of the intervention.

Measures

Three types of outcome measures were used to evaluate the intervention: (1) students' compliance with the treatment, (2) students' GPA, and (3) students' school engagement and self-concept in school tasks and leadership skills.

Completion of Treatment

We first examined which students completed the treatment and which students did not. Because underperforming students were the target of the intervention, this was a relevant outcome variable. Completion of the treatment was potentially related to motivational attitudes and could inform us whether interventions on social–emotional factors related to students' school attitude, future goals, and aspirations were likely to succeed. We defined students as treatment group compliers when they completed at least four of the seven assignments. This meant that they received just over half of the treatment. As a robustness check, we also estimated all models using different definitions of treatment compliance, that is, ranging from completing one to all seven assignments.

Demographic control variables included in the analysis of treatment compliance included the educational track that students attended (pre-vocational education track or pre-higher education track), students' age measured in months, gender, parental education, and region of birth. Parental education was measured by taking the education level of the highest educated parent, and we distinguished between (1) primary or lower secondary education, (2) upper secondary education or lower tertiary education, (3) higher tertiary vocational education or higher tertiary academic education, and (4) unknown. Region of birth distinguished between (1) Netherlands, (2) outside Netherlands, and (3) unknown. For the last two variables, the categories "unknown" were included to keep as many respondents in the sample as possible.

Students' GPA

In Dutch secondary schools, students' performance is graded by individual teachers of all subjects, by means of tests that they administer during the year. These are not standardized tests, except for the final examination at the end of secondary school. The grades students receive are measured on a scale ranging from 1 to 10, where 1 represents the lowest and 10 the highest grade. Students receive an official report card that lists the average grades they obtained for all of the subjects they take. They need a sufficient overall GPA to be able to transfer to the next grade (usually > 5.5). For the pre-vocational education track, subjects include Dutch, English, French, German, math, science, biology, economics, geography, history, and civics. For the pre-higher education track, subjects include Dutch, English, French, German, math, physics, chemistry, biology, economics, geography, and history. Not all students took all subjects (depending on which profile they took in school), and for this study, the GPA was calculated based on the subjects students took. The reliability (Cronbach's α) of the GPA score was 0.85 for both educational tracks.

Students' School Engagement

School engagement included two scales: school motivation and hours spent on homework. Students indicated whether they agree or disagree with some statements about their motivation to go to school and their attitude toward learning in general. For example, "I am motivated to continue learning," or "As soon as I can, I quit school." The statements were largely based on the Inventory of School Motivation, developed by McInerney and Sinclair (1991), and the Motivated Strategies for Learning Questionnaire developed by Pintrich et al. (1991). Each statement was measured on a 5-point scale ranging from "fully disagree" to "fully agree."[7] The reliability (Cronbach's α) of the school motivation scale was 0.70. The overall score was calculated using confirmatory factor analysis (CFA) was used to calculate the overall score, using structural equation modelling [SEM, with full information

[7]Section A5 of the **Supplementary Material** shows the items used for the motivational scale.

maximum likelihood (FIML)]. The standardized factor loadings ranged from 0.48 to 0.73. The Comparative Fit Index (CFI) was 0.99, the χ^2 [2 degrees of freedom (df)] was 11.31, and root mean square error of approximation (RMSEA) was 0.07.

The second aspect of school engagement included in the study was the average hours per week that students spent on homework. We included the average total hours spent on homework, that is, both at home and at school during study hours.

Students' Self-Concept

We distinguished between two types of self-concept: school tasks and leadership skills. Following the work of Marsh (1992), students were asked to rate themselves on a range of skills used in school (e.g., arithmetic, writing) and on their behavior toward others (e.g., taking the lead). The skills were rated on a scale ranging from 1 to 10[8]. The reliabilities (Cronbach's α) of the two factors were 0.70 for school tasks and 0.80 for leadership skills. The overall scores were calculated using CFA (SEM/FIML). Standardized factor loadings ranged from 0.41 to 0.71 for school tasks and from 0.59 to 0.77 for leadership skills. The model fit indices (CFI, χ^2/df, RMSEA) for school tasks were 0.99, 5.66/2, and 0.05, and those for leadership skills were 0.99, 9.37/2, and 0.07.

Statistical Analysis

Probit models were used to analyze students' compliance with the treatment. The probit reflected the probability that a student completed at least four assignments. The probit models included the aforementioned demographic control variables. To facilitate interpretation of observed relations, marginal effects were reported.

Linear models of the treatment effect on student outcomes after the treatment were used to analyze the treatment effect on GPA, school engagement, and self-concept. These analyses included the levels of these outcomes before the treatment as lagged variables, or

$$Y_{i,t} = \beta_0 + \beta_1 D_i + \beta_2 Y_{i,t-1} + \varepsilon_i$$

where $Y_{i,t}$ represents the outcome variable in period t after the treatment, D_i equals 1 if the student was in the treatment group and equals 0 otherwise, $Y_{i,t-1}$ represents the outcome variable in period t – 1 before the treatment, and ε_i represents the error term.

Three different ways of defining the treatment were used. The first definition used assignment to treatment (intention to treat or ITT): D = 1 for all students who were assigned to the treatment group at the start of the intervention. However, the treatment group non-compliers did not receive the full treatment. Therefore, a second definition used actual treatment participation: D = 1 for all students who completed at least four assignments. This model assumed that those who dropped out of the treatment also did not benefit from the assignment to treatment. If students self-selected into completing the actual treatment, or if continued participation was based on the expected gains from treatment, the conditional mean independence assumption is violated, and causal inferences are impossible. Such selection was plausible in our case. Therefore, a third definition used an instrumental variable approach, where assignment to the treatment was used as an instrument for the actual treatment taken (treatment effect on the treated or TOT). All treatment models included only students for whom both the pre-test and post-test variables were available. No imputations were made to the data.

We used standardized categorical outcome measures in all our models. The populations before and after treatment were no longer comparable because of the improvement of the treated population. Standardizing on the full population, that is, ignoring this, could lead to a biased estimate of the treatment effect, or in this case an underestimation of the effect size. Furthermore, as the observed dropout of the intervention was likely to be non-random, as explained before, an additional bias might be added to the estimates of the treatment effect. Consequently, we used the complying students in the control group as the basis for the standardization of variables in both outcomes [*cf.* Feron (2018, p221–222) for all details].

Finally, all models were estimated both with robust unclustered standard errors and with standard errors clustered at the school level, because observations might not be independent within schools. Moreover, the models that showed significant effects were also estimated with standard errors bootstrapped with clusters at the school level (400 reps), to see whether results held when simulating a larger sample of schools, because there were only 18 schools in the sample. All models were run in Stata/SE 14.0 (StataCorp, College Station, Texas, United States).

RESULTS

Descriptive Statistics and Randomization Check

Table 2 provides descriptive statistics for students in the treatment and control groups, including some descriptive statistics for schools in the region that did not participate in the intervention. Schools representing the pre-vocational education track were somewhat overrepresented in the study. This has to be taken into consideration when generalizing the results. **Table 2** also provides a comparison between the treatment and control groups as a check for successful randomization. Using bivariate t tests, no significant differences were observed between the treatment group and the control group on any of the observed student characteristics. A multivariate probit model confirmed this[9]. It was concluded that the randomization is successful.

Table 3 shows the bivariate correlations for all variables used in the analyses. Some interesting correlations were observed for GPA and school motivation. The results showed moderate correlations between GPA before and after treatment, and motivation before and after treatment. These correlations seemed stronger after the intervention than before. Similarly, the correlations between motivation and hours of homework seemed

[8]Section A5 of the **Supplementary Material** shows the items used for the two domains of self-concept.

[9]Table A4 in the **Supplementary Material** section A6 provides the estimation results.

TABLE 2 | Number of observations (N), Means (M), standard deviations (SD), scale reliability (α), and model fit (CFI, χ^2, RMSEA) for all measures.

	Schools in intervention						Schools outside intervention in region			Scale reliability	Model fit
	Treatment group			Control group							
	N	M	SD	N	M	SD	N	M	SD	α	CFI/χ^2[df]/RMSEA
Main variables											
GPA t_0	184	6.24	0.56	153	6.22	0.53		n.a.		0.85	
GPA t_1	173	6.14	0.73	134	6.18	0.65					
Motivation t_0[1]	161	−0.02	0.50	140	−0.08	0.60	596	0.03	0.52	0.70	0.99/11.31[2]/0.07
Motivation t_1[1]	79	0.05	0.55	44	−0.00	0.54					
Hours homework t_0[1]	151	6.30	4.41	139	5.55	3.85	572	5.89	3.70		
Hours homework t_1[1]	79	7.36	4.38	44	8.42	7.08					
SC of school tasks t_0[1]	153	−0.06	0.83	135	−0.04	0.93	550	0.03	0.73	0.70	0.99/5.66[2]/0.05
SC of school tasks t_1[1]	79	0.03	0.93	43	−0.11	1.10					
SC of leadership skills t_0[1]	154	−0.05	1.10	140	0.08	1.24	556	−0.01	1.05	0.80	0.99/9.37[2]/0.07
SC of leadership skills t_1[1]	79	−0.71	1.49	43	0.00	1.46					
Demographics t_0											
Share of students in pre-higher education track	202	0.42	0.49	161	0.43	0.50	703	0.52 ∗∗	0.50		
Age in years	202	15.74	0.58	161	15.76	0.57	703	15.71	0.53		
Share of girls	202	0.43	0.50	161	0.36	0.48	703	0.45	0.50		
Parental education level	164	2.20	0.77	144	2.19	0.81	613	2.11	0.78		
Share of children born in Netherlands	169	0.96	0.20	150	0.96	0.20	624	0.98	0.15		

*t_0 refers to pre-test information, t_1 to post-test. At t_0, differences were tested between treatment and control groups as well as between schools that participated in the intervention and those that did not. Differences at t_1 are not tested here, because this is part of the treatment regressions. *p < 0.05, **p < 0.01, ***p < 0.001. GPA, grade point average; SC, self-concept.[1]Standardized variables.*

stronger after the intervention than before. These results could indicate that students with better grades were more motivated to participate in the intervention and spent more time on their homework following the intervention.

Compliance With the Treatment

Figure 3 shows the number of treatment group compliers per assignment. Because of the nature of their school problems, that is, not performing up to their potential and low school engagement, the students in the target group had a relatively high probability of dropping out of the treatment. It proved indeed difficult to keep them involved in the program. We observed a gradual increase in the number of students who stopped completing the assignments during the intervention period; 51% of the students participated in at least four assignments.

Next, we examined to what extent compliers and non-compliers systematically differed from each other. **Table 4** shows the results of the probability to complete at least four assignments for students in the treatment group. Model 1 in **Table 4** included only GPA and controls and showed that older students were more likely to comply with the treatment. Model 2 showed similar results for students who completed the treatment. In model 3, measures for school motivation, homework, and self-concept were included. Students with higher pre-test school motivation were more likely to comply with the treatment, whereas students who showed a higher pre-test self-concept of school tasks were less likely to comply. A standard deviation increase in reported school motivation was related to a 29% increase in the likelihood to comply with the treatment. A standard deviation increase in self-concept of school tasks was related with a 17% decrease in the likelihood to comply with the treatment. These results remained significant when accounting for school fixed effects. The results remained borderline significant after bootstrapping the standard errors (with *p*-values of 0.067 for motivation and 0.059 for self-concept of school tasks), suggesting some weakness in the robustness of the relations. As a further robustness check, different models of compliance were estimated, ranging from completing one to seven assignments. The observed relations were significant in most models, but because of low numbers of observations, the models with compliance measured as completing over six assignments were statistically unstable.

These results suggested that continued participation in the treatment was likely to be selective. Therefore, it was decided that estimating an ITT effect on outcome measures for these students would dilute the estimates of possible treatment effects, and estimating a TOT effect was likely to be more accurate.

Treatment Effects on GPA and Social–Emotional Outcomes

Table 5 reports the estimated coefficients of the treatment on students' GPA for all models. Model 1 used assignment to treatment as the treatment variable (ITT), model 2 used completion of at least four assignments as the treatment variable, and model 3 used assignment to the treatment group as an instrument for completion of at least four assignments (TOT). The results showed no treatment effect of the intervention on students' GPA. Furthermore, it was observed that the treatment

TABLE 3 | Correlation among all variables in the analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. GPA t_0	1														
2. GPA t_1	0.48***	1													
3. Motivation t_0	0.19**	0.05	1												
4. Motivation t_1	0.36***	0.28**	0.41***	1											
5. Hours homework t_0	0.09	0.05	0.11**	−0.00	1										
6. Hours homework t_1	0.07	−0.02	0.23*	0.22*	0.28**	1									
7. SC of school tasks t_0	0.20***	0.06	0.20***	0.03	0.04	−0.00	1								
8. SC of school tasks t_1	0.06	0.11	0.02	0.06	−0.09	−0.19	0.43***	1							
9. SC of leadership skills t_0	0.02	0.05	0.07	0.07	−0.11	−0.02	0.54***	0.18	1						
10. SC of leadership skills t_1	−0.09	0.09	−0.03	0.11	−0.24*	−0.06	0.11	0.16	0.55***	1					
11. Educational track	−0.09	−0.28***	−0.03	−0.00	0.06	0.15	0.02	−0.13	0.05	−0.06	1				
12. Age	−0.01	−0.08	−0.03	0.03	−0.07	−0.01	0.07	0.07	0.19**	0.26**	0.09	1			
13. Girl	0.09	−0.01	0.08*	0.11	0.07	0.07	−0.09	−0.12	−0.11	−0.12	−0.01	−0.10	1		
14. Parental education level	−0.02	0.04	0.05	0.07	−0.12*	0.08	−0.08	−0.16	0.04	0.08	−0.10	0.00	−0.03	1	
15. Born in NL	0.04	0.01	−0.06	−0.16	0.03	−0.05	−0.07	−0.05	−0.02	−0.11	−0.07	−0.13*	0.07	−0.05	1

*t_0 refers to pre-test information, t_1 to post-test. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. GPA, grade point average; SC, self-concept.*

FIGURE 3 | Compliance with treatment. The figure shows the number of students who completed the different assignments in the intervention program.

effect, where assignment to treatment was used as an instrument for treatment taken (model 3), was approximately twice the size of the ITT estimates of model 1. This is consistent with approximately 50% of the students not complying with the intervention. We also checked whether there were any heterogeneous treatment effects, as an overall null effect could be the result of contrasting results among groups of students[10]. No systematic heterogeneous treatment effects were observed.

In a final step, we analyzed whether the treatment had an effect on the students' school engagement, including school motivation and hours spent on homework, and self-concept of school tasks and leadership skills. **Table 6** shows that there were generally no observed effects from the treatment on these outcomes, except for a negative effect of the treatment on student's self-concept of leadership skills. This result remained significant in models with standard errors clustered at the school level, or with bootstrapped standard errors.

DISCUSSION AND CONCLUSION

Using a randomized field experiment, in this study we investigated whether an intervention using self-reflection on school behavior of underperforming secondary school students affected their GPA, school engagement, and some domains of self-concept. With this study, we contribute to the ongoing debate on whether in-school programs targeted at the development of social–emotional skills are effective, in particular for specific target groups such as underperforming students. In talks we had with teachers, they frequently mentioned that they struggled with engaging students who do not perform according to what teachers (or parents) expect from them. Psychological theories pointed to the importance of several social–emotional skills for engaging students in school and raising their school performance.

[10]Section A7 in the **Supplementary Material** presents the findings.

TABLE 4 | Marginal effects of probit models for compliance with the treatment.

	Model 1			Model 2			Model 3		
	β	*p*	95% CI	β	*p*	95% CI	β	*p*	95% CI
Main variables (pre-test)[1]									
GPA	0.01	0.892	[−0.13, 0.15]	−0.12	0.153	[−0.29, 0.05]	−0.18	0.061	[−0.35, 0.08]
Motivation							0.29***	0.009	[0.07, 0.50]
Homework (hours)							0.00	0.943	[−0.02, 0.02]
SC of school tasks							−0.17*	0.032	[−0.33, −0.01]
SC of leadership skills							0.09	0.104	[−0.02, 0.19]
Demographic controls									
Pre-higher education track	0.15	0.080	[−0.02, 0.31]	0.09	0.352	[−0.10, 0.27]	0.10	0.284	[−0.08, 0.29]
Female	−0.01	0.924	[−0.16, 0.15]	−0.07	0.451	[−0.25, 0.11]	−0.07	0.472	[−0.25, 0.12]
Age (in months)	−0.02***	0.001	[−0.03, −0.01]	−0.02**	0.005	[−0.03, −0.01]	−0.02**	0.001	[−0.04, −0.01]
Parental education: vocational	0.04	0.707	[−0.18, 0.27]	0.05	0.641	[0.17, 0.28]	0.02	0.892	[−0.23, 0.26]
Parental education: higher	0.18	0.092	[−0.03, 0.40]	0.18	0.102	[−0.04, 0.40]	0.14	0.237	[−0.09, 0.38]
Parental education: unknown	−0.07	0.639	[−0.38, 0.23]	−0.29	0.331	[−0.86, 0.29]	−0.34	0.200	[−0.87, 0.18]
Born in Netherlands	−0.12	0.525	[−0.47, 0.24]	−0.19	0.289	[−0.54, 0.16]	−0.20	0.310	[−0.58, 0.18]
Country of birth unknown[1]	0.14	0.523	[−0.28, 0.55]						
Average probability of treatment compliance		0.56			0.58			0.59	
Number of observations		184			136			136	

*This table shows the marginal effects (dy/dx) from probit regressions where the dependent variable is equal to 1 if the student completed at least four assignments and 0 otherwise (students in the treatment group only). Y is the average probability of treatment compliance. Models were estimated using robust standard errors. Models with standard errors clustered at the school level and with bootstrapped standard errors showed no differences. *p < 0.05, **p < 0.01, ***p < 0.001. GPA, grade point average; SC, self-concept.[1]This category was used to keep as many students in the first model. In the later models, no information on the social–emotional variables was available for the students in this category and therefore is dropped from the study.*

TABLE 5 | Treatment effect on GPA after treatment.

	Model 1			Model 2			Model 3		
	β	*p*	95% CI	β	*p*	95% CI	β	*p*	95% CI
Treatment	−0.05	0.435	[−0.18, 0.08]	−0.03	0.706	[−0.17, 0.11]	−0.09	0.433	[−0.33, 0.14]
GPA before treatment	0.66***	0.000	[0.48, 0.84]	0.66***	0.000	[0.48, 0.84]	0.66***	0.000	[0.48, 0.84]
Pre-higher education track	−0.38***	0.000	[−0.51, −0.24]	−0.38***	0.000	[−0.51, −0.24]	−0.37***	0.000	[−0.50, −0.24]
Constant	2.91***	0.000	[1.65, 4.16]	2.87***	0.000	[1.61, 4.14]	2.91***	0.000	[1.68, 4.14]
R^2		0.303			0.302			0.298	

*Model 1 used assignment to treatment as the treatment variable (intention-to-treat); model 2 used completion of at least four assignments as the treatment variable; and model 3 used assignment to the treatment group as an instrument for the treatment variable (treatment-on-treated). GPA before treatment and educational track were included as controls. Models were estimated using robust standard errors. Models with standard errors clustered at the school level and with bootstrapped standard errors showed no differences. *p < 0.05, **p < 0.01, ***p < 0.001. The number of observations was 294 in all models. GPA, grade point average.*

These skills included students' expectations, perceptions, or beliefs about their competences and the difficulty of the tasks they have to do at school, their coping strategies when experiencing learning difficulties or challenging tasks, their goal-setting behavior, and their reflective monitoring of progress (cf., Karoly, 1993; Mayer et al., 2004; Wigfield and Cambria, 2010). It was argued that when students have positive beliefs about their own capabilities in relation to school tasks and are able to set realistic achievement goals, they are more likely to be motivated to start with the task and to persist when they encounter difficulties. This would lead to better school performance. Self-reflection on their study behavior and their expectations could help to achieve this.

An important feature of the study was that the intervention was designed in co-creation with teachers. Such codesigned intervention studies in education are becoming more common, in response to the gap between educational interventions developed by scientists and the practical applicability by teachers (Penuel and Gallagher, 2017). When the question arises from educational practice, cooperation of teachers is more likely. The scientific input for the design enhances reliability of observed effects, and generalizability and scalability of the intervention. Developing the research question and designing the intervention together could be an effective approach to target a specific problem in educational practice (Borghans et al., 2016). An important aspect of the intervention in this study was the ease and limited costs with which it could be scaled up. The treatment for the students had a low time intensity and was provided through an online platform. The possible disadvantage of the low-time intensity of the intervention was that the time scheduled for the intervention was too short to observe any effects.

Previous studies showed positive effects of interventions on enhancing school performance and school engagement of students in secondary education. The majority of these interventions targeted the entire group of students in a class or school or focused at underperforming students in relation to giftedness. An important feature of the present study was the sole focus on underperforming students. We specifically focused on students in the later years of secondary school, as evidence pointed to problems in the early years of secondary education resulting from an increased cognitive demand in comparison to the primary school learning environment. Most of the problems related to the transition from primary to secondary school were resolved within 2 years, when students found their way in secondary school. However, for some students, problems were more persistent and put them at risk of early school dropout.

It could be questioned whether the schools that participated in the study were a random group of schools. It was possible that schools were more willing to participate in the intervention if they experienced problems with students' motivation or school performance. Based on additional information about the schools that did not participate in the study, we found that schools offering the pre-vocational education track were somewhat overrepresented in the study. This could imply that underperformance was more common in this track. No differences on the observed student characteristics were observed. From this, we concluded that at least based on these observables the participating schools were not different from the non-participating schools.

There are different ways to define underperformance. This study chose to define the target group of students who "could perform better" by comparing students' observed school performance in ninth grade with high-stakes test results from sixth grade. Both tests used similar domains on which the students were tested and were important for the school curriculum, that is, math and language. A discrepancy between ninth- and sixth-grade school performance could, however, be due to different reasons than motivational deficits. For example, instructions in primary and secondary school are known to be different and might relate to low school performance and school engagement for some groups of students (cf., Becker et al., 2012). Other factors that affect the performance discrepancy could be related to the onset of adolescence or changes in parental involvement (Hopwood et al., 2016). Moreover, the observed discrepancy could be driven by differences in test motivation. Whereas the sixth-grade test was high stakes for the students, the ninth-grade test was low stakes. It has been shown that test scores were generally higher when the stakes of the test increased (e.g., Angrist and Lavy, 2009; Segal, 2012; Simzar et al., 2015). These reasons for the observed discrepancy applied to all students in school, yet apparently not all students were affected in a similar way, and some students "underperform." We argued that by using these two test scores, we had a suitable selection mechanism for students who do not show their full

TABLE 6 | Treatment effect on school engagement and self-concept after treatment.

	School engagement						Self-concept on					
	Motivation			Hours spent on homework			School tasks			Leadership skills		
	β	*p*	95% CI	β	*p*	95% CI	β	*p*	95% CI	β	*p*	95% CI
Treatment	−0.05	0.622	[−0.14, 0.24]	−0.77	0.239	[−2.06, 0.52]	0.18	0.315	[−0.18, 0.54]	−0.63*	0.012	[−1.12, −0.14]
Dependent variable t_0	0.41***	0.001	[0.18, 0.64]	0.24*	0.012	[0.05, 0.43]	0.50***	0.000	[0.33, 0.66]	0.70***	0.000	[0.44, 0.95]
Constant	−1.80**	0.005	[−3.05, −0.55]	3.14	0.401	[−4.24, 10.52]	0.13	0.910	[−2.12, 2.38]	1.39	0.340	[−1.49, 4.27]
R^2		0.237			0.093			0.196			0.354	
Number of observations		108			104			103			106	

*All models in this table were based on treatment defined as treatment completion of all assignments, as post-test information on school engagement and self-concept is not available for non-compliers. GPA before treatment is included as a control in all models (this predicts the outcome variables and thereby increases precision of the measurements for the treatment effect). Models were estimated using robust standard errors. Models with standard errors clustered at the school level and with bootstrapped standard errors showed no differences. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.*

learning potential in secondary school. This was supported by the fact that both teachers and parents confirmed the selection of students. Whereas such personal judgments could also include biases (e.g., Muijs and Reynolds, 2015), using the information from both the objective and subjective instruments provided a valid instrument for the selection of the target group for this intervention. The selection procedure was tested in a small pilot study, and not only teachers and parents, but also students themselves, agreed that they were correctly identified as underperforming students.

Targeting a group of students with lower than expected school engagement and school performance might increase the risk of dropout during the intervention. The first question this article therefore addressed was whether those students who could potentially benefit the most from the intervention, that is, whether those with the lowest school engagement or lowest GPA, had a higher likelihood of dropping out of the intervention. We found that students with higher school motivation before the treatment were more likely to comply, and students with higher self-concept of school tasks (e.g., math, writing) were less likely to comply. The latter relation was partly supported by a marginally significant negative relation between GPA and treatment compliance. In conclusion, among the students who were selected for the intervention, those who potentially gained the most of the program in terms of outcomes in the domain of school motivation and self-concept were more likely to drop out of the intervention. This finding is particularly interesting as this latter group was exactly the group that the program was trying to reach. As described before, recent studies pointed to the malleability of social–emotional skills in school (Durlak et al., 2011; Chernyshenko et al., 2018). The majority of the programs studied were applied to all students in class, and the observed effects of increased social–emotional skills on academic performance and motivation could well be driven by already more advantaged groups in class. More insights were needed to establish the malleability of social–emotional skills for specific groups of students, such as underperforming students.

Our results indicate how difficult it is to reach the particular target group of underperforming students with an in-school intervention. Even though the intervention was designed in co-creation with teachers, this did not prevent students from dropping out of the intervention. Continued participation, however, varied between schools. In some schools, low dropout percentages (<10%) were observed, whereas at other schools, high dropout rates (>60%) were observed. Teachers had an important role in coaching and supervising the students with respect to the intervention. Durlak et al. (2011) also showed that teachers were able to effectively conduct SEL programs in school. Although we had quite intense contact with teachers in most of the schools, it might be that not all teachers were equally motivated. Motivation of teachers seemed to be an important factor in motivating students, and variation in teacher motivation to participate in the intervention could explain differences in the dropout rates between the schools. As discussed in Borghans et al. (2016), for students to be motivated to participate in an intervention, it is important that schools and teachers support the

intervention and facilitate students to take part in the program. Our study could indicate that this is even more important for in-school training programs involving students who have motivational problems.

In the second part of the analyses, we investigated whether the intervention had an effect on students' GPA, school engagement, or self-concept. No robust overall effects of the treatment on students' GPA and social–emotional outcomes were observed, except for a negative effect on self-concept of leadership skills. This latter finding could be due to the fact that students had to reflect on their own capabilities and self-esteem in the intervention and became more modest on their leadership skills. We did observe that the target group of students had a higher self-concept of leadership skills than the other students. So, after the intervention, the target group is now closer to the level of self-concept reported by non-underperforming students. Kerr et al. (2003) had shown earlier that when students in early adolescence become more oriented toward each other, this might also go along with more feelings of insecurity. Without further investigation, we cannot say more on the mechanisms behind this. However, it is questionable whether it is a real effect, or a coincidental finding among a small sample size. In addition, although not robust, there was a weak indication for the treatment to be more effective in raising GPA for those in the pre-vocational education track. This is interesting to explore in more detail in future studies. It might have implications for increasing school performance among certain groups of students who are more at risk, such as those of lower socioeconomic backgrounds. Previous studies showed that low school performance more frequently occurred among students from lower socioeconomic backgrounds and that these students were more commonly found in lower educational tracks (e.g., Walkey et al., 2013).

There are multiple possible explanations for why this study did not find significant treatment effects on students' GPA, school engagement, and self-concept. First, the intensity of the treatment, with one assignment per month, might have been too low to significantly increase the outcomes. Second, the selection of underperforming students might make it more difficult to observe treatment effects as these students are less likely to participate in an intervention. Moreover, as a large number of students drop out during the intervention, the sample size for treatment effect analyses decreased, and finding significant effect sizes becomes more difficult. Third, the difference in dropout rates between schools could indicate that motivating teachers for an intervention is important.

Apart from these more operational reasons for not finding an effect, reasons could also be related to the design of the intervention and the measures used. For example, the randomization of treatment and control group was conducted at the school level, rather than at the class level. However, 18 schools might be too few for randomization to balance all potential confounders. While we trust the randomization using tests for group differences, unobserved factors might still drive differences between treatment and control groups. Finally, even though the factors for school engagement and self-concept show good factor loadings and sufficient to good internal consistency, the model fit indices do not always show optimal fit. Whereas the CFIs were good for all models, the χ^2/df and RMSEA were acceptable (e.g., RMSEA between 0.05 and 0.07). It is not uncommon that the model fit indices provide contrasting information (cf. Barrett, 2007). It should be noted, though, that RMSEA tends to inflate when there are low df's, which is the case in our models, especially those with the acceptable (but not optimal) model fit (Kenny et al., 2014). It could still be possible that the items included in one factor pick up different dimensions of self-concept, yet the confirmatory factor analysis of self-concept proved the existence of two distinct factors, and with less than the current four items per factor, content validity is at stake. Addressing these issues might lead to more beneficial results of the intervention. However, it could well be that even in that case there might be no effect of this specific in-school training program on students' school performance, school engagement, or self-concept for this specific group of underperforming students.

Hulleman and Cordray (2009) argued that field experiments often showed smaller effects of interventions than those taken in laboratories. Reasons were differences, both observed and unobserved, in the implementation of the intervention and the multitude of contextual factors that came into play when the intervention was administered in real life. While we regularly met with the teachers who supervised the intervention in class, we were not present when the students took the assignments. There was no strict control over the implementation process, which might have led to unwanted behavior during the hours that students worked on the assignments. Large sample sizes are often needed to overcome such problems and reach adequate treatment effects (Gelman and Carlin, 2014). This is not always possible in educational settings and poses a trade-off to the researchers. In the power analysis that we calculated before approaching the schools, we already included a proxy for non-compliance, taken from evidence on compliance in other, mostly laboratory, experiments. When designing a field experiment, we learned that the size of this proxy should be substantial, to avoid measurement problems due to low sample sizes.

Despite the fact that mainly null effects were observed in this study, which were not related to weak power, and given the fact that the intervention was thoroughly designed in co-creation with educational practice and tested in a pilot study, results are worth sharing and disseminating. Recently, concern has risen about publication bias and disregard of null findings in educational research, whereas these studies are informative for educational policy, practice, and research and add to the pool of evidence-based research in education (Chow and Ekholm, 2018). Jacob et al. (2019) showed that even large-scale (quasi-)experimental studies in education, which were designed and executed appropriately, often show weak or null effects. They further showed that even those studies have merit for educational practice and research, because it helps to reveal information about complex learning mechanisms among students. This study adds to our knowledge on whether educational interventions or training programs in school can foster students' social–emotional

skills, such as motivation or self-concepts of specific groups of students.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

TS designed the intervention. EF administered the intervention at the schools and prepared the data. EF and TS analyzed and interpreted the data and wrote the manuscript. All authors read and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01356/full#supplementary-material

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Is There a Rise in the Importance of Socioemotional Skills in the Labor Market? Evidence From a Trend Study Among College Graduates

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In this study, we examine whether socioemotional skills have become more important in the labor market within the past 14 years. To this end, we analyze data from a unique dataset on recent graduates from Dutch professional colleges (*N* = 67,000). Two different indicators of skill change are investigated, namely changes in the skill level required in the labor market and changes in the wage returns to these skills. The results indicate that socioemotional skills related to knowledge and innovation such as logical reasoning and information gathering, as well as skills related to working to plan and collaboration, have undergone a significant increase in terms of labor market requirements. We also observe an increase in the required level of the work-related skills digital literacy and occupation-specific knowledge. However, significant increases in wage returns are only observed for socioemotional skills related to knowledge and innovation. The labor market importance of socioemotional skills appears to be only modestly affected by business cycle effects.

Keywords: socioemotional skills, skill requirements, college graduates, labor market, trend analysis, wages

INTRODUCTION

The rapid development of information communication technologies (ICT) in recent decades has had far-reaching implications for how we act and interact in our daily lives, especially at work. Many routine tasks have been taken over by computers and robots, as these machines can carry out the same type of tasks at lower costs and greater levels of quality and safety. At the same time, demand has increased for non-routine tasks that cannot be specified and defined through a clear set of coded rules and are in need of human coordination and interpretation (Autor et al., 2003; Autor et al., 2006; Goos and Manning, 2007; OECD, 2018a). This line is slowly shifting, as advances in machine learning and big data use have begun to make some non-routine tasks susceptible to automation as well (Brynjolfsson et al., 2018; Ghislieri et al., 2018). Nonetheless, it is widely believed

among ICT experts that certain engineering bottlenecks will remain (Robotics-VO, 2013). These bottlenecks can be divided into three types of non-routine tasks: (1) perception and manipulation tasks, i.e., tasks that require manual acuity, (2) creative intelligence tasks, i.e., tasks that require the generation of novel and useful ideas, and (3) social intelligence tasks, i.e., tasks that require social insight (Damian et al., 2017).

The alterations in job content have led to a decrease in the demand for low and especially middle skilled jobs, as many of these jobs consist to a high degree of routine tasks (Autor, 2019). The consequences for the demand for higher skilled workers seem to be more favorable, but also for this group the technical improvements have had serious implications for their work life, as they now must continuously adjust their work tasks to the rapid technological advances. As such, it has been argued that a specific set of skills has gained in importance which enable workers to adjust to these task changes (Voogt and Roblin, 2012; OECD, 2018a; Simmering et al., 2019). This shift in the importance of skills for higher skilled workers is the focus of this paper.

Skills mentioned in the literature as potentially gaining in importance include social skills, self-regulatory skills and knowledge-acquisition skills. These skills have also been referred to as socioemotional skills (Kautz et al., 2014; De Fruyt et al., 2015; OECD, 2018b). The OECD (2018b) defines socioemotional skills as abilities that allow one to manage one's own thoughts, emotions and behavior. These skills differ from cognitive abilities such as literacy or numeracy in that they are more related to the ability to regulate oneself than to a raw ability to process information. As with closely related concepts such as non-cognitive skills, employability skills, 21st-century skills and soft skills, socioemotional skills are seen as abilities that are at least partially independent of cognitive aptitude, and that cannot be easily substituted by technology (Borghans et al., 2008; Kyllonen et al., 2014; OECD, 2018b).

During the last decade, several studies have been carried out to investigate the changing importance of socioemotional skills in the labor market. These studies have been mainly conducted from the point of view of shifts in the occupational structure. Based on the skill requirements in a baseline year, some of these studies investigated whether the number of workers in occupations that demanded more socio-emotional skills grew faster than in occupations that required mainly manual, routine or cognitive skills (Acemoglu and Autor, 2011). Others have looked at whether wages have grown faster in occupations requiring higher levels of socioemotional skills than other occupations (Castex and Dechter, 2014; Beaudry et al., 2016; Deming, 2017). For all these studies, the Dictionary of Occupational Titles (DOT) or the Occupational Information Network (O*NET) have been important sources for the classification of the skill requirements (Acemoglu and Autor, 2011; Castex and Dechter, 2014; Beaudry et al., 2016; Deming, 2017). It is very likely that the changes in the labor market also changed the skill requirements within each occupation. However, as the occupational titles of the DOT and O*NET are not measured repetitively over time (e.g., the last revision of O*NET was in 2010), changes within occupations cannot be observed. It can therefore be argued that these studies have underestimated shifts in the demand for socioemotional skills.

Using unique data on recent graduates from Dutch professional colleges for the period 2003–2017, the present paper investigates whether the importance of socio-emotional skills in the labor market has changed for this specific group of higher educated graduates over the past fourteen years. We do so by analyzing changes in two indicators of the importance of skills: (1) skill requirements in the labor market and (2) wage returns to skills. To our knowledge, to date only Edin et al. (2018) have studied trends in the demands for socioemotional skills of individual workers – as opposed to trends in skills demands for occupation categories. Since these authors focused on relatively experienced workers, they potentially confounded learning effects in education with experience effects in the labor market. They also used an overall socioemotional score which did not distinguish between different types of socioemotional skill. By contrast, our study analyses trends in a range of socioeconomic skills among a homogeneous group of college graduates surveyed one to two years after entering the labor market. Moreover, our study also analyses wage returns to skills, thereby painting a more precise picture in terms of the changes that have been taking place in the labor market for socioeconomic skills in different domains.

In sum, the present study aims to investigate the following research questions:

1. Has the level of socioemotional skills required of higher educated workers increased in the past decade?
2. If so, has the required level of all socioemotional skills risen to the same degree?
3. To what extent have changes in the socioemotional skills required of higher educated workers been reflected in higher wage returns?

MATERIALS AND METHODS

Participants and Procedure

The present study uses data from the HBO-Monitor, an annual survey among graduates from Dutch universities of applied sciences (henceforth professional colleges), who were surveyed one to two years after graduation. Professional colleges are one of the two main types of higher education in the Dutch binary system, the other being academic universities. While academic universities have a stronger focus on scientific research, professional colleges are more practical and vocationally oriented. Professional college graduates account for a large and highly important part of the new entrants to the labor market each year. Numerically, they outnumber graduates from academic universities by a factor of around two to one, and they are present in large numbers in almost every firm and organization of any size in the country. As a population to study changes in skill requirements over time, particularly professional colleges are interesting as, in contrast to academic universities, they aim to provide their graduates with the occupation-specific skills needed to perform at a high level

in the labor market. At the same time, these colleges make strong use of precisely the kind of group-based learning methods that one might expect to be effective in fostering socioemotional skills.

The HBO-Monitor survey has been conducted annually by the Research Centre for Education and the Labour Market (ROA) of Maastricht University starting in the early 1990s and continuing to the current time. It provides information on graduates' first experiences in the labor market, as well as the skill requirements in their job and background information such as age, gender and migration background. Around 25,000 graduates participate in this survey each year, with a response rate of about 40%. Due to changes in the questions asked, we restricted our analyses to data from the survey years 2004 through 2017, comprising cohorts who graduated in the study years 2002–2003 through 2015–2016.

Further Selection of Cases for Present Study

As previously mentioned, the analyses in the present study focus on changes in required skill level and the wage returns to required skills of recent graduates of bachelor programs at professional colleges in the Netherlands. To ensure that the comparison over time is as consistent as possible, it is important to focus on graduates who have followed a more or less standard path through education and the initial transition to the labor market. This is because non-standard career paths may introduce variance in both skills and outcomes that is driven by different experiences than those of young graduates who proceed directly to the labor market after graduation. For this reason, the present analyses are limited to graduates who were aged 30 or less at the time of the survey and who were enrolled in full-time study programs.

The analyses of required skill level, as well as the analyses of wage returns to required skill, are by necessity restricted to graduates who were in paid employment at the time of the survey. We specifically focus on full-time graduate jobs, which we define as jobs for at least 32 h per week requiring a college degree or higher in the discipline for which the graduates were trained. Finally, graduates who were working abroad at the time of the survey are also removed from the analyses, to avoid confounding our results with effects of differences in costs of living and exchange rates. After applying all these restrictions, we are left with around 67,000 cases for analysis, an average of almost 5,000 cases per year.

Measures

Required Skill Level

This variable is measured among recent college graduates by means of the following question: 'Below you find a number of aspects that may be important for carrying out a job. For each aspect, please indicate the level required for your current job' Each aspect was rated on a 5-point Likert scale, ranging from 'basic' to 'excellent.' The same list of skills was presented to successive graduate cohorts each year from 2004 through 2017. In total, nine socioemotional skills and for comparison three more general work-related skills were investigated. For expositional purposes, the selected socioemotional skills can be grouped into three broad categories. The first category refers to skills whose primary function is to help people regulate their own functioning at work on a day to day basis, which we henceforth refer to as self-regulation skills: (a) the ability to perform your work without supervision (WORKING INDEPENDENTLY), (b) the ability to work within a budget, plan or guideline (WORKING TO PLAN), and (c) the ability to recognize problems and opportunities (ALERTNESS). The second category of skills are deployed to help people function at work in relation to their co-workers, which we refer to as social skills: (a) the ability to cooperate productively with others (COLLABORATION) and (b) the ability to make your meaning clear to others (EXPLAINING). The third category is referred to as knowledge and innovation skills: (a) the ability to gather information (INFORMATION GATHERING), (b) the ability to come up with new ideas and solutions (CREATIVITY), (c) the ability to learn new things (LEARNING ABILITY), and (d) the ability to reason logically (LOGICAL REASONING). In addition to these nine socioemotional skills, the list contains three more general work-related skills, namely (a) knowledge of one's own field or discipline (OCCUPATION-SPECIFIC KNOWLEDGE), (b) knowledge of other fields or disciplines (INTERDISCIPLINARY KNOWLEDGE), and (c) the ability to use information and communication technology (DIGITAL LITERACY).

Hourly Earnings

Respondents were asked about their monthly earnings and the working hours in their main job according to the working contract, which are used to construct a measure of log hourly earnings.

Control Variables

Additionally, respondents were asked about general background characteristics such as their gender, age, ethnic background (i.e., country of birth of themselves and their parents), field of study, and region of employment. In all analyses, these background characteristics are used as control variables. These control variables are centered around the grand mean, to avoid large impacts on the main effects of skills.

Correction for the Business Cycle

It is possible that employers are forced to lower their standards with respect to the skills they expect graduates to have in economic good times, because they would otherwise face problems in hiring enough workers. For that reason, we include the annual percentage of graduates working full-time in graduate jobs (jobs for at least 32 hours per week requiring a college degree or higher in the discipline for which they were trained) as a business cycle indicator to the analyses. Since there are almost no regional differences in the business cycle, we apply it at the national level. **Figure 1** shows the changes in this indicator over the period in question. As the figure shows, this proportion of graduates working full-time in graduate jobs rose sharply in the years before the 2008 crisis, then dropped equally sharply starting in 2009 as the crisis took its toll. From 2014 onward the

proportion once again started to rise, as the graduate labor market recovered from the effects of the crisis.

ANALYTICAL APPROACH

In order to determine whether the importance of socioemotional skills is rising for recent Dutch college graduates, we perform two distinct series of analyses.

First, to examine whether the required level of these skills has changed in the past 14 years, ordered probit regression analyses are employed, in which the mean level and trend in required level of each skill is estimated for graduates working in the Netherlands in college-level, full-time jobs matching the discipline for which they were trained. To ensure that substantive changes in required skills by the labor market are not confounded by shifts in the composition of the graduate population, we control for gender, age, migration background, a broad classification for field of study and region of current work. As such, these analyses are performed in two steps. First, we estimate the probit regression with dummies for each year, allowing us to plot the non-parametric development of skills requirements. Next, we estimate the model with a linear time trend to get an estimate of the average change in skills requirements of time. Since skills requirements could be sensitive to the business cycle, we also add the business cycle indicator as a control variable.

In these analyses, we implement a small departure from what is typically used in ordered probit models, where the distribution of the residuals is standardized with a mean of 0 and standard deviation of 1. Normally, the mean skill requirement in 2004 would be set equal to 0. However, since in our data the level of the average response is relevant information to take into account, we set the midpoint of the range of possible responses (the middle of the interval indicated by response option 3) equal to 0. Consequently, the constant term in the ordered probit shows how many standard deviations the mean of the distribution exceeds this midpoint. Our first probit regression can therefore be specified as follows:

$$y_{i,t} = \sum_{t=2004}^{2017} \delta_t d_t + X\beta + \varepsilon_{i,t} \text{ with } Var\left(\varepsilon_{i,t}\right) = 1$$

with

$$Y_{i,t} = 1 \quad if\ y_{i,t} < \theta_1$$

$$Y_{i,t} = 2 \quad if\ y_{i,t} \geq \theta_1\ and\ y_{i,t} < -\theta_2$$

$$Y_{i,t} = 3 \quad if\ y_{i,t} \geq -\theta_2\ and\ y_{i,t} < \theta_2$$

$$Y_{i,t} = 4 \quad if\ y_{i,t} \geq \theta_2\ and\ y_{i,t} < \theta_3$$

$$Y_{i,t} = 5 \quad if\ y_{i,t} \geq \theta_3$$

in which $y_{i,t}$ is a latent variable representing the skill requirement for individual i observed in year t. $Y_{i,t}$ is the observed answer on the skills requirement question, ranging from 1 to 5. d_t indicates year dummies, equal to 1 if year = t, and otherwise 0. X represents the control variables. The θs represent the cut-off parameters. The difference with respect to the regular specification of probit is that there are no independent cut-offs points to separate answer 2 from 3 and 3 from 4. Instead we force the second cut-off to be minus the third cut-off. Now, as already indicated, the estimate of the 2004-dummy reveals the number of standard deviations of the error term by which the average skill requirement in 2004 deviates from the midpoint of the scale. Since in our data there are idiosyncratic shocks per year, we estimated the probit regression with clustered standard errors per year.[1]

In order to estimate linear trends in skill requirements we specified the following probit model:

[1]The results are almost identical to those of a multilevel probit with individuals nested within years.

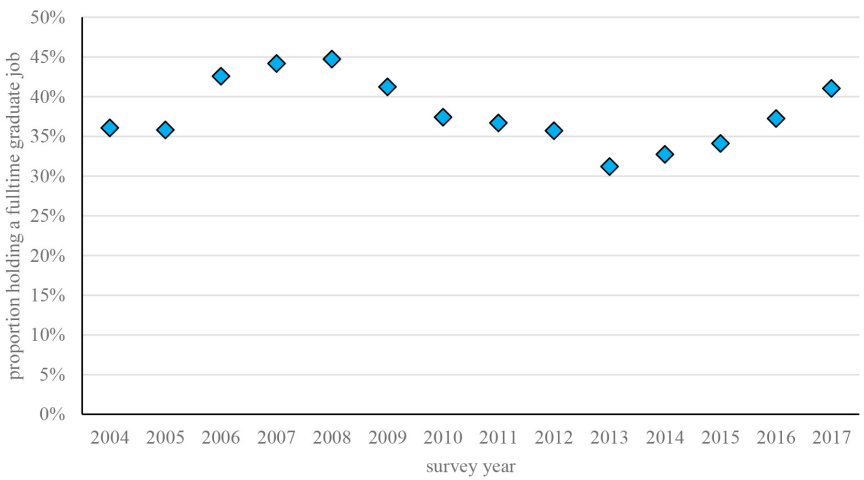

FIGURE 1 | Business cycle fluctuations in graduate jobs, 2004–2017 (total N = 147,540).

$$y_{i,t} = c + \delta\,(t - 2004) + \alpha B_t + X\beta + \varepsilon_{i,t} \text{ with } Var\left(\varepsilon_{i,t}\right) = 1$$

with

$$Y_{i,t} = 1 \quad if\ y_{i,t} < \theta_1$$

$$Y_{i,t} = 2 \quad if\ y_{i,t} \geq \theta_1\ and\ y_{i,t} < -\theta_2$$

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$$Y_{i,t} = 5 \quad if\ y_{i,t} \geq \theta_3$$

This model replaces the year dummies with a linear trend, and includes the business cycle indicator B_t to control for possible effects of the business cycle on skill requirements. Finally, to examine the extent to which changes in skill requirements are reflected in their returns in the labor market, we estimate additional models with log hourly earnings as dependent variable.

The wage regression is specified as follows:

$$\ln(w)_{i,t} = \gamma_1 Y_{i,t} + \gamma_2 Y_{i,t}\,(t - 2004) + \gamma_3 Y_{i,t} B_t + \sum_{t=2004}^{2017} \delta_t d_t + X\beta + \varepsilon_{i,t}$$

γ_1 represents the wage premium of skill y in 2004. γ_2 represents the trend in this premium from 2004 onward and γ_3 how much the relationship between wage and skill requirements in affected by the business cycle. A full set of yearly dummies corrects for annual fluctuations in the average wage level. Again, the standard errors are calculated based on a clustering per year.

RESULTS

Descriptive Analyses

Table 1 provides a descriptive overview of the measures used for the group of graduates included in the analyses. A little over half of included graduates are females, and the average age is 24.5 years. Most graduates are native Dutch, but a total of around 11% of graduates were either born abroad or born in the Netherlands to foreign-born parents. Almost half of the graduates worked, at the time of the survey, in the heavily populated western part of the country. Average hourly earnings over the whole period were around 14.82 euros at 2017 rates.

Table 2 shows the mutual correlations between required skills, age and hourly earnings for graduates working in the Netherlands in fulltime jobs matching their level and field of education. In general, most of the skills are quite strongly related to each other in terms of required level. The strongest exception is for INTERDISCIPLINARY KNOWLEDGE, which is only moderately related to the other skills in terms of required level. The other work-related skills – OCCUPATION-SPECIFIC KNOWLEDGE and DIGITAL LITERACY – are also a little less strongly related to the socioemotional skills than the socioemotional skills are related to each other. There are particularly strong correlations between CREATIVITY and LEARNING ABILITY (r = 0.49, $p < 0.01$), between ALERTNESS and INFORMATION GATHERING (r = 0.47, $p < 0.01$), between EXPLAINING and LEARNING ABILITY (r = 0.46, $p < 0.01$), and between ALERTNESS and LOGICAL REASONING (r = 0.45, $p < 0.01$). Most of the required skills show weak but significant negative correlations with age, and weak but significant positive relations with real hourly earnings. Age is strongly correlated with real hourly earnings (r = 0.18, $p < 0.01$).

TABLE 1 | Description of control and outcome variables used in the analyses.

	%	Mean	S.D.	N of observations
Gender: % female	51.6%	–	–	68,268
Age (average years)	–	24.5	1.9	68,398
Migration background (%):				66,914
Native Dutch	89.2%	–	–	
Non-western migration background	4.9%	–	–	
Western migration background	5.9%	–	–	
Region of work (%)				66,920
North	8.1%	–	–	
East	20.6%	–	–	
West	48.6%	–	–	
South	22.7%	–	–	
Hourly earnings (average 2017 euros)	–	14.83	3.02	61,609

Table 3 shows how required skills, age and hourly earnings are related to gender, migration background, broad field of study and region of work. The between-group differences are generally quite small, but being based on a large number of cases nonetheless mostly statistically significant. In general, women report a slightly higher level of required skill than men, with DIGITAL LITERACY the notable exception to the rule, with men reporting a higher required level of that skill than women. There is little difference in required skill by migration background, with DIGITAL LITERACY once again the main exception. Graduates with (non-Dutch) western and non-western migration backgrounds report a somewhat higher required level of DIGITAL LITERACY than native Dutch graduates. There is relatively little systematic difference between fields of study in required skill levels, although there are some specific skills that score relatively high or low in certain fields. For example, teaching and education graduates work in jobs typically requiring a high level of OCCUPATION-SPECIFIC KNOWLEDGE but a relatively low level of WORKING TO PLAN. There is very little variation in required skill level by region of work.

Multivariate Analyses

As already outlined in the introduction, we use two indicators to assess the changing importance of socioemotional skills: (1) Changes in skill requirements and (2) changes in wage returns to skills. In this section we present the results of a series of multivariate analyses designed to provide a robust picture of these changes.

TABLE 2 | Correlations between required skills, age and real hourly earnings.

	Working independently	Working to plan	Alertness	Explaining	Collaboration	Information gathering	Creativity	Learning ability	Logical reasoning	Occupation-specific knowledge	Interdisciplinary knowledge	Digital literacy	Age
Working to plan	0.233												
Alertness	0.364	0.288											
Explaining	0.445	0.263	0.461										
Collaboration	0.341	0.249	0.353	0.427									
Information gathering	0.304	0.275	0.474	0.364	0.285								
Creativity	0.342	0.267	0.436	0.441	0.360	0.336							
Learning ability	0.355	0.259	0.393	0.460	0.395	0.385	0.494						
Logical reasoning	0.382	0.337	0.452	0.427	0.340	0.424	0.393	0.408					
Occupation-specific knowledge	0.286	0.201	0.343	0.325	0.265	0.287	0.304	0.336	0.327				
Interdisciplinary knowledge	0.140	0.175	0.227	0.187	0.167	0.238	0.238	0.234	0.208	0.233			
Digital literacy	0.210	0.243	0.277	0.244	0.222	0.388	0.249	0.276	0.297	0.215	0.213		
Age	−0.040	0.005	−0.049	−0.050	−0.059	−0.006	−0.044	−0.054	−0.025	−0.062	0.006	0.001	
Real hourly earnings	0.018	0.016	0.035	0.040	-0.007	0.044	0.001	0.019	0.036	0.042	0.011	0.016	0.175

Number of cases varies per correlation, between 59,968 and 68,398.

TABLE 3 | Mean of required skills, age and real hourly earnings, by gender, migration background, broad field of study and region of work.

Geslacht	Working independently	Working to plan	Alertness	Explaining	Collaboration	Information gathering	Creativity	Learning ability	Logical reasoning	Occupation-specific knowledge	Interdisciplinary knowledge	Digital literacy	Age	Real hourly earnings
Gender														
Male	4.16	3.72	4.00	4.05	3.92	3.87	3.81	3.88	4.02	3.77	3.27	3.75	24.96	15.18
Female	4.35	3.69	4.15	4.22	4.14	3.91	3.97	4.02	4.05	3.92	3.31	3.67	24.14	14.50
Migration background														
Western (excl. native Dutch)	4.27	3.76	4.10	4.17	4.08	3.94	3.92	3.97	4.08	3.83	3.32	3.81	25.07	14.95
Non-western	4.24	3.78	4.08	4.14	4.08	3.94	3.86	3.99	4.05	3.80	3.36	3.81	25.57	15.29
Native Dutch	4.26	3.70	4.08	4.13	4.03	3.88	3.89	3.95	4.03	3.85	3.29	3.70	24.43	14.79
Broad Field of study														
Agriculture and food	4.30	3.79	4.08	4.13	3.96	3.89	3.88	3.96	4.08	3.89	3.27	3.73	24.60	14.65
Teaching and education	4.30	3.40	4.22	4.28	4.16	3.74	4.05	4.03	3.87	4.03	3.34	3.51	24.11	14.16
Technical	4.16	3.74	3.95	4.00	3.94	3.86	3.86	3.92	4.06	3.75	3.23	3.77	24.77	14.98
Economics	4.24	3.82	4.04	4.10	3.98	3.95	3.83	3.90	4.04	3.75	3.31	3.82	24.63	14.62
Health studies	4.39	3.71	4.06	4.21	4.13	3.89	3.86	4.05	4.15	4.05	3.26	3.61	24.19	15.85
Social studies	4.37	3.67	4.31	4.29	4.18	3.97	3.98	4.00	4.07	3.91	3.36	3.56	24.68	15.28
Region of current work														
North	4.29	3.69	4.08	4.16	4.03	3.89	3.90	3.96	4.02	3.86	3.34	3.69	24.77	14.49
East	4.26	3.67	4.08	4.13	4.01	3.87	3.90	3.94	4.02	3.86	3.30	3.68	24.46	14.62
West	4.26	3.72	4.08	4.13	4.05	3.89	3.89	3.95	4.03	3.85	3.29	3.73	24.54	15.01
South	4.26	3.70	4.08	4.13	4.03	3.90	3.88	3.95	4.06	3.83	3.29	3.71	24.49	14.73

a. Between-group variance is significant at $p < 0.01$ in all cases, except for working independently × migration background, alertness × migration background, working independently × region, alertness × region, explaining × region, creativity × region, and learning ability × region ($p > 0.05$). b. Number of cases varies per table, between 59,311 and 66,920.

TABLE 4 | Importance of skills in 2004 (intercept).

	Required skills			Wages		
	b (*SE*)	*P*	*N*	*b* (*SE*)	*p*	*N*
Self-regulation skills						
Working independently	1.694	**	63,833	0.006	**	57,778
	(0.032)			(0.001)		
Working to plan	0.690	**	64,429	0.003		58,298
	(0.016)			(0.002)		
Alertness	1.336	**	64,980	0.015	**	58,757
	(0.035)			(0.003)		
Social skills						
Explaining	1.504	**	64,036	0.017	**	57,963
	(0.029)			(0.002)		
Collaboration	1.269	**	63,885	0.002		57,827
	(0.011)			(0.002)		
Knowledge and innovation skills						
Information gathering	1.145	**	64,979	0.006	**	58,752
	(0.015)			(0.001)		
Creativity	1.033	**	64,113	0.004	*	58,024
	(0.023)			(0.002)		
Learning ability	1.161	**	64,082	0.004	**	58,000
	(0.024)			(0.001)		
Logical reasoning	1.360	**	64,448	0.007	**	58,291
	(0.022)			(0.002)		
Work-related knowledge and skills						
Occupation-specific knowledge	1.088	**	65,588	0.014	**	59,250
	(0.023)			(0.001)		
Interdisciplinary knowledge	0.383	**	65,215	0.006	**	58,940
	(0.038)			(0.002)		
Digital literacy	0.796	**	64,981	0.002	*	58,755
	(0.021)			(0.001)		

*$p < 0.05$, **$p < 0.01$. Note. All analyses include controls for gender, age, broad field of study and region of work f (see **Supplementary Appendix A**, **Tables A1, A2** for details). The stars that indicate the level of significance have to be put closer to the parameters.*

Which Skills Were Most Important in 2004?

Before we analyze the trends in importance of skills, it is important to identify the skills that were already relatively important at the start of the period under consideration – namely in 2004 –, and the skills that were relatively less important at that time. For a proper interpretation of trends, it makes a good deal of difference whether the changes are to skills that were already important, or to skills that were formerly less important but are becoming more so in time. **Table 4** shows this. We include both measures of importance in the table. The coefficients in the table with respect to skill requirements can be interpreted as the number of standard deviations that the average respondent lies above the midpoint of the 5-point response scale in 2004. For example, in **Table 4**, the skill requirements coefficient of 0.690 for the skill WORKING TO PLAN, indicates that the average respondent has a required level of this skill equal to 0.690 standard deviations above the scale midpoint. The coefficients with respect to the wage effects can be interpreted as the extra wage a graduates received in 2004 who scores one point higher on the relevant skill requirement scale. For example, in **Table 4**, the wage coefficient 0.006 for the skill WORKING INDEPENDENTLY indicates that an increase of one scale point on this skill is associated with an increase of 0.6% in hourly wages.

All of the coefficients for required skills are significantly positive, indicating that the majority of respondents have a required level of skill of greater than 3, which is the midpoint of the scale. Most of the coefficients for the effect of skills on wages are significantly positive, the exceptions being WORKING TO PLAN and COLLABORATION. Looking at the size and rank order of the coefficients, there is some overlap in the ranking of importance in 2004 according to the two indicators, but also some differences. For example, EXPLAINING and ALERTNESS were not only characterized by a relatively high required level, but also yielded relatively high wage returns. At the other end of the continuum, WORKING TO PLAN, INTERDISCIPLINARY KNOWLEDGE, CREATIVITY and DIGITAL LITERACY emerge as relatively less important in 2004 in terms of both skill requirements and wage returns. On the other hand, WORKING INDEPENDENTLY and COLLABORATION show low or even non-significant wage returns despite being required at a relatively high level, while OCCUPATION-SPECIFIC KNOWLEDGE yields high wage returns despite only being required at a relatively modest level. These differences illustrate the fact that skills that are required at a high level in graduate jobs are not always the skills that employers are prepared to pay the most for.

Which Skills Are Becoming More Important Over Time?

In order to gain a first impression of changes over time in the importance of skills, we can look at changes from year to year in mean requirements and wage returns to skills. To ensure that trends are not confounded by changes from year to year in the composition of the graduate population, we control for gender, age, migration background, a broad classification for field of study and region of current work. To illustrate how this impacts the estimates, **Figure 2** shows the changes over time in the required level of the skills COLLABORATION and ALERTNESS, before and after adding the control variables.

In general, the trends appear to become somewhat stronger after controlling for the composition of the graduate population. This appears to be mainly due to the fact that the mean age has increased in the same period by around three quarter of a year, with age being negatively correlated with the required level of most of the skills (see **Table 2**). There have also been significant changes in composition in terms of migration background, broad field of study and region of work, confirming the importance of controlling for these variables.[2]

Although the controls lead to somewhat stronger trends, the general pattern is similar before and after adding

[2]The total graduate population has grown considerably in the same period, both in absolute terms and as a proportion of the working age population. Around 21% of the working age population had a college degree in 2017, compared to around 15% in 2004 (CBS, 2019). It is not immediately clear how this could impact the importance of graduate skills, but there is little reason to expect this to have systematically enhanced the importance of graduate skills.

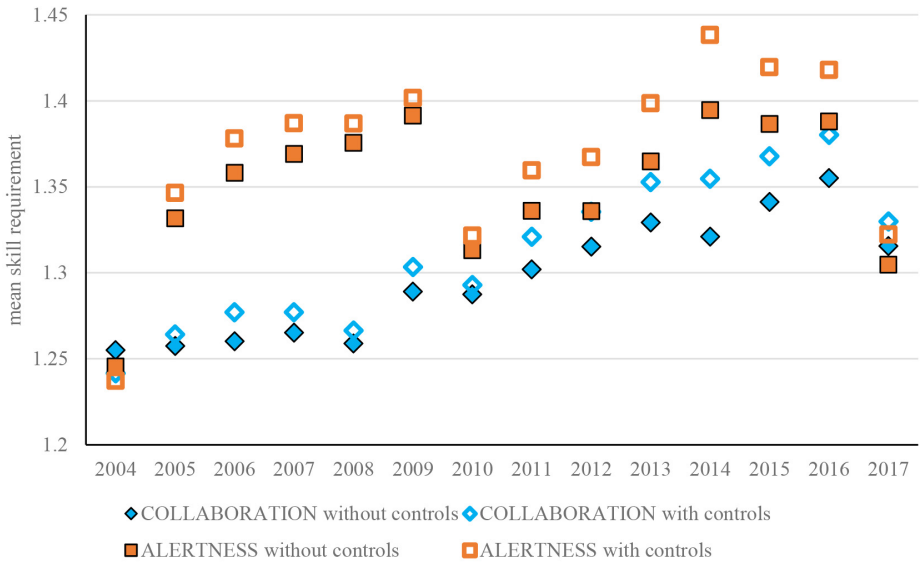

FIGURE 2 | Estimated required level of the skills collaboration and alertness per year, before and after adding controls*. Notes: 1.*Controls included for gender, age, broad field of study, region of work and GPA. 2.*Number of cases collaborations = 63,189; number of cases alertness = 64,564.

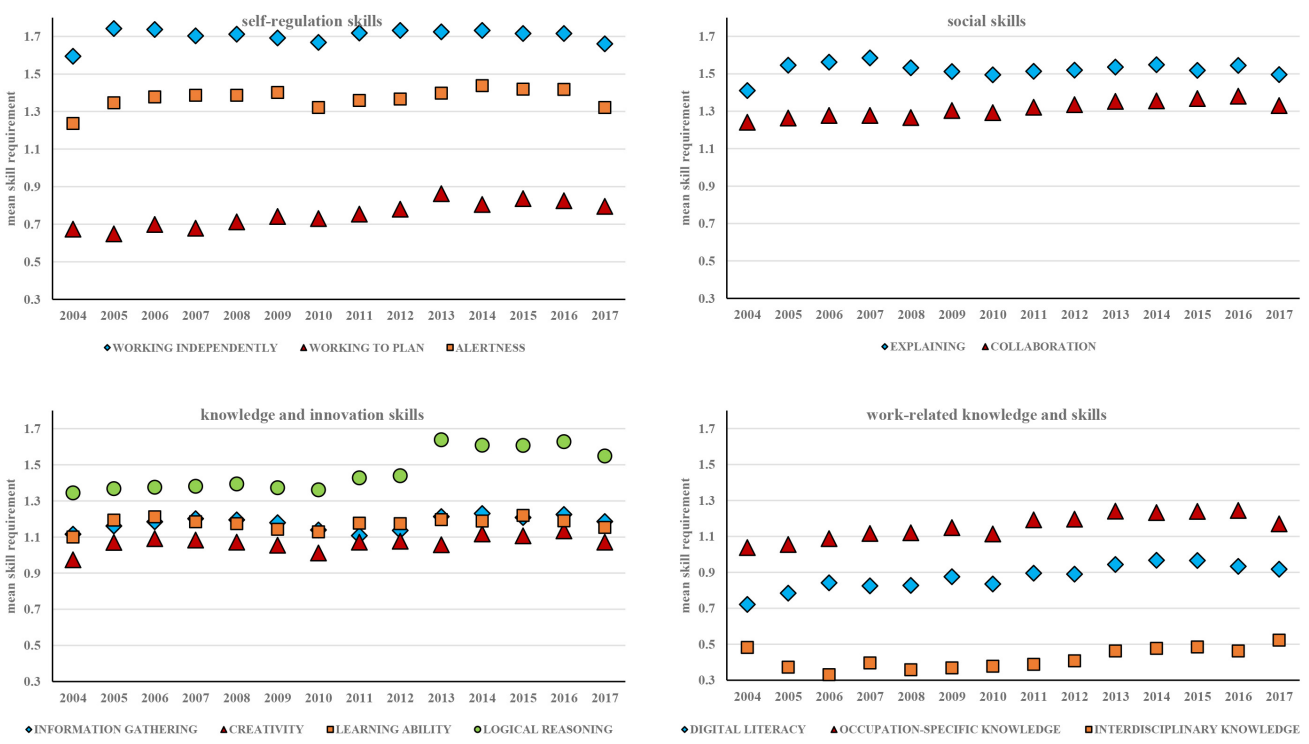

FIGURE 3 | Changes in required level of skills, 2004–2017. Notes: 1. All analyses include controls for gender, age, broad field of study, region of work and GPA. 2. Number of cases varies per dimension of required skill, between 63,456 and 65,113.

the controls. In the interests of brevity, we therefore subsequently only show the estimated trends after adding controls. **Figure 3** shows the changes over time in the estimated required level of all 12 skills, grouped into the four skill clusters.

For some skills, such as LOGICAL REASONING, OCCUPATION SPECIFIC KNOWLEDGE, DIGITAL LITERACY, WORKING TO PLAN and COLLABORATION, there seems to be a discernible increase in the level of requirements over time. For other skills, such as INTERDISCIPLINARY KNOWLEDGE, ALERTNESS, CREATIVITY

and INFORMATION GATHERING, there seems to be some increase over time, but it is harder to distinguish this from the non-linear fluctuations from year to year. For the remaining skills there is no discernible trend at all.

A problem with this purely descriptive approach is that is does not provide any guidance on how to interpret changes, even when these changes are clear and systematic. Changes over time could reflect not only a trend toward more importance, but could also be affected by, for example, changing conditions in the graduate labor market. In particular, business cycle fluctuations may not only affect graduates' chances of finding employment, but also the kinds of skills they are required to possess, and the degree to which those skills are rewarded in the form of higher wages. This is an importance issue in this instance, since one of the most serious economic recessions in history took place in the middle of the period under consideration.

In order to obtain a clear and robust picture of the extent to which the importance of skills has changed systematically over time, the business cycle indicator was added to the model.

In the new model specification, the coefficient of the trend indicator allows us to precisely quantify the size and significance of systematic changes in skill requirements over time. By interacting the trend with skills in the wage models, we can also precisely quantify any systematic change in wage effects of skills over time. By controlling for business cycle fluctuations, we are able to obtain an estimate of that part of these trends left when the effects of the economic cycle have been taken into account. **Table 5** shows these trends.

As was the case with the importance of skills at the start of the period under consideration in 2004, there is some overlap between skill requirements and wage effects in terms of the trend in importance, but also some clear differences. According to both measures we see strong positive trends in the importance of LOGICAL REASONING and DIGITAL LITERACY. INFORMATION GATHERING is also gaining importance according to both measures, more strongly in the case of wage effects than in terms of skill requirements. Interestingly, despite showing no significant increase in importance in terms of skill requirements, the wage effects of LEARNING ABILITY are increasing strongly over time. Conversely, we see no increase in wage returns to OCCUPATION-SPECIFIC KNOWLEDGE, WORKING TO PLAN, COLLABORATION, CREATIVITY and INTERDISCIPLINARY KNOWLEDGE, despite significant increases in requirements over time for these skills.

TABLE 5 | Trends in the importance of skills.

	Required skills			Wages		
	b (*SE*)	*P*	*N*	*b* (*SE*)	*p*	*N*
Self-regulation skills						
Working independently	0.001		63,833	0.0002		57,778
	(0.004)			(0.0002)		
Working to plan	0.013	**	64,429	0.0002		58,298
	(0.002)			(0.0002)		
Alertness	0.005		64,980	−0.0002		58,757
	(0.005)			(0.0004)		
Social skills						
Explaining	0.002		64,036	−0.0003		57,963
	(0.004)			(0.0003)		
Collaboration	0.008	**	63,885	0.0002		57,827
	(0.002)			(0.0003)		
Knowledge and innovation skills						
Information gathering	0.005	*	64,979	0.0007	**	58,752
	(0.002)			(0.0002)		
Creativity	0.006		64,113	0.0003		58,024
	(0.003)			(0.0002)		
Learning ability	0.002		64,082	0.0007	**	58,000
	(0.003)			(0.0001)		
Logical reasoning	0.021	**	64,448	0.0007	**	58,291
	(0.002)			(0.0002)		
Work-related knowledge and skills						
Occupation-specific knowledge	0.013	**	65,588	0.0002		59,250
	(0.003)			(0.0001)		
Interdisciplinary knowledge	0.008		65,215	−0.0002		58,940
	(0.005)			(0.0002)		
Digital literacy	0.014	**	64,981	0.0005	**	58,755
	(0.003)			(0.0002)		

*$^{*}p < 0.05$, $^{**}p < 0.01$. Note. All analyses include controls for gender, age, broad field of study and region of work f (see **Supplementary Appendix A**, **Tables A1, A2** for details). The stars that indicate the level of significance have to be put closer to the parameters.*

Which Skills Vary in Importance According to Economic Circumstances?

Finally, the trends have been corrected for cyclical fluctuations in the graduate labor market. This is important, because it ensures that the trends we observe are real trends, and not just the result of, for example, adjustments to the economic crisis in the years after 2008. The effects of economic circumstances are also interesting in their own right. **Table 6** shows the effects of the economic cycle on the trends.

In general, the effects of the economic cycle are not very strong, and for fully half of the skills we see no significant change as conditions in the graduate labor market change over time. The effects such as they are, are each only observed for one of the two indicators. The required level of WORKING TO PLAN, LOGICAL REASONING, and COLLABORATION become weaker as the graduate economy improves and stronger when things take a turn for the worse. The most probable explanation for this is that the jobs that are left for graduates during a recession are on average different than the jobs that are available when the economy is booming. Since we only look at graduates in jobs matching their level of education, this suggests that jobs requiring these three skills are relatively robust and these skills are relatively needed even more when demand is low.

There are no wage effects accompanying these cyclical effects in skill requirements. However, we do find positive earnings effect for INFORMATION GATHERING ($b = 0.067$, $p < 0.01$) and a negative effect for EXPLAINING ($b = -0.048$, $p < 0.05$). The positive effect indicates that INFORMATION GATHERING is more rewarded than usually during good economic years, and relatively less during a recession. The negative effect indicates that

TABLE 6 | Effects of economic cycle on the importance of skills.

	Required skills			Wages		
	b (*SE*)	*p*	*N*	*b* (*SE*)	*p*	*N*
Self-regulation skills						
Working independently	−0.049		63,833	0.033		57,778
	(0.297)			(0.018)		
Working to plan	−0.376		64,429	0.000		58,298
	(0.201)			(0.03)		
Alertness	0.111		64,980	−0.023		58,757
	(0.372)			(0.035)		
Social skills						
Explaining	0.257		64,036	−0.048	*	57,963
	(0.301)			(0.021)		
Collaboration	−0.255	*	63,885	−0.034		57,827
	(0.102)			(0.021)		
Knowledge and innovation skills						
Information gathering	0.199		64,979	0.067	**	58,752
	(0.207)			(0.023)		
Creativity	0.179		64,113	−0.015		58,024
	(0.214)			(0.029)		
Learning ability	−0.030		64,082	0.008		58,000
	(0.21)			(0.015)		
Logical reasoning	−0.743	*	64,448	0.019		58,291
	(0.289)			(0.029)		
Work-related knowledge and skills						
Occupation-specific knowledge	−0.320		65,588	−0.026		59,250
	(0.251)			(0.018)		
Interdisciplinary knowledge	−0.435		65,215	0.002		58,940
	(0.319)			(0.023)		
Digital literacy	−0.159		64,981	0.046		58,755
	(0.227)			(0.034)		

*$^*p < 0.05$, $^{**}p < 0.01$. Note. All analyses include controls for gender, age, broad field of study and region of work f (see **Supplementary Appendix A**, **Tables A1, A2** for details). The stars that indicate the level of significance have to be put closer to the parameters.*

EXPLAINING is rewarded relatively more during a recession than in boom years.

DISCUSSION

It has been argued that rapid technological changes are increasing the importance of socioemotional skills in the labor market for highly educated graduates. In this study, we have looked for evidence of such changes in the labor market for Dutch professional college graduates during the past 14 years. This was done using a unique dataset on recent graduates from Dutch professional colleges, containing information on nine socioemotional skills, three more general job-related skills and a range of other personal and work characteristics. Two different indicators of change in the importance of skills were investigated, namely changes in the level of skill required in the graduate labor market and changes in the wage returns to these skills. In estimating these changes, we corrected for business cycle fluctuations and reported on which socioemotional skills have become more or less important in good economic times as opposed to downturns. To provide some structure to our results, the twelve skills were grouped into four categories: self-regulation skills, social skills, knowledge and innovation skills, and work-related skills.

The findings revealed that socioemotional skills related to knowledge and innovation such as logical reasoning and information gathering as well as working to plan and collaboration have increased significantly in terms employer requirements between 2004 and 2017. We also observed an increase in the required level of the work-related skills digital literacy and occupation-specific knowledge. The trends in required skill level are thus divided across all four skill categories, suggesting that college graduates are facing increasingly high demands in terms of how they regulate their own work behavior, how they interact with others in the work place, how they collect and process information, and how well they have mastered the work-related content that they need to perform their work on a day to day basis. It is worth noting that all the socioemotional skills that did not show a positive trend in terms of required level were already required at a high level in 2004. The reverse is also mostly true: most of the skills that have experienced an increase in importance were at most moderately important in 2004. As such, there is to some extent a narrowing of the gap in required level between skills, which implies that most of the socioemotional skills we examined have either already long been important in graduate employment or are becoming more important over time. In the case of logical reasoning, both are true: this skill has experienced a sharp increase in required level during the investigated period of fourteen years, even though it was already one of the skills required at the highest level in 2004.

Regarding wage returns to required skills, significant results were only found for socioemotional skills related to knowledge and innovation, as well as for the work-related skill digital literacy. Once again it is worth remarking that a number of skills that showed no positive trend in wage returns were already relatively well-rewarded in 2004. This applies to the socioemotional skills explaining and alertness, as well as to the work-related skill occupation-specific knowledge. However, several socio-emotional skills that showed relatively low wage returns in 2004 – working to plan, collaboration and creativity – showed no significant increase in wage returns over time. Interestingly, as we saw above, the first two of these were among the skills with the strongest increase in terms of required level. This suggest that these skills are indeed becoming an increasingly important feature of graduate working life, but that these changes are so far not reflected in greater wage returns.

What does this mean in concrete terms for policymakers and educational practitioners who aim to prepare college students as well as possible for today's labor market? First of all, it means that it is very important that higher education institutions monitor the degree to which their graduates are equipped for the changing demands of the labor market and, where necessary, focus on how they can contribute to the development of socioemotional skills, especially those that are in high and/or increasing demand.

Fortunately, the HBO-Monitor, the survey on which our analyses are based, is specifically designed to help professional colleges to do precisely that. Each year the colleges receive a detailed report on their own graduates, including information on the skills required in the labor market. If it appears that graduates of some study programs are failing to adapt sufficiently to changes in demands for certain socioemotional skills, there are a range of ways in which colleges can remedy this. For example, active learning methods, such as collaborative, personalized and problem-based learning, have proven effective in enhancing socioemotional skills (Laursen et al., 2013; Baepler et al., 2014). The idea behind these learning methods is that by making learning an activity that is controlled by the learners themselves – rather than a teacher or a subject expert – learners learn how to gain control of their own learning process, by determining their own learning needs, learning strategies, and learning materials, alone or together with other learners. Students can also enhance their own self-regulation and knowledge and innovation skills by formulating their own learning goals, identifying human and material learning resources, and evaluating their own learning outcomes (Tekkol and Demirel, 2018).

As mentioned before, our dataset differed from those used by many other researchers investigating changes in the importance of socioemotional skills in the labor market. This has advantages and disadvantages that are worthy of note. On the positive side, our data provided a more precise and differentiated measure of the skills that employees possess, as well as those that they need to carry out their daily jobs than earlier studies on this topic. Since the skill items were strictly comparable across the full time period studied, trends in required skill level accurately assessed. Furthermore, an extensive psychological literature base confirms that people are relatively good at using questionnaires to communicate their true experiences, conditional upon them knowing how the questions asked should be answered, and on them feeling at ease in reporting accurately on them (see for an overview, Duckworth and Yeager, 2015). As such, anonymous self-report questionnaires are better suited than other measures for assessing personal attributes.

However, there also certain disadvantages related to this approach. All our central measures are based on self-reports in questionnaire surveys. This may introduce some subjectivity regarding these measures. For example, in order to answer the questions on required skill level, some frame of reference has to be used to arrive at a certain judgment. As such, a 'reference bias' may occur, in which some respondents may use different standards than others. Furthermore, for various reasons, respondents may not always be entirely truthful about their stances and dispositions. A well-known example is 'acquiescence bias,' a tendency of people to give the average answer on all questions, either to deal with it quickly or because they have difficulty in placing themselves with respect to the average. In most respects, our survey data should not be expected to be especially prone to such measurement errors, and any bias that is present should not change systematically over time. For this reason, we believe that our assessment of trends in required skills and their relation to outcomes is basically valid, even if potentially subject to a certain amount of random "noise." Moreover, we have strived to avoid the above-mentioned forms of bias, by guaranteeing respondents that their data would be treated anonymously, and by giving respondents the opportunity to skip certain questions they would prefer not to answer.

In sum, the present study has showed that socioemotional skills have increasingly been required and rewarded in college graduates in the labor market in the past 14 years. Particularly knowledge and innovation skills and digital literacy have become increasingly rewarded by employers, suggesting that to secure a job in the labor market of tomorrow, it is worthwhile for graduates to invest in this type of skills.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

LB developed the study concept. JA, LB, and BB contributed to the study design. JA and BB were responsible for data preparation and data management. LB and JA analyzed the data, and all authors were involved in interpreting the results. BB drafted the manuscript, and all coauthors contributed to the final manuscript. All authors approved the final manuscript for submission.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01710/full#supplementary-material

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Character Strengths Are Related to Students' Achievement, Flow Experiences, and Enjoyment in Teacher-Centered Learning, Individual, and Group Work Beyond Cognitive Ability

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While character strengths have been found to predict educational outcomes beyond broad personality traits and cognitive ability, little is known about their differential contribution to success and positive learning experiences in different school settings. In this study, we use trait activation theory to investigate the relationships of students' character strengths with achievement, flow experiences, and enjoyment in different learning situations (i.e., teacher-centered learning, individual tasks, and group work). In studying these relationships, we controlled for psychometric intelligence. Secondary school students (N = 255; 46.3% male; mean age = 14.5 years) completed a self-report measure of character strengths, the VIA-Youth (Park and Peterson, 2006b). Cognitive ability was assessed using a standardized intelligence test (PSB-R; Horn et al., 2003) at baseline. Three months later, students completed the Flow Short Scale (Rheinberg et al., 2003) adapted to the three learning situations and indicated their typical enjoyment of these situations. Both the students and their teachers (N = 18; 50% male; mean age = 44.8 years) provided ratings on school achievement in each of the three learning situations. Results indicate that, as expected, (a) certain character strengths (love of learning and perseverance) show consistent relationships with achievement and positive learning experiences (flow and enjoyment) above and beyond cognitive ability across all learning situations, whereas (b) other character strengths show differential trait-outcome relationships (e.g., the character strength of teamwork was predictive of achievement and positive learning experiences in group work). Taken together, these results suggest that different character strengths play a role in different school situations and that their contribution to explaining variance in educational outcomes is incremental to the contribution of cognitive ability.

Keywords: character strengths, socio-emotional skills, positive education, optimal experience, trait activation theory

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INTRODUCTION

As early as 1940, non-cognitive variables were discussed as important predictors of educational outcomes that could add to the predictive value of cognitive ability (Harris, 1940). Many decades later, there is substantial evidence that personality traits explain variance in educational outcomes (Poropat, 2009) and also do so incrementally above the influence of cognitive ability (e.g., Lechner et al., 2017). However, much is still unknown about which aspects of students' learning experiences and performance are influenced by individual differences in cognitive and non-cognitive (i.e., personality) traits and the most useful level of analysis (i.e., broader vs. narrower traits; see O'Connor and Paunonen, 2007).

In the present study, we use the concept of character strengths (Peterson and Seligman, 2004) to investigate the role of a comprehensive set of (narrower) positively valued personality traits. While previous studies found character strengths to go along with overall school achievement (e.g., Wagner and Ruch, 2015), when controlling for broader personality traits and cognitive ability (Wagner and Ruch, 2020), school does not represent a uniform situation but rather a range of different settings, in which achievement and positive learning experiences might be facilitated by different personality traits. Therefore, we aimed at studying whether character strengths explain variance in achievement across different learning situations – namely teacher-centered learning, individual tasks, and group work – above and beyond cognitive ability. Given the relevance of positive learning experiences both for overall well-being (e.g., Stiglbauer et al., 2013) and for future achievement (e.g., Engeser and Rheinberg, 2008), we also include variables related to well-being by studying the relationships of character strengths to the experience of flow and enjoyment in the different learning situations.

Character Strengths

Building on the theoretical framework of the Values in Action (VIA) classification (Peterson and Seligman, 2004), character is defined as a set of positive characteristics shown in feelings, thoughts, and actions. The VIA classification suggests a hierarchical structure of character where 24 character strengths are organized under six broad virtues: (1) wisdom and knowledge (encompassing the character strengths of creativity, curiosity, judgment, love of learning, and perspective), (2) courage (i.e., bravery, perseverance, honesty, and zest), (3) humanity (i.e., love, kindness, social intelligence), (4) justice (i.e., teamwork, fairness, and leadership), (5) temperance (i.e., forgiveness, humility, prudence, and self-regulation), and (6) transcendence (i.e., appreciation of beauty and excellence, gratitude, hope, humor, and spirituality). In that sense, character strengths are the "psychological processes or mechanisms that define the virtues" (Peterson and Seligman, 2004, p. 13). By definition, character strengths are ubiquitous, positively morally valued, fulfilling, trait-like, distinct, and measurable individual differences that contribute to optimal development across the lifespan (Peterson and Seligman, 2004). Importantly, character strengths are defined as malleable, which makes them ideal targets for interventions (for an overview in the educational context, see Lavy, 2019).

Character strengths also seem to be measurable and relevant in young people. Previous research has established that character strengths are already present in young children (Park and Peterson, 2006a) and can be reliably and validly measured using self-reports from the age of 10 years (e.g., Park and Peterson, 2006b; Ruch et al., 2014). A number of studies using those instruments established robust associations between character strengths and well-being among adolescents across different cultures (e.g., van Eeden et al., 2008; Gillham et al., 2011; Toner et al., 2012; Ruch et al., 2014).

Character Strengths and Educational Outcomes

How do character strengths relate to educational outcomes? Evidence suggests that the character strengths of love of learning and perseverance are particularly conducive to a range of educational outcomes (e.g., Weber and Ruch, 2012; Shoshani and Slone, 2013; Wagner and Ruch, 2015, 2020; Weber et al., 2016). However, previous studies suggest that, depending on the outcomes assessed (e.g., school achievement, school satisfaction, or positive relationships at school), different character strengths are additionally of relevance. For instance, the character strengths of zest and social intelligence are relevant in explaining variance in positive affect at school, whereas the character strengths of teamwork, hope, self-regulation, and love are most strongly associated with low negative affect at school (Weber et al., 2016). Specifically, the strengths found to be associated with achievement and with positive experiences at school overlap strongly, but some strengths (such as prudence) tend to show stronger relationships with achievement and other strengths (such as zest) tend to show stronger relationships with positive experiences at school. Recently, it was also demonstrated that a number of character strengths still predicted a range of educational outcomes when cognitive ability and personality traits of the five-factor model were controlled for (Wagner and Ruch, 2020).

Differential Relationships Between Personality or Character and Educational Outcomes

Studies on the relationships between character strengths and achievement almost exclusively rely on overall school achievement, or GPA. However, a first hint for differential relationships is represented by the finding that character strengths are generally more strongly related to grades in core academic subjects than to grades in non-academic subjects (e.g., physical education, and arts; Wagner and Ruch, 2015). Academic achievement is not a unidimensional construct and therefore, using overall school achievement or only using school grades as criterion might not allow for uncovering relationships with specific components of achievement (see O'Connor and Paunonen, 2007; Poropat, 2009). This idea is supported by findings that demonstrate differential trait-outcome relationships of the personality dimensions of the five-factor model for

different school subjects or different assessments of educational achievement (e.g., Spengler et al., 2013; Zhang and Ziegler, 2016; Brandt et al., 2020). This underlines the need for a more fine-grained examination of the associations between personality traits and educational outcomes. Using broader and more varied criterion measures of academic performance than GPA to study their relationships with personality traits (e.g., Kappe and van der Flier, 2010) has generally yielded two conclusions: First, certain traits (mainly conscientiousness) are consistently positively related with academic performance irrespective of the chosen measure. Second, for a number of personality traits (such as extraversion or neuroticism), the existence and size of relationships with academic achievement depend on how achievement is measured (i.e., GPA, thesis, performance in a group project, etc.).

In interpreting such findings and in hypothesizing relationships between character strengths and educational outcomes, we relied on the theoretical framework of trait activation theory (Tett and Guterman, 2000; Tett and Burnett, 2003). The theory's central premise is that situations differ in their relevance to any given trait, which is a well-accepted idea (see, e.g., Allport, 1937). A second premise of the theory assumes that trait expression is a rewarding experience – that is, individuals enjoy situations that allow the expression of their traits (Tett and Burnett, 2003). Trait expression (i.e., showing trait-related behavior) in a given situation is enabled by a set of situational cues, which can also be construed as opportunities or expectations. While much work on trait activation theory refers to predicting work-related outcomes, these ideas can also be applied to predicting educational outcomes (see Brandt et al., 2020). Brandt et al. (2020) argue that, for instance, different ability-grouped school tracks represent different learning contexts with distinguishable characteristics. These characteristics include different instructional styles as well as behavioral norms and expectations. Based on the notions of trait activation theory, these serve as situational cues that activate different sets of traits, which in turn causes differences in trait-performance associations between academically oriented and vocationally oriented school tracks. Specifically, Brandt et al. (2020) found, in a large sample of German students in grade nine, that conscientiousness had a stronger positive association with school performance in academic than in vocational school tracks. This finding supports the hypothesis that conscientiousness is activated to a stronger degree in a setting with higher academic demands.

The Role of Learning Situations as Trait-Relevant Learning Contexts

Trait activation theory (Tett and Guterman, 2000; Tett and Burnett, 2003) assumes that traits are activated in response to cues within the situation. In the educational context, these cues can be located within (a) the task a student performs, (b) the social environment a student is in, or (c) the wider organizational context (Brandt et al., 2020). Differential trait-performance relationships have been observed across different types of performance assessments, such as grades or performance in standardized tests (which might mostly represent a variation within the task), grades in various subjects (again mostly a variation within the tasks), and different ability-grouped school tracks (a variation at the organizational level). Up to now, little attention has been paid to the second aspect, the students' social environment. Yet, different learning situations that teachers use in organizing their school lessons (see Rubin and Hebert, 1998; Rimm-Kaufman et al., 2005; Meyer, 2013) may be an important cause of variability. Diverse learning situations (e.g., teacher-centered learning, individual tasks, or group work) are likely to impose differential expectations and norms for students' behavior, thus activating traits differentially, which results in differential trait-performance associations.

Learning situations can be described as either teacher-centered learning or student-centered learning (e.g., Rubin and Hebert, 1998; Rimm-Kaufman et al., 2005), with the latter including both individual tasks and group work. *Teacher-centered learning* is characterized by the leading role of the teacher in presenting the lessons' contents, either in a lecture-type presentation or through a moderated conversation in class. When working on *individual tasks,* students are independently working on assignments. *Group work* is characterized by students working together on assignments in (small) groups (see Meyer, 2013). A varying social environment characterizes these different learning situations: Teacher-centered learning typically involves mainly interactions with the teacher, with the entire classroom present. Individual work features minimal interactions with others and a single focus on the task given. In contrast, group work is characterized by a lot of interactions with peers and a need for cooperation.

Aims of the Present Study and Hypotheses

The present study aims at investigating whether students' character strengths predict both achievement and positive learning experiences (flow experiences and enjoyment) in different learning situations (i.e., teacher-centered learning, individual tasks, and group work) over and above cognitive ability. Drawing on trait activation theory, we assume that character strengths (as trait-like individual characteristics) are expressed in response to trait-relevant situational cues, thus giving rise to behaviors that impact performance and the level of achievement in this situation, and that their expression leads to positive learning experiences. As a consequence, we expect different character strengths to be related to positive learning experiences and achievement in different situations.

We derived a set of hypotheses regarding specific character strengths and achievement and positive learning experiences in different learning situations based on several sources: (a) theoretical assumptions on character strengths (Peterson and Seligman, 2004) and characteristics of the three learning situations studied (see Meyer, 2013), (b) trait activation theory (Tett and Guterman, 2000; Tett and Burnett, 2003), (c) previous findings on the relationships between character strengths and school achievement (e.g., Weber and Ruch, 2012, 2015; Weber et al., 2016) and differential personality-outcome associations

(e.g., Kappe and van der Flier, 2010), and (d) teachers' definitions of achievement in the three learning situations. To obtain these definitions, we asked participating teachers (N = 18) to provide their own definitions of achievement (i.e., what it means to be successful and to show a good performance in each of the learning situations) using an open-ended format at the first measurement occasion (i.e., 3 months before the outcomes variables were assessed). The answers were content-coded and the most common behavioral criteria for achievement that were mentioned are summarized in **Figure 1**.

We hypothesized that some character strengths (in particular, love of learning and perseverance) should be conducive to academic achievement and positive learning experiences across a wide range of settings, whereas other strengths should specifically contribute to achievement and positive learning experiences in certain settings as they are specifically activated by cues present in these contexts. Specifically, we expected that love of learning and perseverance would be conducive to achievement *across all learning situations*. This was also supported by the fact that teachers mentioned behaviors that are expressive of the character strengths of love of learning (e.g., "showing interest in the topic") and perseverance (e.g., "working on the task persistently" and "working toward a goal") as relevant for achievement across all learning situations (see **Figure 1**).

Achievement in *teacher-centered learning* was hypothesized to be additionally related to specific character strengths since it requires active participation in class (zest), the ability to focus one's attention (self-regulation), and self-confidence (hope). As working on *individual tasks* requires working in a self-regulated manner, we also expected achievement in individual tasks to be related to the strength of self-regulation. Successfully working on a task in a group also requires integrating different opinions or types of information (strengths of judgment and perspective) and working well with other students (strengths of love, kindness, social intelligence, teamwork, fairness, and leadership), which is why we assumed that these strengths would be associated with better performance in *group work*. We expected those strengths that should go along with better performance to also relate to positive learning experiences (flow and enjoyment) in the respective situation. With regard to flow experiences, we additionally expected that creativity, curiosity, judgment, love of learning, perseverance, zest, self-regulation, and hope would be conducive to experiencing flow in all of the learning situations,

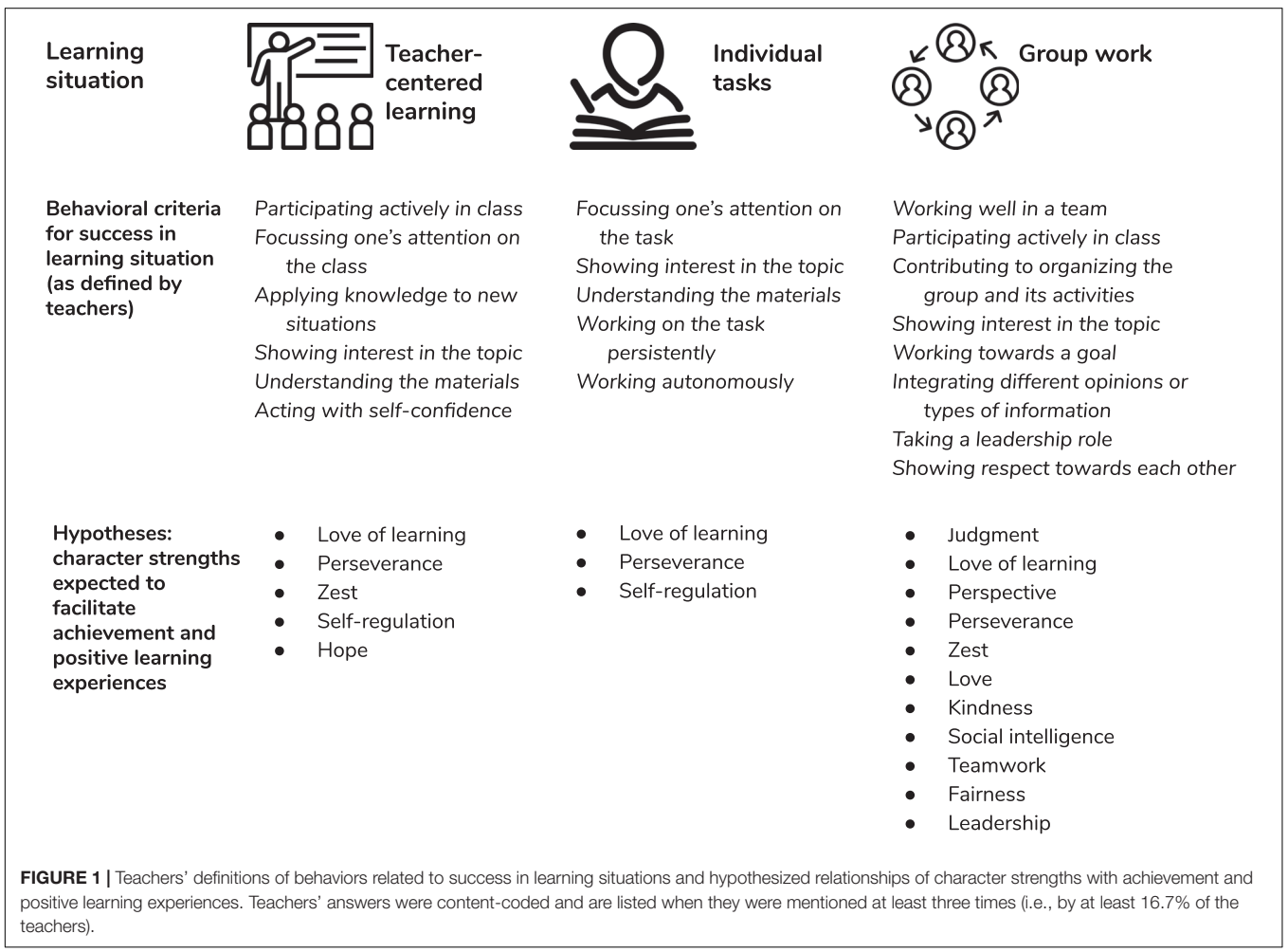

FIGURE 1 | Teachers' definitions of behaviors related to success in learning situations and hypothesized relationships of character strengths with achievement and positive learning experiences. Teachers' answers were content-coded and are listed when they were mentioned at least three times (i.e., by at least 16.7% of the teachers).

in line with earlier findings (Wagner and Ruch, 2020). **Figure 1** gives an overview of the hypothesized relationships.

MATERIALS AND METHODS

Participants

We calculated the required sample size using G*Power 3.1 (Faul et al., 2009) based on a power of at least 0.80 to detect an effect of $r = 0.20$ (based on previous studies' results; e.g., Wagner and Ruch, 2015) using an α-level of 0.01 and one-tailed tests. This resulted in a required sample size of at least $N = 247$.

Altogether, we collected data of 301 participants in 19 classrooms. Data of 48 participants were excluded from the analyses because they had missing data in several relevant instruments ($n = 18$, mostly because they did not participate in both data collections), did not complete the intelligence test ($n = 14$, i.e., one classroom), showed response patterns indicative of careless responding ($n = 8$, determined by examining repeated answers, the consistency of recoded and non-recoded items, and response times), or had too little knowledge of German ($n = 6$). Thus, the analyzed sample consisted of $N = 255$ students (46.3% boys and 53.7% girls) from 18 different classrooms. At the time of the first data collection, participants had a mean age of 14.49 years ($SD = 1.07$; ranging from 12.42 to 18.75 years). Most (83.2%) were between 13 and 15 years old. In Switzerland, secondary schools can be categorized into two tracks: Around one-quarter of participants attended schools with basic requirements (i.e., with a vocational orientation) and 76.5% of participants attended schools with augmented requirements (i.e., with an academic orientation), which approximately represents the distribution of schools in the respective communities.

The sample of teachers consisted of $N = 18$ teachers (8 female and 10 male) with a mean age of 43.67 years ($SD = 12.16$, ranging from 24 to 60 years). They had been working as teachers for on average of 19.17 years ($SD = 12.46$). In the Swiss secondary school system, students in one classroom typically attend most classes together as a group. The teachers participating in the present study were their homeroom teachers in most cases (i.e., in 94.4%) and typically taught several school subjects to the same class (on average 10.78 hours per week, with $SD = 4.08$). All teachers had also been teaching the respective students for at least 6 months ($M = 15.44$ months, $SD = 9.79$). Thus, it can be assumed that they were sufficiently familiar with the students to rate their achievement in different learning situations.

Instruments

To assess students' character strengths, we used the *Values in Action Inventory of Strengths for Youth* (VIA-Youth; Park and Peterson, 2006b) adapted to German by Ruch et al. (2014), which is based on the VIA classification (Peterson and Seligman, 2004) and consists of 198 items with a 5-point answer format (from 5 = *very much like me* to 1 = *not like me at all*). A sample item is "I don't boast about what I achieve" (character strength of humility). The VIA-Youth has demonstrated its reliability and validity in a number of studies (e.g., Park and Peterson, 2006b; Ruch et al., 2014). In this study, the internal consistency coefficients of the 24 scales yielded a median of α = 0.77 (ranging from 0.67 to 0.88, see **Table 1**). As not all VIA-Youth scales can be assumed to be fully unidimensional, these coefficients might be biased and need to be interpreted with caution. However, previous research (Ruch et al., 2014) testing other forms of reliability, namely test-retest correlations across 4 months (median $r_{tt} = 0.72$), provides further evidence for the reliability of the measure.

To assess school achievement across the different learning situations, we used both *teacher- and self-reports*. For each learning situation, teachers were asked to rate each student on two items (e.g., for individual tasks "The student is successful in individual tasks." and "The student performs well in individual tasks.") using a 7-point scale (ranging from 1 = *completely disagree* to 7 = *completely agree*). Each learning situations was explained in a short description (provided in **Supplementary Material**). For example, individual tasks were introduced by the following description: "At school, there are situations, in which the teacher gives the students a task to complete. In some of these situations, students are asked to work on these tasks individually. We refer to these situations as 'individual tasks.'" Since the two items correlated highly [$r(253) = 0.86$ for teacher-centered learning, $r(253) = 0.93$ for individual tasks, and $r(253) = 0.93$ for working in groups, all $p < 0.001$], we used the means across the respective two items in our analyses. Similarly, students were

TABLE 1 | Descriptive statistics, internal consistencies, and correlations with age, gender, and school track for VIA-Youth scales.

	M	*SD*	*Min*	*Max*	α	r_{age}	r_{gender}	r_{track}
Creativity	3.60	0.62	1.50	5.00	0.77	−0.13*	−0.10	0.02
Curiosity	3.54	0.58	2.00	5.00	0.76	−0.06	−0.10	0.09
Judgment	3.52	0.54	2.25	5.00	0.73	−0.02	0.04	−0.01
Love of learning	3.44	0.59	1.63	4.88	0.75	−0.08	0.21*	0.02
Perspective	3.68	0.49	2.38	4.88	0.70	−0.03	0.17*	0.12
Bravery	3.73	0.58	2.38	5.00	0.79	−0.03	0.10	0.00
Perseverance	3.49	0.60	1.56	5.00	0.79	−0.10	0.23*	−0.16*
Honesty	3.78	0.57	1.25	5.00	0.82	−0.01	0.27*	−0.04
Zest	3.52	0.56	1.88	5.00	0.73	−0.18*	0.04	−0.03
Love	4.04	0.63	1.89	5.00	0.81	−0.03	0.21*	−0.06
Kindness	4.08	0.55	2.11	5.00	0.82	−0.10	0.41*	−0.02
Social intelligence	3.78	0.48	2.25	5.00	0.67	0.02	0.19*	0.09
Teamwork	3.99	0.49	2.13	5.00	0.72	0.01	0.23*	0.07
Fairness	3.58	0.55	1.89	4.89	0.72	0.03	0.32*	0.08
Leadership	3.34	0.67	1.25	5.00	0.85	0.01	0.01	0.01
Forgiveness	3.78	0.62	1.29	5.00	0.77	0.04	0.03	0.15
Humility	3.69	0.57	1.67	5.00	0.73	−0.02	0.25*	0.09
Prudence	3.34	0.58	1.63	4.63	0.73	0.04	0.15*	0.03
Self-regulation	3.49	0.59	1.56	5.00	0.75	0.06	0.16*	0.00
Beauty	3.51	0.69	1.63	5.00	0.79	0.01	0.37*	0.14*
Gratitude	4.18	0.53	2.00	5.00	0.79	−0.03	0.17*	−0.08
Hope	3.80	0.59	1.75	5.00	0.80	0.02	−0.03	0.02
Humor	3.96	0.60	1.67	5.00	0.79	−0.01	−0.10	0.10
Spirituality	3.51	0.99	1.00	5.00	0.88	−0.17*	0.12	−0.21*

*N = 255. Beauty = Appreciation of beauty and excellence. Age: 12.42–18.75 years. Gender: 0 = male, 1 = female. Track: 0 = school with vocational orientation, 1 = school with academic orientation. *p < 0.05 (two-tailed).*

also provided with descriptions of the learning situations (see **Supplementary Material**) and asked to rate their achievement in each learning situation (e.g., for individual tasks "I am successful in individual tasks." and "I perform well in individual tasks.") using a 7-point scale (ranging from 1 = *completely disagree* to 7 = *completely agree*). Again, the two respective items correlated highly [$r(253) = 0.75$ for teacher-centered learning, $r(253) = 0.87$ for individual tasks, and $r(253) = 0.78$ for working in groups, all $p < 0.001$], so we also used the means in the analyses.

To assess habitual flow experiences across the different learning situations, we used an adaptation of the Flow Short Scale (FSS; Rheinberg et al., 2003). The FSS consists of 10 items (answered on a 7-point scale) covering different components of flow experiences and was designed to assess flow in specific situations. We adapted the scale to assess habitual experiences by presenting it with an instruction to think of the different learning situations (referring to the same description as for the achievement rating). The three versions of the scale (and a version assessing experiences in school in general, which is not relevant for the present study) were presented in a randomized order to avoid systematic order effects. In the present study, these three scales reached internal consistencies of $\alpha = 0.82$ (teacher-centered learning), $\alpha = 0.89$ (individual tasks), and $\alpha = 0.86$ (group work).

To assess the enjoyment of learning situations, we used three items, one for each situation (e.g., for individual tasks "I enjoy individual tasks."). Students rated to what extent they agreed with each statement on a 7-point scale (ranging from 1 = *completely disagree* to 7 = *completely agree*).

To assess psychometric intelligence, we used the *Prüfsystem für Schul-und Bildungsberatung für 6. bis 13. Klassen, Revidierte Fassung* (Testing System for Scholastic and Educational Counseling, Grades 6–13 –revised version; PSB-R 6–13; Horn et al., 2003). The PSB-R 6–13 was designed for use in educational settings and encompasses the assessment of reasoning and verbal intelligence (including school-specific knowledge) as well as concentration. It consists of nine subtests (three for the assessment of verbal intelligence, four for the assessment of reasoning, and two for the assessment of concentration). The PSB-R 6–13 has previously demonstrated strong convergent validity with other measures of cognitive ability as well as criterion validity in the prediction of outcomes such as school grades (Horn et al., 2003). In the present study, we used the total score, which is based on all nine subtests and offers a comprehensive measure of cognitive ability that was found of particular relevance to predicting school achievement. For the analyses, we used age-standardized scores ($M = 100$; $SD = 10$) of this total score.

Procedure

The study's procedures were approved by the institutional ethical board at the Faculty of Philosophy at the University of Zurich. All participants gave their written consent and participated voluntarily. Students under the age of 14 years were provided written permission to participate by a parent or legal guardian. As an incentive, participating students were offered individualized feedback on their character strengths.

Data presented here were collected as part of a larger project and the sample presented here overlaps (by 70.6%) with Wagner and Ruch (2020). Wagner and Ruch (2020) studied the incremental validity of character strengths in predicting educational outcomes beyond intelligence and the personality traits of the five-factor model. Two of the predictors overlap between both studies, but none of the outcomes. Specifically, Wagner and Ruch (2020) focused on educational outcomes in general, whereas the present study investigates differential trait-outcome associations across different learning situations. Questionnaire data were collected on school computer or tablets, whereas the intelligence test was administered in paper/pencil-format. The VIA-Youth and the intelligence test (PSB-R 6–13) were completed at a baseline assessment, and the data on outcome variables (achievement ratings by teachers and students, FSS, and enjoyment ratings) were collected about 3 months later ($M = 95.49$ days, $SD = 3.87$, range: 84–102). Both data collections also contained other measures not relevant to the present study.

Data Analysis

To account for the nested structure of the data, we first computed ICC(1) coefficients to evaluate the amount of variance in our outcome variables on the classroom level. For some of the outcomes, the ICC(1) coefficients were significant; that is, the levels of students in the same classroom were not independent of each other. Those outcomes were teacher-rated achievement in teacher-centered learning, ICC(1) = 0.10, $F(17, 237) = 2.644$, $p < 0.001$; teacher-rated achievement in group work, ICC(1) = 0.11, $F(17, 237) = 2.687$, $p < 0.001$; self-rated achievement in teacher-centered learning, ICC(1) = 0.05, $F(17, 237) = 1.757$, $p = 0.035$; flow in individual tasks, ICC(1) = 0.08, $F(17, 237) = 2.331$, $p = 0.003$; and enjoyment of group work, ICC(1) = 0.08, $F(17, 237) = 2.150$, $p = 0.006$. Based on this non-independence, we decided to run multilevel analyses to address the study's research questions.

We ran random-intercept models using the lme4 package (Bates et al., 2015) in R (R Core Team, 2013), that is, the respective intercepts could vary between the classrooms. Adding a random slope to the models did not yield an increase in explained variance; hence, we report the results of the random-intercept models. The models used restricted maximum likelihood (REML) estimation. We used lmerTest (Kuznetsova et al., 2017) to compute *p*-values. In the main analyses, we applied an alpha level of $\alpha = 0.01$ to account for the effects of multiple testing. Given the associations of various study variables with age, gender, and ability-based school track (vocational or academic orientation; see **Tables 1**, **2**), we decided to include these variables as covariates in the analyses testing the hypotheses.

RESULTS

Descriptive Statistics

Descriptive statistics for character strengths and correlations with age, gender, and school track (vocational or academic orientation) are shown in **Table 1**.

TABLE 2 | Descriptive statistics, correlations with age, gender, and school track, and intercorrelations for intelligence and dependent variables.

	Descriptives					Intercorrelations											
	M	*SD*	r_{age}	r_{gender}	r_{track}	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Intelligence	100.51	8.73	0.05	−0.05	0.56	0.17	0.18	0.28	0.17	0.06	0.13	0.12	0.22	0.04	−0.09	0.12	0.02
(2) Teacher-rated achievement: teacher-centered	5.02	1.22	−0.06	0.02	0.02		0.43	0.35	0.29	0.26	0.21	0.21	0.27	0.16	0.14	0.13	0.07
(3) Teacher-rated achievement: individual tasks	5.19	1.24	−0.16	0.24	−0.04			0.51	0.16	0.33	0.14	0.20	0.27	0.11	0.07	0.29	−0.02
(4) Teacher-rated achievement: group work	4.94	1.36	−0.11	0.34	0.11				0.17	0.13	0.22	0.16	0.17	0.15	0.02	0.18	0.09
(5) Self-rated achievement: teacher-centered	4.96	1.20	−0.12	0.00	−0.06					0.40	0.40	0.60	0.45	0.34	0.54	0.12	0.15
(6) Self-rated achievement: individual tasks	5.50	1.08	−0.04	0.09	0.06						0.32	0.40	0.64	0.24	0.13	0.56	0.03
(7) Self-rated achievement: group work	5.38	1.07	−0.04	0.13	−0.10							0.34	0.29	0.49	0.23	0.03	0.60
(8) Flow: teacher-centered	4.38	0.91	−0.14	0.01	0.03								0.65	0.57	0.42	0.17	0.17
(9) Flow: individual tasks	4.70	1.05	−0.16	0.00	0.16									0.50	0.21	0.39	−0.01
(10) Flow: group work	4.64	0.98	−0.15	0.05	0.05										0.24	0.12	0.42
(11) Enjoyment: teacher-centered	4.58	1.64	−0.08	−0.02	−0.08											0.03	0.17
(12) Enjoyment: individual tasks	4.81	1.59	−0.05	0.17	0.11												−0.27
(13) Enjoyment: group work	5.84	1.34	−0.05	0.00	−0.04												

N = 255. Intelligence: Age-standardized scores (M = 100, SD = 10). Flow, achievement, and enjoyment: Range 1–7. Age: 12.42–18.75 years. Gender: 0 = male, 1 = female. Track: 0 = school with vocational orientation, 1 = school with academic orientation. Correlations r ≥ 0.13 are significant at p < 0.05.

As displayed in **Table 1**, some small- and medium-sized correlations with demographic variables emerged. Descriptive statistics of intelligence and the dependent variables (school achievement, flow experience, and enjoyment in three learning situations), as well as the respective intercorrelations are displayed in **Table 2**.

Intelligence was positively related to achievement in all three situations (with the exception of self-rated achievement in individual tasks) and to flow experience in individual tasks, but unrelated to the remaining outcome variables. Both achievement and flow ratings showed high intercorrelations between the three situations, but also seemed separable. Enjoyment ratings seemed to overlap less between the situations, with the enjoyment of individual tasks being negatively related to the enjoyment of group work. The results also show generally small to medium-sized positive correlations between achievement and flow as well as between achievement and enjoyment and medium to large correlations between flow and enjoyment. With the exception of achievement in and enjoyment of group work, the outcomes regarding one type of situation were always positively related.

Multilevel Analyses

The main analyses refer to the relationships between character strengths and outcomes (teacher- and self-rated achievement, flow, and enjoyment) while controlling for age, gender, school track, and intelligence. The results of the analyses regarding achievement are displayed in **Table 3**, the results without a control for intelligence are displayed in **Supplementary Table S1**.

As shown in **Table 3**, in line with our expectations, and across both self- and teacher-ratings love of learning, perseverance, zest, and hope were positively related to achievement in teacher-centered learning, and love of learning was also positively related to achievement in individual tasks. However, we did not find the expected association between self-regulation and achievement in teacher-centered learning and the associations of perseverance and self-regulation with achievement in individual tasks were only found in self-ratings of achievement. With regards to achievement in group work, the hypothesized positive relations with perspective and teamwork were found across both ratings. In contrast, no significant relationships for love and kindness were observed and the character strengths of judgment, love of learning, zest, social intelligence, fairness, and leadership were only associated with self-rated achievement in group work. Additionally, we found several strengths to positively relate to teacher-rated achievement in teacher-centered learning (i.e., bravery, honesty, fairness, teamwork, and gratitude) and in group work (i.e., prudence), as well as a larger number of strengths to positively relate to self-rated achievement.

Considering flow experiences, we found that, as expected, the strengths of creativity, judgment, love of learning, perseverance, zest, self-regulation, and hope were positively related to flow across the different learning situations beyond intelligence (see **Table 4** and **Supplementary Table S2** for results without control for intelligence). Curiosity did not show the expected positive relationships with flow experiences. Perspective, love, social intelligence, teamwork, fairness, and leadership (but not kindness) were also additionally related with flow in group work.

TABLE 3 | Fixed effects (standardized) of intelligence and character strengths predicting self- and teacher-rated school achievement in three learning situations (controlling for influences of age, gender, school track, and for character strengths also for intelligence).

	Teacher-rated achievement			Self-rated achievement		
	Teacher-centered learning	Individual tasks	Group work	Teacher-centered learning	Individual tasks	Group work
Intelligence	0.23*	0.30*	0.35*	0.20*	0.08	0.17
Character strengths						
Creativity	−0.07	−0.06	0.04	0.21*	0.21*	0.21*
Curiosity	0.10	0.13	0.11	0.18*	0.19*	0.09
Judgment	0.07	0.04	0.11	0.20*	0.26*	0.15*
Love of learning	0.19*	0.16*	0.13	0.35*	0.42*	0.16*
Perspective	0.13	0.02	0.15*	0.25*	0.24*	0.24*
Bravery	0.18*	0.00	0.10	0.20*	0.19*	0.07
Perseverance	0.22*	0.12	0.14	0.32*	0.34*	0.21*
Honesty	0.16*	0.05	0.05	0.11	0.24*	0.19
Zest	0.26*	0.03	0.13	0.37*	0.25*	0.16*
Love	0.13	−0.02	0.09	0.28*	0.14	0.09
Kindness	0.12	0.02	0.13	0.12	0.12	0.14
Social intelligence	0.10	−0.01	0.10	0.19*	0.24*	0.19*
Teamwork	0.20*	0.03	0.17*	0.12	0.26*	0.41*
Fairness	0.16*	0.14	0.13	0.06	0.25*	0.19*
Leadership	0.13	−0.09	0.06	0.25*	0.11	0.25*
Forgiveness	0.12	0.10	0.06	0.07	0.17*	0.20*
Humility	0.03	0.04	0.03	−0.11	0.15*	0.12
Prudence	0.07	0.11	0.15*	0.10	0.22*	0.09
Self-regulation	0.14	0.08	0.04	0.11	0.34*	0.18*
Beauty	−0.04	−0.05	0.10	0.20*	0.13	0.11
Gratitude	0.19*	0.04	0.11	0.23*	0.20*	0.17
Hope	0.20*	0.07	0.10	0.34*	0.25*	0.15
Humor	0.01	−0.12	0.06	0.07	0.00	−0.03
Spirituality	0.04	0.02	0.05	0.09	0.13	0.05

*N = 255. Beauty = Appreciation of beauty and excellence. *p < 0.01 (one-tailed).*

In line with our expectations, love of learning, perseverance, zest, and hope were associated with enjoying teacher-centered learning, whereas no relationships were found with self-regulation (see **Table 4**). Love of learning and self-regulation (but not perseverance) were predictors of enjoying individual tasks, and only the character strength of teamwork predicted enjoying group work. In addition, enjoying teacher-centered learning was also positively related to curiosity, judgment, and perspective and enjoying individual tasks was also positively related to creativity, curiosity, judgment, fairness, and appreciation of beauty and excellence.

DISCUSSION

The present study followed the principles of trait activation theory in testing the extent to which character strengths show differential trait-outcome relationships across different learning situations that are assumed to activate different sets of character strengths. In doing so, it demonstrated differential relationships of positively valued traits with both achievement and positive learning experiences (flow and enjoyment) across different learning situations beyond cognitive ability. The results are summarized in **Figure 2**, which gives an overview on the hypotheses supported and not supported by the observed results.

With regard to achievement in different learning situations, we found support for both the idea that certain strengths (such as love of learning and perseverance) are conducive to school achievement in general and the idea that other strengths are activated and contribute to achievement only in specific learning situations.

For instance, the character strength of zest was found to be of particular relevance for achievement and positive learning experiences in *teacher-centered learning*. In this learning situation, students seem to be mostly required to keep up a level of focus and activity, which is favored by approaching the situation with zest. Previous research has demonstrated that extraversion tends to show no (or even negative) relationships with overall academic achievement, at least in secondary and tertiary education (Poropat, 2009). Nonetheless, studies using specific performance criteria, such as oral participation in class (Furnham and Medhurst, 1995), report a positive relationship of extraversion with these achievement criteria, arguably because extraverted behaviors help interact with teachers. The character strength of zest might capture some of the most relevant aspects of extraversion's facet "activity" that contribute to an advantage in interacting with teachers in teacher-centered learning. Additionally, the character strength of hope was positively related to all four outcome measures regarding teacher-centered learning, in line with expectations. Hope has been

TABLE 4 | Fixed effects (standardized) of intelligence and character strengths predicting flow and enjoyment in three learning situations (controlling for influences of age, gender, school track, and for character strengths also for intelligence).

	Flow			Enjoyment		
	Teacher-centered learning	**Individual tasks**	**Group work**	**Teacher-centered learning**	**Individual tasks**	**Group work**
Intelligence	0.13	0.16	0.00	−0.07	0.07	0.06
Character strengths						
Creativity	0.23*	0.24*	0.21*	0.16	0.19*	0.08
Curiosity	0.13	0.14	0.11	0.17*	0.20*	−0.04
Judgment	0.28*	0.31*	0.21*	0.16*	0.23*	0.02
Love of learning	0.34*	0.40*	0.18*	0.26*	0.35*	−0.09
Perspective	0.21*	0.29*	0.21*	0.25*	0.08	0.10
Bravery	0.12	0.20*	0.05	0.11	0.03	−0.03
Perseverance	0.35*	0.41*	0.22*	0.23*	0.11	−0.02
Honesty	0.16*	0.24*	0.14	0.09	0.05	0.09
Zest	0.32*	0.26*	0.20*	0.18*	0.10	0.04
Love	0.22*	0.20*	0.17*	0.14	−0.03	0.14
Kindness	0.15	0.08	0.12	0.03	−0.01	0.10
Social intelligence	0.25*	0.26*	0.22*	0.14	0.08	0.09
Teamwork	0.16*	0.16*	0.25*	0.04	0.04	0.31*
Fairness	0.15	0.28*	0.17*	0.05	0.20*	0.02
Leadership	0.14	0.16*	0.20*	0.14	−0.01	0.12
Forgiveness	0.10	0.15*	0.13	0.07	0.06	0.11
Humility	0.01	0.13	0.07	−0.13	0.13	0.09
Prudence	0.26*	0.28*	0.23*	0.14	0.14	0.03
Self-regulation	0.20*	0.28*	0.18*	0.01	0.19*	0.04
Beauty	0.16*	0.17*	0.17*	0.13	0.20*	0.02
Gratitude	0.14	0.16*	0.11	0.08	0.10	0.14
Hope	0.30*	0.34*	0.16*	0.20*	0.14	0.00
Humor	−0.04	−0.02	0.00	0.04	−0.06	0.03
Spirituality	0.06	0.11	0.01	0.10	0.04	0.01

*N = 255. Beauty = Appreciation of beauty and excellence. *p < 0.01 (one-tailed).*

shown to be predictive of academic achievement in a variety of educational settings (e.g., Day et al., 2010; Gallagher et al., 2017) and the present results suggest that these relationships found with overall GPA may in part be driven by teacher-centered learning situations, in which hope seems to be particularly activated.

Achievement in *individual tasks* seems to be least explained by character strengths, which might be because it relates least to overt behavior and is thus more difficult to be rated from the teacher's perspective. Nonetheless, we also found some evidence for the expected relevance of self-regulation, though only with regard to self-reported measures. However, no relationships were found for self-regulation with achievement in *teacher-centered learning*. As self-regulation is a relatively common individual difference variable studied in relation to academic achievement (for an overview, see, e.g., Duckworth and Carlson, 2013), the notion of differential trait-outcome relationships for different learning situations might also be relevant for this research.

In line with our expectations, the character strengths of perspective and teamwork were positively related to both teacher- and self-rated achievement in *group work*. Previous research (Kappe and van der Flier, 2010) investigating the personality dimensions of the five-factor model was not able to find the expected relationships between agreeableness and performance in a learning situation involving a group project. Thus, the narrower traits of character strengths, and traits such as teamwork in particular, might be better suited than the broader and "neutral" dimension of agreeableness to describe individual differences relevant to doing well in a task completed in a group. However, the character strengths of love and kindness were unrelated to both teacher- and self-rated achievement in group work. Both strengths have been found to be of particular relevance for positive peer relationships in the classroom (Wagner, 2019; Wagner and Ruch, 2020), but it seems that this advantage does not necessarily extend into improved performance in situations that require cooperation with peers.

The present study also showed that specific traits can offer a deeper understanding of relationships with outcomes than broader traits. For example, Kappe and van der Flier (2010) found openness to experience to relate to lower performance ratings in group settings and argued that bringing a lot of different perspectives into the discussion can distract from completing a group task in a timely manner. However, the strength of judgment covers exactly this specific aspect (i.e., considering different perspectives), whereas openness to experience is a much broader and non-valued trait that includes many different aspects, which might also be relevant to how openness to

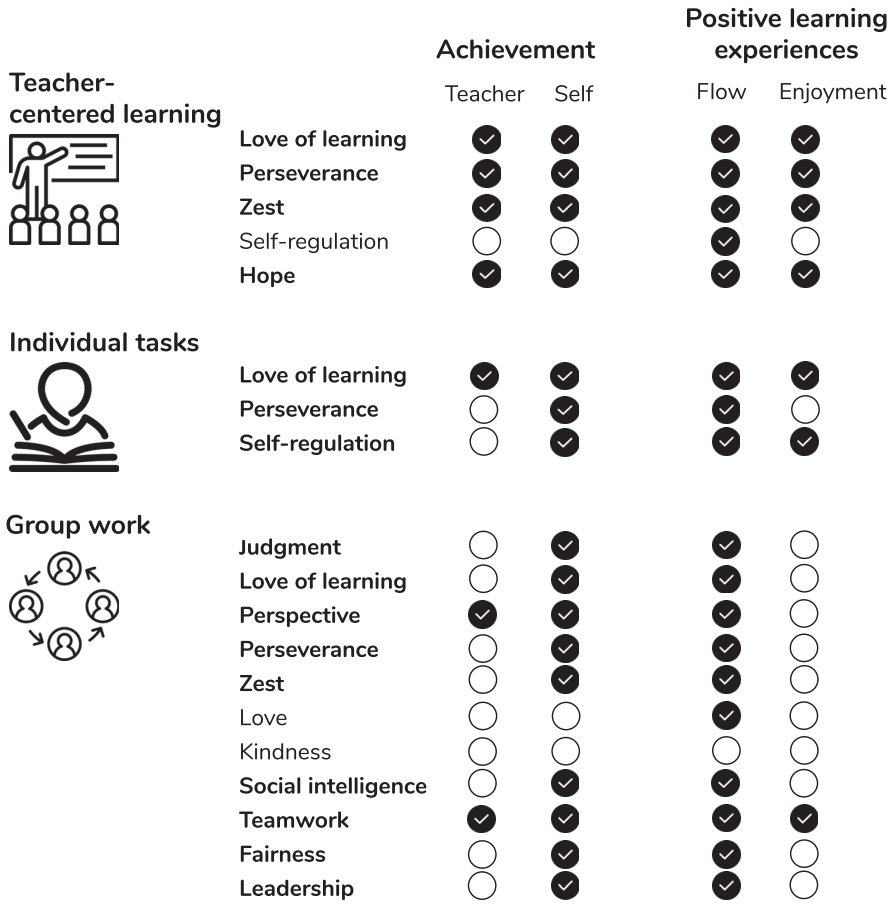

FIGURE 2 | Overview of results in relation to hypotheses. Boldface = positive relationships with at least one indicator of achievement and one indicator of positive learning experiences in the respective learning situation.

experience contributes to performing in a group task. Our results suggest that the narrower strength of judgment is conducive to self-rated achievement and to flow experiences in group settings, at least in the context of secondary school. Thus, specific traits allow for a more nuanced examination of the relationships between personality traits and educational outcomes.

When we assess the full picture of relationships with achievement against previous studies on the role of character strengths for overall school achievement (e.g., Wagner and Ruch, 2015), we find that the strengths of love of learning and perseverance show the strongest and most consistent relationships with achievement across various learning situations beyond the influence of cognitive ability. Wagner and Ruch (2015) found that, in addition to love of learning and perseverance, overall school achievement was positively correlated with zest, prudence, gratitude, hope, and perspective across two samples. In the present study, zest, hope, and perspective show at least some evidence of differential trait-outcome relationships, with zest and hope, in particular, being mostly related to performance in teacher-centered learning. There were no hypotheses for gratitude and prudence; however, gratitude was linked with both teacher- and self-rated achievement, but not with positive learning experiences, in teacher-centered learning, and prudence demonstrated a positive relationship with teacher-rated achievement in group tasks. Thus, the present results offer some support that these character strengths are predictive of academic achievement even when controlling for the influence of cognitive ability.

With regard to flow experiences in the different learning situations, we also found support for our expectations. At the same time, while some character strengths showed differential patterns of relationships (such as love of learning, which was associated more strongly with flow in individual than in group tasks, or self-regulation, which showed the strongest association with flow in individual tasks), many others showed similar associations across the different learning situations. This might suggest that certain traits are generally linked to a proneness to experience flow in the school setting, irrespective of the learning situation. A number of strengths might generally predispose students to enter a flow state in the educational setting (such as creativity, judgment, and love of learning). In contrast, other strengths can be assumed to be conducive to entering a flow state (such as zest or hope) or staying in a flow state in the face of distractions (such as perseverance or self-regulation; see

Wagner et al., 2020; Wagner and Ruch, 2020). Future research would benefit from a more fine-grained analysis of situations in which flow occurs at school to allow uncovering differential associations with personality traits.

Finally, when considering enjoyment of the three learning situations, the relationships varied a lot between the different learning situations; that is, results were much more in line with the notion of different character strengths predisposing individuals to enjoy learning in different contexts. These findings are again in line with the arguments of trait activation theory, which also assumes that the display of traits leads to satisfaction. Specifically, if a contextual cue activates a trait and the trait is displayed, the individual will in turn be likely to enjoy this situation.

In our analyses, we controlled for intelligence with the aim to study the incremental contribution of character strengths in predicting educational outcomes beyond cognitive ability. In theory, character strengths and intelligence do not overlap, and also the observed overlap in the present study was small. It should be considered, though, that we used a comprehensive measure of cognitive ability that includes both fluid and crystallized aspects of intelligence. Character strengths demonstrated incremental validity even above this broadly defined assessment of intelligence, suggesting that they represent useful constructs to study relationships between narrower traits and achievement as well as positive experiences at school (see O'Connor and Paunonen, 2007). The size of the relationships for intelligence and the relevant character strengths with the main outcome (teacher-rated achievement) was overall comparable. In the case of teacher-rated achievement in teacher-centered learning, when intelligence was considered together with love of learning, perseverance, zest, teamwork, or hope, the relationship proved to be numerically smaller yet very similar-sized. For the other two learning situations, the relationships of achievement with intelligence were somewhat stronger than the associations of the relevant strengths with achievement, albeit also of comparable size. These analyses include three different methods (intelligence test, self-reported character strengths, and teacher-rated achievement) and intelligence was measured more reliably than character strengths. As a consequence, the findings represent a strong argument for the relevance of positively valued traits, such as character strengths, in predicting achievement in the educational context. With regard to self-rated achievement, flow, and enjoyment in the three learning situations, character strengths clearly outperform intelligence in their predictive power.

Our findings contribute to the understanding of specific contextual factors that determine how personality traits relate to educational outcomes. Learning situations that vary with regards to demands, type, and amount of social interaction should be further considered as contextual factors in understanding these complex relationships. Future research should also study whether strengths-related behavior varies as expected between the different learning situations. The three learning situations we studied only represent one of many aspects in which achievement and positive learning experiences can vary; other characteristics, such as the subject content as well as relationships with classmates and teachers involved, might be of equal importance. Nonetheless, performing well in different types of social interactions might also be relevant in later life, such as in university education or at the workplace. Thus, the present findings might also have implications for how character strengths relate to different aspects of performance in adulthood (see Harzer and Ruch, 2014). Furthermore, when considering the possibility of interventions to foster certain personality traits or character strengths, information on the role of specific contexts, such as learning situations, should be considered. Another practical recommendation following the current findings could extend to designing schools and planning specific lessons. Based on the present results, offering a variation or a choice of learning situations would allow different strengths to be activated and as a consequence, more students (with diverse strengths) to be able to perform well and enjoy learning.

Strengths and Limitations

The present study has several strengths. For instance, it uses different data sources (self-reports, standardized tests, teacher ratings) and different time points (3 months apart) to reduce or eliminate the influence of common method bias. However, the present results also need to be interpreted in light of several limitations. First, the learning situations selected in the present study certainly do not cover all situations that are potentially relevant to learning in a classroom, and the descriptions provided were rather general. Thus, students and teachers might have differed in their understanding of the types of situations described. Second, teachers might not be the best informants about achievement in group work; hence, future studies might also consider peer ratings. Third, the assessment of all outcomes relied on ratings of habitual behavior (teacher- and self-rated school achievement) or habitual experiences (self-reported flow experience and enjoyment). In future studies, it would be desirable to assess these outcomes through either observation or experience-sampling methods. Fourth, even though participants were diverse to some extent (attending different school tracks in several communities in German-speaking Switzerland), the present results might not extend to other cultural contexts. Finally, an important limitation is that it is impossible to draw conclusions regarding directionality or causality based on the present results.

CONCLUSION

The present study looked at the role of students' character strengths in predicting educational outcomes beyond the influence of cognitive ability. Specifically, we asked the question: Which students perform well and have positive experiences in different situations at school, irrespective of their intelligence? We focused on three learning situations and the results demonstrated that the associations differed between those situations. Our results support the notion that character strengths represent a useful framework for a nuanced examination of the complex relationships between personality traits and educational

outcomes. Overall, quite a large number of character strengths are relevant when predicting different educational outcomes and the strengths' narrow definitions allow for depicting differential relationships.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Zurich, Zurich, Switzerland; Ethikkommission (für psychologische und verwandte Forschung). All participants gave their written consent and participated voluntarily. Students under the age of 14 years were provided written permission to participate by a parent or legal guardian.

AUTHOR CONTRIBUTIONS

LW and WR contributed to the conception and design of the study. MH and HW collected the data and wrote sections of the manuscript. LW performed the statistical analysis and wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01324/full#supplementary-material

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Big Five Personality Traits Predict Successful Transitions From School to Vocational Education and Training: A Large-Scale Study

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Educational transitions play a pivotal role in shaping educational careers, and ultimately social inequality. Whereas parental socioeconomic status (SES) and cognitive ability have long been identified as key determinants of successful educational transitions, much less is known about the role of socio-emotional skills. To address this gap, the present study investigated whether Big Five personality traits predict success in the transition from secondary school to vocational education and training (VET) above and beyond SES, cognitive ability, and other covariates. Using data from Starting Cohort 4 of the German National Educational Panel Study (NEPS; N = 4,137), we defined seven indicators of successful transition: obtaining a VET position, number of acceptances for VET positions, starting a VET position, (the absence of) dropout intentions and actual dropout, final VET grade, and satisfaction with VET. The results revealed that some Big Five traits were incrementally associated with several indicators of transition success. Conscientiousness emerged as the single most relevant trait, predicting all the transition success indicators but 1 (dropout intentions). The other Big Five traits had much weaker and less consistent links with transition success. Extraversion predicted the final VET grade and obtaining a VET position; Agreeableness was linked to a higher risk of dropout. Openness and Emotional Stability had no incremental effects on transition success. There was also some evidence for both compensatory and synergistic interactive effects, with Openness moderating mainly the effects of parental SES (on dropout intentions, actual dropout, and number of acceptances), and Agreeableness moderating the effects of cognitive ability (on obtaining a VET position, number of acceptances, and satisfaction with VET). Although individual effect sizes were

small, the Big Five's joint contribution to transition success was non-negligible, and often larger than that of sociodemographic characteristics and cognitive ability. Our results suggest a hitherto underappreciated contribution of personality to successful transitions to VET.

Keywords: personality, Big Five, socio-emotional skills, non-cognitive skills, educational transitions, school-to-work transition, vocational education and training

INTRODUCTION

Throughout their educational careers, individuals are faced with various transitions, such as the transition from primary to secondary school or – in the German context – from secondary school to vocational education and training (VET) or higher education. By sorting individuals into different educational trajectories, educational transitions enable or constrain the range of possible options available to individuals in the future (Blossfeld et al., 2019; Erikson, 2019; Kogan, 2019; Stocké, 2019). By virtue of this, educational transitions play a pivotal role in shaping individuals' long-term educational attainment, career prospects, and a range of associated outcomes such as health and well-being (Maaz et al., 2006; Klein et al., 2009; Schoon and Silbereisen, 2009).

Given the long-term consequences of educational transitions, it is important to understand why some individuals master such transitions successfully, whereas others do less well. Hence, successful transitions can be seen as an additional aspect of educational success, next to educational attainment and achievement. In this regard, previous research has identified several sources of individual differences in transition success, although their individual contributions are often small: sociodemographic characteristics (e.g., Blossfeld and Shavit, 1993; Duncan and Brooks-Gunn, 1997; Becker and Schubert, 2011); contextual factors such as social relationships or learning environments (e.g., Griebel and Niesel, 2004; Griebel, 2011); and cognitive ability (e.g., Gustafsson and Undheim, 1996). In contrast, little is known about the role of so-called socio-emotional (or "non-cognitive") skills such as the Big Five personality traits (Costa and McCrae, 1992; Goldberg, 1992) in shaping educational transitions. Although a growing body of evidence attests to the incremental predictive validity of the Big Five for educational achievement and attainment (for a recent review, see Lechner et al., 2019), empirical studies on the role of socio-emotional skills in the success of educational *transitions* are almost absent from the literature.

Therefore, the question we addressed in the present study was: Can personality traits – understood as a proxy of socio-emotional skills – add to our understanding of why some individuals master educational transitions better than others? To address this question, we investigated whether the Big Five personality traits predict success in the transition from secondary school to VET in the German context. For this purpose, we leveraged data from a large-scale German panel study in which ninth-grade students were followed across the transition to VET. The German "dual system" of vocational education and training combines schooling with an apprenticeship (i.e., on-the-job training) at a company. Over the course of 2–3 years, apprentices spend part of their time at a company, where they get extensive training in a specific occupation, and the other part at a vocational school, where they receive education in occupation-related subjects (Heckhausen and Tomasik, 2002).

ESTABLISHED PREDICTORS OF EDUCATIONAL ACHIEVEMENT AND SUCCESSFUL TRANSITIONS

Previous research has identified several determinants and correlates of educational achievement and attainment, including successful transitions. Sociological research has focused mainly on the role of parental SES, gender, and migration background in predicting educational success (e.g., Blossfeld and Shavit, 1993; Duncan and Brooks-Gunn, 1997; Klein et al., 2009; Schoon, 2010; Becker and Schubert, 2011; Paat, 2015; McElvany et al., 2018). Psychological research has highlighted the crucial role of cognitive ability in shaping learning, and ultimately achievement and attainment (e.g., Kuncel et al., 2004; Deary et al., 2007; Roth et al., 2015). Research in educational science has focused additionally on the role of contextual factors such as social relationships or learning environments (e.g., Griebel and Niesel, 2004; Griebel, 2011). Among these determinants, sociodemographic characteristics and cognitive ability have typically shown the strongest links to educational success.

Although these predictors explain individual differences in educational achievement (e.g., grades) and attainment (e.g., the highest educational qualification obtained), their predictive power vis-à-vis educational *transitions* is limited. Thus, our understanding of transition success remains incomplete. Another important consideration is the nature of these predictors: parental SES and cognitive ability can hardly be changed. From a policy and intervention perspective, it would therefore be desirable to identify more malleable factors that contribute to successful educational transitions and that could be targeted by programs aimed at helping young people to master educational transitions. Here, we propose that socio-emotional skills – in particular the Big Five personality traits – might add to our understanding of transition success over and above the aforementioned established predictors.

PERSONALITY TRAITS AS PREDICTORS OF EDUCATIONAL ACHIEVEMENT

"Socio-emotional skills" is an umbrella term used to denote a broad set of individual difference constructs such as

personality traits, motivation, and values. The common denominator of these constructs is that they refer to relatively consistent patterns of behavior, cognition, and affect that – although having a genetic basis – can be influenced by socialization and learning/experience, develop in interaction between environmental influences and biological predispositions, cannot easily be acquired, and have beneficial effects on relevant educational and life outcomes (see De Fruyt et al., 2015; Abrahams et al., 2019; Lechner et al., 2019). The Big Five framework (Costa and McCrae, 1992; Goldberg, 1992) is currently the most established and well-validated model of personality traits and is often used as a guiding framework in studies on socio-emotional skills. The framework comprises five global dimensions: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience (henceforth only called Openness).

There is already a growing body of evidence pointing to incremental associations of the Big Five with success at school and at college/university as well as with career success – often over and above parental socioeconomic status (SES) and cognitive ability. Several meta-analyses (e.g., Poropat, 2009; Vedel and Poropat, 2017) and recent (large-scale) studies (e.g., Spengler et al., 2013, 2016; Lechner et al., 2017; Bergold and Steinmayr, 2018; Brandt et al., 2020) have identified Conscientiousness and Openness as the personality traits most relevant to educational achievement and attainment in both secondary and tertiary level students. Some of these studies (Spengler et al., 2016; Lechner et al., 2017; Brandt et al., 2020) showed that Conscientiousness was positively related to school grades and achievement test scores even when cognitive ability was controlled for. Similarly, Poropat's (2009) meta-analysis of personality–academic performance relationships based on the Big Five model demonstrated that the effect sizes of Conscientiousness for school achievement [assessed by grades and grade point average (GPA)] rivaled that of cognitive ability and were incremental over – and independent of – cognitive ability. Recently, Diedrich et al. (2018) showed that Conscientiousness was the most robust positive predictor of GPA (achievement) – also specifically among VET students. Rammstedt et al. (2017) demonstrated a positive relationship between Conscientiousness and level of education (i.e., attainment). Openness was found to have positive but small associations with GPA and grades (i.e., achievement; Spengler et al., 2016) as well as with achievement test scores (Spengler et al., 2013) at school and university (Trapmann et al., 2007; Richardson et al., 2012; Vedel, 2014). Findings from a study on life outcomes identified a positive relationship between Openness and level of education (i.e., attainment; Rammstedt et al., 2017).

Agreeableness, Emotional Stability, and Extraversion have been found to have weaker and more inconsistent associations with educational and academic performance (e.g., Caspi et al., 2005; Poropat, 2009; Lechner et al., 2017; Vedel and Poropat, 2017). Agreeableness has been shown to have positive but small associations with GPA/grades (achievement; Poropat, 2009; Richardson et al., 2012; Vedel, 2014) and a positive relationship with life satisfaction (Rammstedt et al., 2017). Regarding Emotional Stability, Rammstedt et al. (2017) identified a positive relationship with level of education (attainment) and with life satisfaction. Concerning academic satisfaction, results of Trapmann et al. (2007) indicate a positive association with Emotional Stability. Finally, Rammstedt et al. (2017) found a negative relationship between Extraversion and the highest level of education (attainment). In sum, the Big Five have repeatedly replicated robust effects on a range of educational outcomes, above and beyond parental SES and cognitive ability.

PERSONALITY TRAITS AS PREDICTORS OF SUCCESSFUL TRANSITIONS

Are the Big Five personality traits as potent in predicting transition success as they are in predicting educational achievement and attainment? Extant findings refer only to a narrow set of global success indicators (such as GPA or the highest level of educational attainment; see above) and, in part, only to a priori selected personality traits such as Conscientiousness (Libbrecht et al., 2014; Shanahan et al., 2014b) or Extraversion and Neuroticism (Vasileva-Stojanovska et al., 2015). Other aspects of the transition process that constitute success, such as obtaining a VET position in the first place, have been neglected to date. This dearth of evidence may stem partly from the fact that there are few established indicators of successful transitions to VET – an issue that we addressed in the present study by operationalizing success in the transition to VET in a comprehensive fashion (see next section).

There is good reason to expect that the Big Five personality traits can contribute to transition success. We theorize that there are 2 principal pathways through which socio-emotional skills such as the Big Five personality traits might influence the success of educational transitions. Both of these pathways draw on an integrative social-ecological developmental model of agency that investigates the interplay of agency and structure in school-to-work transitions and the multiple influences shaping these transitions (Schoon and Heckhausen, 2019). The first pathway is individuals' behavior during the transition process. Personality traits are psychosocial and self-regulatory resources (i.e., skills) that can be harnessed to select and pursue goals. In other words, they might foster individual agency during educational transitions (Heckhausen et al., 2010; DeYoung, 2013; Lechner et al., 2019). According to Schoon and Heckhausen (2019), "individual agency is most needed at times of transition, when individuals leave a pre-structured path." Individual agency depends on resources such as the Big Five personality traits, which can therefore be regarded as prerequisites for agency, or, in economic terms, as human capital. For example, Extraversion and Agreeableness might help young people to build social relationships that can be instrumental in finding a VET position, and Conscientiousness might help them to prepare good application documents. Employers' perception of VET applicants is the second pathway through which personality traits might act. It is likely that desirable and undesirable Big

Five personality traits will be perceived by employers during the selection process and consequently rewarded or punished. For example, employers may choose VET applicants whom they perceive to be especially conscientious (e.g., Dunn et al., 1995; Caldwell and Burger, 1998; Moy and Lam, 2004), or they may prefer candidates who are emotionally stable (e.g., Dunn et al., 1995; Caldwell and Burger, 1998). We assume that the 2 pathways – individuals' behaviors and employers' perceptions – are inextricably linked, and that they contribute to transition success in complementary ways.

Irrespective of the specific pathways through which personality traits may affect transition success, their associations with indicators of transition success can take 2 main forms: additive and interactive. An additive effect (or "main effect") would mean that personality has an incremental linear association with transition success above and beyond the effects of other predictors, such as parental SES and cognitive ability.

An interactive effect (or "moderation effect") would imply that the strength of other predictors, such as parental SES or cognitive ability, varies in dependence on personality. Such interactive effects may be compensatory or synergistic in nature. According to resource substitution theory (Mirowsky and Ross, 2003), low resources in 1 domain can be substituted by resources in another domain. For example, cognitive ability may be more important for individuals with low SES, because high cognitive ability can compensate for low SES. This suggests that personality traits such as Conscientiousness may also be able to compensate for low SES or low cognitive ability. In contrast, a synergistic interactive effect is an effect where high resources in 1 domain augment the effect of resources in another domain. According to Damian et al.'s (2015) Matthew effect hypothesis (the Matthew effect was originally operationalized by Merton, 1968), personality traits are more relevant under advantaged developmental conditions such as a higher level of parental SES.

Only a few studies have tested possible interactive effects of personality with SES and cognitive ability. For example, Sackett et al. (1998) and Danner et al. (2019) found interactions between personality and sociodemographic factors in predicting job performance. Even fewer studies have tested such compensatory or synergistic effects with regard to educational outcomes (e.g., Shanahan et al., 2014a; Damian et al., 2015; Rammstedt et al., 2016; Ayoub et al., 2018; Bergold and Steinmayr, 2018). For example, with regard to the prediction of educational attainment, Ayoub et al. (2018) reported a compensatory interactive effect between parental SES and Emotional Stability, Openness, Conscientiousness, and Agreeableness; Damian et al. (2015) reported a compensatory interactive effect between parental SES and Conscientiousness, Agreeableness, and Extraversion; and Shanahan et al. (2014a) reported a compensatory interactive effect between parental SES and Agreeableness, Extraversion, Openness, and Emotional Stability. Results from Bergold and Steinmayr (2018) suggest positive interactive associations between cognitive ability and Conscientiousness and Emotional Stability in predicting senior secondary school GPA. Rammstedt et al. (2016) found a negative interactive effect between Conscientiousness and labor force participation and a positive interactive effect between Openness and educational attainment in predicting cognitive ability.

AIMS AND RESEARCH QUESTIONS OF THE PRESENT INVESTIGATION

In sum – despite empirical evidence of robust links between personality and educational success in general – it remains largely unclear whether the Big Five personality traits play a role in shaping educational transitions. To close this research gap, we investigated in the present study whether the Big Five personality traits predict success in the transition from lower secondary or intermediate secondary school to VET above and beyond parental SES, gender, migration background, and cognitive ability. Moreover, we aimed to identify the specific role of personality in shaping transition success by testing whether the Big Five show mainly additive associations with transition success (i.e., main effects), or whether they also moderate the effects of other established predictors of transition success, in particular parental SES and cognitive ability (i.e., interactive effects). Because there is little previous work to build on, the latter analyses of interactive effects are purely exploratory in nature. We comprehensively operationalized transition success with the following seven indicators (for details, see Measures): obtaining a VET position, number of acceptances, starting a VET position, (absence of) dropout intentions, (absence of) actual dropout, final VET grade, and satisfaction with VET.

Based on previous findings on how the Big Five contribute to educational achievement and attainment (e.g., Spengler et al., 2013, 2016; Lechner et al., 2019; Brandt et al., 2020), we expected Conscientiousness, Emotional Stability, Openness, and Extraversion to have consistently positive associations with all aspects of transition success above and beyond the effects of the covariates (additive effects). For Agreeableness, we had no specific expectation, and we examined its effects in an exploratory fashion. The rationale behind our expectations was as follows: We presumed that Conscientiousness would manifest itself in performance effort and application behavior in terms of the number and type of applications. In addition, Conscientiousness itself could be a criterion in the selection process. Emotional Stability could manifest itself in a better handling of demands and overextension. In addition, Emotional Stability could curb test anxiety or anxiety during the application procedure. We assumed that Openness would lead to more creative apprenticeship search strategies and to greater openness toward different sectors. Extraversion describes the tendency to engage in social behavior and could therefore be helpful for acquiring a social network. Furthermore, Extraversion could manifest itself in assertiveness in the application procedure. Agreeableness could also foster the development of a social network by being cooperative and compassionate. Additionally, Agreeableness could reflect sympathy, which appears to be beneficial in selection procedures. In contrast, low Agreeableness may be accompanied by high task orientation, which is also relevant to success.

We further expected that, in addition to having additive effects, personality traits would moderate the associations

between established predictors of transition success – namely, parental SES and cognitive ability – and our seven success indicators. Given the lack of previous evidence and pertinent theorizing regarding possible interactions between personality and sociodemographic characteristics or cognitive ability, we refrained from formulating specific hypotheses in this regard. Instead, we tested these interactive effects in an exploratory fashion. We classified any interaction that emerged according to whether it was compensatory or synergistic in nature.

MATERIALS AND METHODS

Database and Sample

We used data from the German National Educational Panel Study (NEPS): Starting Cohort 4 (Grade 9; Blossfeld and Roßbach, 2011; doi: 10.5157/NEPS:SC4:9.1.0). NEPS is an ongoing longitudinal multi-cohort panel study. Starting Cohort 4 comprises students who were attending ninth grade in the 2010/2011 school year. Students from this cohort were first interviewed in autumn/winter 2010/2011 (wave 1), when they were in ninth grade. They were re-interviewed biannually until spring 2013 (waves 2–6) and annually thereafter until autumn 2015/spring 2016 (waves 7–9). The survey mode varied between paper-and-pencil interviewing (PAPI) for students and computer-assisted telephone/personal interviewing (CATI/CAPI) for school-leavers. For the present research, we used data from waves 1 to 7. For every individual, information on the variables was assessed once. Information on personality traits, sociodemographic variables, and cognitive ability was gathered in grade 9 (waves 1–2) before the transition from school to VET. Information on the success indicators was gathered within waves 3–7.

Germany has a very stratified school and vocational training system. After primary school, students are selected into different school types: *Hauptschule* (school at lower secondary level providing a basic secondary education), *Realschule* (intermediate secondary school), and *Gymnasium* (academically oriented secondary schools or school tracks). Graduates from *Hauptschule* leave the school system after 9th grade at the age of 15, graduates from *Realschule* after 10th grade at the age of 16, and graduates from *Gymnasium* after 12th or 13th grade at the age of 18 or 19 with different levels of school-leaving certificates. Graduates from *Hauptschule* and *Realschule* are eligible to do a VET, while graduates from *Gymnasium* have the possibility to go to college/university[1]. In addition to these three "regular" school types, there are so-called *Förderschulen* (special needs schools), which students with disabilities, such as learning, physical, or developmental disabilities, attend.

Beginning with N = 16,425 participants, we reduced the sample to individuals who had graduated from *Hauptschule* after 9th grade or from *Realschule* after 10th grade, and for whom data were available since wave 1 (n = 16,052). The reason why we only investigated the transition from school to VET was that the dataset simply did not allow investigating other transitions. We excluded students from *Gymnasium* because no student from this school type in the sample transitioned to VET during the observation period (n = 5,568). We also excluded students from *Förderschulen* (n = 1,186) because they cannot be compared to students from "regular" schools and students from Waldorf schools (n = 171) because these schools are based on a completely different pedagogical principle compared to "regular" schools without, for instance, grading or grade retention. We also excluded students with wave-specific temporary or final dropouts (e.g., no data available since graduation or individual tracking no longer possible; n = 3,556); students whose first vocational track did not begin until Wave 8 or 9 (n = 530); students with inconsistent spell data (e.g., because they entered a vocational preparation program [*Berufsvorbereitung*] or underwent vocational training prior to graduation; n = 311); and students with missings on the Big Five questionnaire (n = 416). This resulted in a total of 4,314 school-leavers. The mean age of the students in the first wave was 15.3 years old (SD = 0.7; 42.4% female).

Most of these school-leavers (N = 4,137; 96%) applied for a VET position within the first year after graduation. The majority among them (N = 3,524; 85%) obtained an acceptance for a VET position; 68% (N = 2,411) of those who obtained an acceptance actually started VET within the first year after graduation.

Measures

Big Five Personality Traits

The Big Five personality traits were assessed with the 10-item Big Five Inventory (BFI-10; Rammstedt and John, 2007) plus 1 additional item for the Agreeableness domain. The BFI-10(+1) is an established and widely used 10-item short scale with 2 items per dimension that is used, for example, in the World Value Survey (WVS) and in the International Social Survey Programme (ISSP) and has satisfying psychometric quality criteria (e.g., Rammstedt and John, 2007; Rammstedt et al., 2014). All 11 items were to be answered on a 5-point response scale ranging from *strongly disagree* (1) to *strongly agree* (5). In the present

[1]Between 2011 and 2014, on average 17% graduated from *Hauptschule*, 53% from *Realschule*, and 30% from *Gymnasium*. On average 98% graduates from *Hauptschule* started either a VET or a prevocational training program and less than 2% continued schooling for acquiring a university entrance qualification. On average 46% graduates from *Realschule* started either a VET or a prevocational training program and 54% continued schooling for acquiring a university entrance qualification. On average 19% graduates from *Gymnasium* started a VET and 81% went to college/university (Statistisches Bundesamt, 2013, 2014a,b, 2015).
As the present study focused on VET-bound students on a vocational track graduating after 9th and 10th grade and entering VET positions, a brief description of the German dual education system, a system before labor market entry (i.e., of initial vocational training; Protsch and Solga, 2016), is needed. VET combines a on average 3-year company-based training in a specific occupation or trade, such as banker, geriatric nurse, plumbing and heating installer, or baker, with a 2-day-per-week school-based education in occupation-related subjects, such as accounting, hygiene, or medical engineering (e.g., Heckhausen and Tomasik, 2002). In some dual educational structures, for example, a 2-week training in a company alternates with a 2-week school education. Not all VET programs are eligible for all graduates, that is, some require an intermediate school-leaving degree, such as mechatronics technicians, industrial mechanics, or management assistants in wholesale, and others even an university entrance diploma (*Abitur*), such as bank clerks, insurance clerks, or IT specialists (Protsch and Solga, 2016). As a consequence, "access to the different occupations offered in the apprenticeship system is itself highly stratified by school attainment" (Protsch and Solga, 2016, p. 645).

sample, internal consistency (as measured by the Spearman-Brown formula, which is appropriate for 2-item scales) for the Big Five dimensions ranged from 0.35 (Agreeableness) to 0.55 (Extraversion). These values are sufficient for 2-item scales because the items are designed to assess heterogeneous facets of the Big Five dimensions (Rammstedt and John, 2007). Importantly, previous research shows that the BFI-10(+1)'s test–retest reliabilities are much higher (on average $r = 0.75$; see Rammstedt and John, 2007) than its internal consistencies. Furthermore, the BFI-10(+1)'s predictive validity for a broad range of criteria is as high as – and sometimes higher than – that of much longer Big Five scales (Thalmayer et al., 2011). Because the BFI-10 is a balanced scale, the scale scores implicitly control for acquiescence. Therefore, we used the manifest scale scores (Big Five personality traits and covariates) as predictors, and we modeled the interactions between personality traits and covariates as multiplicative terms (as centered variables, except for migration background). Negatively keyed items were recoded beforehand.

Transition Success Indicators

There is no clear consensus in the literature on school-to-work transitions as to what constitutes a successful transition to VET. Consequently, to address our research questions, we first defined what constitutes a successful transition to VET and selected appropriate success indicators. Our criteria for selecting these success indicators were that the indicator should (a) be positively valued by individuals and society and (b) have long-term consequences for individuals' further life chances. Thus, the indicators should capture a normative understanding of transition success from a life-course perspective. Moreover, (c) the indicators should refer to a critical phase of the transition from school to VET – namely, the initial phase (1 year after leaving school), the intermediate phase (1 year after starting a VET position), or the concluding phase (during VET). In line with these criteria, we selected the following seven success indicators in order to obtain a depiction of transition success as comprehensive as possible with the given data (NEPS dataset): (a) obtaining a VET position within 1 year after graduation (i.e., acceptance by an employer after the submission of an application); (b) number of acceptances for VET positions within 1 year after graduation; (c) starting a VET position within 1 year after graduation (given the receipt of an acceptance for a VET position); (d) (absence of) dropout intentions; (e) (absence of) actual dropout; (f) final VET grade; and (g) satisfaction with VET after 1 year in a VET position.

Obtaining a VET position was operationalized with *yes* (1) vs. *no* (0). The number of acceptances for VET positions was assessed with the question "How many acceptances did you get in all? Tell me the number of apprenticeships you were offered." and ranged from 0 to 20. Starting a VET position was operationalized with *yes* (1) vs. *no* (0). Dropout intentions were assessed with the question "Are you seriously considering at this time changing or dropping out of your apprenticeship/vocational training program?" Possible answers were *yes* (1) or *no* (0). Actual dropout was measured with the question: "Did you end the vocational training early or did you stay to the end but not earn the qualification?" Possible answers were *yes* (1) or *no* (0). The final VET grade was measured with the question "What was your overall grade for this vocational training program?" and theoretical ranges – after recoding (7 – raw score) – from *low* (1) to *high* (6); in the present sample, the values ranged from *low* (2.8) to *high* (6.0). Satisfaction with VET was assessed with the question "How satisfied are you with your vocational training program?" on a scale ranging from *completely dissatisfied* (0) to *completely satisfied* (10).

Control Variables

We included the following established predictors of transition success as statistical control variables in order to investigate the incremental predictive power of personality traits: (a) parental SES [International Socio-Economic Index of Occupational Status (ISEI-08; Ganzeboom et al., 1992); ISEI describes the occupational status as both level of education needed for a specific occupation and the corresponding income of that specific occupation (Züll, 2015) ranging from *low* (11.56; i.e., farmers), to *high* (88.96; i.e., judges); it was assessed with the open question "What profession do your parents currently pursue? For example, car mechanic, shop assistant, teacher at a Gymnasium, civil engineer. If either your mother or father is currently not working, please think of her or his last professional activity." and then assigned to different codings of standard categorization schemes of occupations, among others the ISEI – if a student's parents had different values, we used the highest ISEI in the family]; (b) migration background (captured via the proxy of having German as a mother tongue; *yes* [1] vs. *no* [0]); (c) gender [*male* (1) vs. *female* (2)]; and (d) cognitive ability. Cognitive ability was assessed with the NEPS reasoning test (NEPS-MAT), a figural reasoning task that measures general cognitive ability with 12 items (see Pohl and Carstensen, 2012) ranging from *low* (0) to *high* (12). In the present sample, internal consistency (Cronbach's alpha) was 0.66.

Analysis

We examined the association between transition success and personality with OLS regression models for the quasi-continuous dependent variables (number of acceptances for VET positions, final VET grade, and satisfaction with VET) and logistic regressions for the dichotomous dependent variables [obtaining a VET position, starting a VET position, (absence of) dropout intentions, and (absence of) actual dropout]. To facilitate the interpretation of the results of the logistic regressions, we report the average marginal effects (AMEs). AMEs have a straightforward interpretation as probabilities.

In the first step, we analyzed the association between the Big Five traits and the seven indicators of transition success (Model I). In the second step, we added the covariates in order to examine whether the Big Five incrementally predicted transition success over and above these covariates (Model II). In the third and fourth steps, we additionally included interaction terms between the Big Five traits and 1 covariate at a time – cognitive ability in the third model, parental SES in the fourth model – in order to examine whether personality traits moderated the association

between parental SES, cognitive ability, and success (Models III–IV). To keep the sample size within each dependent variable equivalent across the individual models (I–IV), we used complete case analysis and only analyzed data of students without missing values on the independent variables. The statistical analyses were run with Stata.

RESULTS

Descriptive Statistics

Descriptive statistics for the personality traits, the covariates, and the success indicators are depicted in **Table 1**. As can be seen from that table, there was substantial variation in all variables. **Table 2** shows the correlations between Big Five traits, the success indicators, and the covariates. As can be seen from that table, there were small associations between Extraversion, Emotional Stability, Openness, and in particular Conscientiousness and several success indicators ($-0.10 \leq r \leq 0.08$), suggesting that personality is related to at least some of our transition success indicators. **Table 2** further reveals that the Big Five personality traits were moderately associated with cognitive ability ($-0.10 \leq r \leq 0.06$), parental SES ($-0.08 \leq r \leq 0.06$), migration background ($r = 0.06$), and gender ($-0.21 \leq r \leq 0.19$). We therefore used multiple regression analyses to examine whether the Big Five explained transition success above and beyond sociodemographic characteristics and cognitive ability.

Multivariate Models Predicting Successful Transitions

The regression estimators for the seven success indicators are displayed in **Tables 3–9** (unstandardized coefficients; *b* for quasi-continuous outcomes; AMEs for dichotomous outcomes). Statistically significant interactions are additionally depicted in **Supplementary Figures S1–S6**. We report only statistically significant effects ($p < 0.05$) in the text.

Obtaining a VET Position

Our first success indicator was obtaining a VET position within 1 year after graduation (given the submission of an application). As shown in **Table 3**, high Conscientiousness was associated with a 1.7% higher likelihood of obtaining a VET position, and high Extraversion was associated with a 1.5% higher likelihood. Overall, personality explained 0.6% of the variance (*Pseudo* R^2; Model I). Analyzing the effects of personality traits and covariates simultaneously, Model II explained 2.8% of the overall variance (*Pseudo* R^2) and indicated a significant association between high cognitive ability (0.8% higher likelihood), being male (4.6% higher likelihood), not having a migration background (7.3% higher likelihood), and obtaining a VET position. Nevertheless,

TABLE 1 | Descriptive statistics for continuous and categorical variables.

Continuous variables	***M***	***SD***	**No. of items**	**Cronbach's alpha**	***N***
Extraversion	3.41	0.87	2	0.55	4,314
Agreeableness	3.46	0.68	3	0.34	4,314
Conscientiousness	3.20	0.87	2	0.46	4,314
Emotional stability	3.22	0.85	2	0.35	4,314
Openness	3.35	0.93	2	0.36	4,314
Cognitive ability	7.71	2.59	12	0.66	3,993
Parental SES	43.57	18.16	1		3,701
Number of acceptances	1.89	2.31	1		3,238
Final VET grade	2.53	0.65	1		954
Satisfaction with VET	8.17	1.53	1		1,811
Categorical variables	**Categories**				***n***
Obtaining a VET position	0: No				613
	1: Yes				3,524
Starting a VET position	0: No				1,113
	1: Yes				2,411
Dropout intentions	0: No				2,222
	1: Yes				118
Actual dropout	0: No				2,107
	1: Yes				304
Gender	1: Male				2,484
	2: Female				1,830
Migration background	0: German as mother tongue				3,779
	1: Other mother tongue(s)				490

The Big Five scores range between 1 and 5 (strongly disagree–strongly agree); cognitive ability ranges between 0 and 12 (sum score); parental SES ranges between 11.56 and 88.96 (low–high); number of acceptances ranges between 0 and 20; final VET grade ranges between 0 and 4.2 (high–low); satisfaction with VET ranges between 0 and 10 (completely dissatisfied–completely satisfied).

TABLE 2 | Correlations between the Big Five personality traits and the success indicators and covariates.

		Extraversion			Agreeableness			Conscientiousness			Emotional Stability			Openness		
Success indicators	***N***	***r***	**$CI_{95\%}$**	***p***	***r***	**$CI_{95\%}$**	***p***	***r***	**$CI_{95\%}$**	***p***	***r***	**$CI_{95\%}$**	***P***	***r***	**$CI_{95\%}$**	***p***
Obtaining a VET position	4,137	**0.04**	[0.01, 0.07]	0.022	−0.01	[−0.04, 0.02]	0.624	**0.04**	[0.01, 0.07]	0.006	**0.03**	[0.00, 0.06]	0.046	−0.02	[−0.05, 0.01]	0.172
Number of acceptances	3,238	0.02	[−0.02, 0.05]	0.312	0.03	[−0.01, 0.06]	0.092	**0.06**	[0.02, 0.09]	0.001	0.02	[−0.01, 0.06]	0.162	−0.00	[−0.04, 0.03]	0.831
Starting a VET position	3,524	−0.01	[−0.04, 0.03]	0.698	−0.02	[−0.05, 0.02]	0.299	0.02	[−0.01, 0.06]	0.177	**0.04**	[0.00, 0.07]	0.036	−0.01	[−0.05, 0.02]	0.422
Dropout intentions	2,340	0.01	[−0.03, 0.06]	0.495	−0.03	[−0.07, 0.01]	0.177	−0.03	[−0.07, 0.01]	0.198	0.02	[−0.02, 0.06]	0.387	0.03	[−0.01, 0.07]	0.199
Actual dropout	2,411	0.03	[−0.01, 0.07]	0.211	0.03	[−0.01, 0.07]	0.184	**−0.05**	[−0.09, −0.01]	0.027	−0.01	[−0.05, 0.03]	0.752	0.03	[−0.01, 0.07]	0.135
Final VET grade	954	**0.10**	[0.04, 0.16]	0.002	−0.01	[−0.08, 0.05]	0.714	0.05	[−0.01, 0.11]	0.128	0.06	[−0.01, 0.12]	0.083	**0.09**	[0.02, 0.15]	0.009
Satisfaction with VET	1,811	−0.00	[−0.05, 0.05]	0.997	0.04	[−0.01, 0.09]	0.101	**0.08**	[0.03, 0.12]	0.001	**0.07**	[0.02, 0.11]	0.005	−0.04	[−0.09, 0.01]	0.089
Covariates																
Cognitive ability	3,993	**−0.06**	[−0.09, −0.03]	0.000	0.02	[−0.01, 0.06]	0.134	**−0.10**	[−0.13, −0.07]	0.000	**0.05**	[0.02, 0.08]	0.002	**0.06**	[0.03, 0.09]	0.000
Parental SES	3,701	**0.04**	[0.01, 0.07]	0.010	**−0.05**	[−0.08, 0.01]	0.005	**−0.08**	[−0.11, 0.04]	0.000	**0.05**	[0.01, 0.08]	0.005	**0.06**	[0.02, 0.09]	0.001
Gender	4,314	0.02	[−0.01, 0.05]	0.235	**0.12**	[0.09, 0.15]	0.000	**0.19**	[0.16, 0.22]	0.000	**−0.21**	[−0.24, 0.19,]	0.000	**0.17**	[0.14, 0.20]	0.000
Migration background	4,269	−0.01	[−0.04, 0.02]	0.631	0.01	[−0.02, 0.04]	0.433	**0.06**	[0.03, 0.09]	0.000	−0.02	[−0.05, 0.01]	0.290	0.03	[−0.01, 0.06]	0.099

Coefficients significant at the $p < 0.05$ level are in bold type.

Model II revealed that the effects of Conscientiousness (2.7% higher likelihood) and Extraversion (1.7% higher likelihood) were even greater compared to Model I, and that they were incremental. The maximum difference between a student scoring at the lowest possible value of Conscientiousness (i.e., 1 on the 5-point scale) and the highest possible value (i.e., 5 on the 5-point scale) was (5–1)*2.7% = 10.8%, which is larger than that of all significant covariates. The maximum difference in the case of Extraversion was 6.8%, which was therefore larger than that of gender, but somewhat smaller than that of cognitive ability (9.6%) and migration background.

Supplementary Figure S1 illustrates that 2 Big Five personality traits interacted with different covariates. First, low Agreeableness was more detrimental for students with low cognitive ability, whereas it was helpful for students with high cognitive ability (0.8%; Model III). Second, Emotional Stability was more detrimental for students with low parental SES and more helpful for students with high parental SES (0.1%; Model IV).

Number of Acceptances for VET Positions

The second success indicator was the number of acceptances for VET positions within 1 year after graduation. **Table 4** indicates that Conscientiousness was positively associated with the number of acceptances for VET positions ($b = 0.109$), even when adjusted for the covariates ($b = 0.129$), of which only gender was associated with the number of acceptances (with males obtaining more acceptances compared to females; $b = -0.215$). Personality alone explained 0.3% of the overall variance (Model I); personality and covariates together explained 0.5% of the overall variance (Model II). Even though the models are not statistically significant overall, it is noteworthy that the effect of Conscientiousness increased over Model I. Furthermore, after standardizing the variable, it became apparent that Conscientiousness ($b_{std} = 0.516$) was even more predictive than gender.

As can be seen from **Supplementary Figure S2**, Agreeableness compensated for low cognitive ability ($b = -0.056$; Model III). In addition, high Conscientiousness ($b = -0.006$) and low Openness ($b = 0.006$) led to a higher number of acceptances for VET positions when parental SES was low (Model IV).

Starting a VET Position

The third success indicator was starting a VET position within 1 year after graduation (given the receipt of an acceptance for a VET position). As can be seen in **Table 5**, high Conscientiousness was associated with a 2.2% higher likelihood of starting a VET position; high Emotional Stability was associated with a 2.6% higher likelihood; and low (not high) Agreeableness was associated with a 2.8% higher likelihood (Model I). Personality traits explained 0.4% of the overall variance (*Pseudo* R^2; Model I). Incorporating personality traits and covariates jointly into the model (Model II), we found that the pattern of significant predictors changed. The positive effect of Conscientiousness increased (3.2% higher likelihood) and was incremental; the relationship with Emotional Stability and Agreeableness disappeared. In total, Model II explained 1.5% of the overall variance (*Pseudo* R^2). Furthermore, there

TABLE 3 | Average marginal effects for obtaining a VET position within 1 year after graduation (given the submission of an application) regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	AME	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***
C	**0.017**	[0.003, 0.031]	0.018	**0.027**	[0.012, 0.041]	0.000	**0.028**	[0.014, 0.043]	0.000	**0.028**	[0.014, 0.042]	0.000
ES	0.008	[−0.006, 0.022]	0.256	−0.001	[−0.016, 0.013]	0.862	−0.001	[−0.015, 0.014]	0.933	0.000	[−0.014, 0.015]	0.965
O	−0.010	[−0.023, 0.002]	0.115	−0.008	[−0.021, 0.005]	0.224	−0.007	[−0.020, 0.005]	0.255	−0.009	[−0.022, 0.004]	0.173
E	**0.015**	[0.001, 0.028]	0.037	**0.017**	[0.004, 0.031]	0.014	**0.018**	[0.004, 0.031]	0.012	**0.018**	[0.004, 0.032]	0.010
A	−0.007	[−0.025, 0.011]	0.460	−0.004	[−0.022, 0.014]	0.633	−0.008	[−0.027, 0.010]	0.368	−0.005	[−0.023, 0.013]	0.605
Cognitive ability				**0.008**	[0.003, 0.012]	0.001	**0.008**	[0.004, 0.013]	0.000	**0.008**	[0.003, 0.012]	0.001
Parental SES				0.001	[−0.000, 0.001]	0.051	**0.001**	[0.000, 0.001]	0.044	**0.001**	[0.000, 0.002]	0.012
Gender				**−0.046**	[−0.070, −0.021]	0.000	**−0.047**	[−0.071, −0.023]	0.000	**−0.048**	[−0.072, −0.023]	0.000
Migration background				**−0.073**	[−0.106, −0.039]	0.000	**−0.072**	[−0.106, −0.038]	0.000	**−0.074**	[−0.107, −0.040]	0.000
Cognitive ability × C							0.004	[−0.001, 0.009]	0.157			
Cognitive ability × ES							0.002	[−0.003, 0.007]	0.406			
Cognitive ability × E							0.004	[−0.001, 0.009]	0.161			
Cognitive ability × O							0.001	[−0.004, 0.006]	0.680			
Cognitive ability × A							**−0.008**	[−0.015, −0.001]	0.018			
SES × C										0.001	[−0.000, 0.001]	0.193
SES × ES										**0.001**	[0.000, 0.002]	0.003
SES × O										0.000	[−0.001, 0.001]	0.980
SES × E										0.000	[−0.000, 0.001]	0.321
SES × A										−0.001	[−0.002, 0.000]	0.152
Pseudo R^2	**0.006**		0.008	**0.028**		0.000	**0.033**		0.000	**0.034**		0.000

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 3,276. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

TABLE 4 | Unstandardized regression coefficients for the number of acceptances for VET positions within 1 year after graduation regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	b	**$CI_{95\%}$**	***p***	***b***	**$CI_{95\%}$**	***p***	***b***	**$CI_{95\%}$**	***p***	***b***	**$CI_{95\%}$**	***p***
C	**0.109**	[0.002, 0.217]	0.047	**0.129**	[0.019, 0.239]	0.022	**0.127**	[0.017, 0.237]	0.024	**0.130**	[0.020, 0.240]	0.021
ES	0.052	[−0.057, 0.162]	0.350	0.022	[−0.091, 0.135]	0.705	0.020	[−0.093, 0.133]	0.724	0.020	[−0.094, 0.133]	0.735
O	−0.012	[−0.111, 0.086]	0.805	0.006	[−0.095, 0.106]	0.913	0.010	[−0.091, 0.111]	0.844	0.002	[−0.098, 0.103]	0.962
E	0.045	[−0.060, 0.151]	0.401	0.055	[−0.052, 0.161]	0.314	0.049	[−0.058, 0.155]	0.372	0.054	[−0.053, 0.160]	0.321
A	0.058	[−0.081, 0.197]	0.413	0.072	[−0.068, 0.212]	0.311	0.068	[−0.071, 0.208]	0.338	0.067	[−0.073, 0.206]	0.351
Cognitive ability				0.001	[−0.034, 0.037]	0.950	0.001	[−0.034, 0.037]	0.936	0.001	[−0.034, 0.037]	0.948
Parental SES				0.000	[−0.005, 0.005]	0.911	0.000	[−0.005, 0.006]	0.863	0.000	[−0.005, 0.005]	0.885
Gender				**−0.215**	[−0.408, −0.022]	0.029	**−0.220**	[−0.413, −0.027]	0.026	**−0.210**	[−0.403, −0.017]	0.033
Migration background				−0.043	[−0.375, 0.289]	0.799	−0.038	[−0.370, 0.294]	0.822	−0.040	[−0.372, 0.292]	0.815
Cognitive ability × C							0.020	[−0.023, 0.063]	0.364			
Cognitive ability × ES							0.001	[−0.042, 0.044]	0.955			
Cognitive ability × E							0.013	[−0.028, 0.055]	0.530			
Cognitive ability × O							−0.033	[−0.072, 0.006]	0.098			
Cognitive ability × A							**−0.056**	[−0.112, −0.001]	0.048			
SES × C										**−0.006**	[−0.012, −0.000]	0.049
SES × ES										−0.002	[−0.008, 0.004]	0.472
SES × O										**0.006**	[0.000, 0.011]	0.037
SES × E										0.004	[−0.002, 0.010]	0.208
SES × A										0.001	[−0.007, 0.009]	0.807
R^2	0.003		0.162	0.005		0.169	0.008		0.089	0.009		0.073

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 2,606. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

TABLE 5 | Average marginal effects for starting a VET position within 1 year after graduation (given the receipt of an acceptance for a VET position) regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	AME	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***
C	**0.022**	[0.002, 0.042]	0.034	**0.032**	[0.011, 0.052]	0.002	**0.032**	[0.012, 0.053]	0.002	**0.032**	[0.011, 0.052]	0.002
ES	**0.026**	[0.005, 0.047]	0.014	0.017	[−0.005, 0.038]	0.124	0.017	[−0.004, 0.038]	0.122	0.016	[−0.005, 0.038]	0.132
O	−0.004	[−0.022, 0.015]	0.696	−0.002	[−0.021, 0.017]	0.841	−0.002	[−0.020, 0.017]	0.858	−0.002	[−0.021, 0.016]	0.794
E	−0.017	[−0.037, 0.004]	0.107	−0.015	[−0.036, 0.005]	0.133	−0.015	[−0.035, 0.005]	0.137	−0.015	[−0.035, 0.005]	0.136
A	**−0.028**	[−0.055, −0.002]	0.036	−0.025	[−0.052, 0.001]	0.060	−0.025	[−0.051, 0.001]	0.064	−0.025	[−0.051, 0.001]	0.065
Cognitive ability				**0.008**	[0.001, 0.015]	0.020	**0.008**	[0.001, 0.015]	0.020	**0.008**	[0.002, 0.015]	0.016
Parental SES				**0.001**	[0.000, 0.002]	0.042	**0.001**	[0.000, 0.002]	0.020	**0.001**	[0.000, 0.002]	0.049
Gender				−0.034	[−0.070, 0.002]	0.067	−0.034	[−0.070, 0.002]	0.062	−0.031	[−0.067, 0.004]	0.086
Migration background				**−0.134**	[−0.192, −0.077]	0.000	**−0.134**	[−0.191, −0.076]	0.000	**−0.130**	[−0.188, −0.073]	0.000
Cognitive ability × C							0.002	[−0.006, 0.010]	0.630			
Cognitive ability × ES							0.004	[−0.004, 0.012]	0.335			
Cognitive ability × E							−0.001	[−0.009, 0.007]	0.859			
Cognitive ability × O							0.003	[−0.005, 0.010]	0.486			
Cognitive ability × A							−0.000	[−0.011, 0.010]	0.949			
SES × C										0.000	[−0.001, 0.001]	0.603
SES × ES										**−0.001**	[−0.002, −0.000]	0.036
SES × O										0.000	[−0.001, 0.001]	0.490
SES × E										**0.002**	[0.000, 0.003]	0.002
SES × A										0.001	[−0.000, 0.002]	0.159
Pseudo R^2	**0.004**		0.016	**0.015**		0.000	**0.016**		0.000	**0.019**		0.000

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 2,846. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

was a positive association between cognitive ability (0.8% higher likelihood), parental SES (0.1% higher likelihood), and not having a migration background (13.4% higher likelihood) and starting a VET position. After standardizing the variables, Model II indicated that Conscientiousness – with a 12.8% higher likelihood – had a larger effect on starting a VET position than three of the four established predictors. Only migration background still had slightly more predictive power (cognitive ability: 9.6%; SES: 7.7%).

Supplementary Figure S3 demonstrates that both Emotional Stability (0.1%) and Introversion (0.2%) compensated for low parental SES (Model IV) in the prediction of starting a VET position.

Dropout Intentions

The fourth success indicator was (the absence of) dropout intentions. As can be seen in **Table 6**, this outcome variable was positively related to Openness (1.1%). However, the model was not significant, with an overall explained variance of 0.9% (*Pseudo* R^2; Model I). Considering both personality traits and covariates simultaneously in Model II, we found that the positive association with Openness vanished. In total, Model II explained 2.9% of the overall variance (*Pseudo* R^2). In addition, being female (2.9% higher likelihood) and having a migration background (4.2% higher likelihood) were positively associated with the intentions of dropping out of VET.

From **Supplementary Figure S4** it is apparent that Openness, as a positive resource to avoid forming the intentions to drop out, was more beneficial for students with low cognitive ability (0.5%; Model III) and low parental SES (0.1%) and more detrimental for students with high cognitive ability and high parental SES (Model IV).

Actual Dropout

The fifth success indicator was (the absence of) actual dropout from VET. As **Table 7** indicates, personality alone explained 1.0% of the overall variance (*Pseudo* R^2; Model I), with high Conscientiousness related to a 2.2% higher likelihood of not dropping out of VET, and low Agreeableness related to a 2.8% higher likelihood. Although Model II did not substantially change the relationships, it increased the overall explained variance to 1.9% (*Pseudo* R^2). Moreover, Model II indicated that the observed association with high Conscientiousness (2.5% higher likelihood of not dropping out) was slightly higher than in Model I, and that it was incremental. The link with low Agreeableness (2.7% higher likelihood of not dropping out) remained almost the same. In addition, Model II revealed that high cognitive ability (0.7% higher likelihood) and not having a migration background (5.9% higher likelihood) were also related to not dropping out, but – after standardizing the variables – to a lesser extent than Conscientiousness (10.0%) and Agreeableness (−10.8%; cognitive ability: 8.4%).

Supplementary Figure S5 represents the same pattern as before – namely, that Openness was more detrimental for students with high parental SES, but that it compensated for low parental SES (0.1%; Model IV).

TABLE 6 | Average marginal effects for dropout intentions regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	AME	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***
C	−0.006	[−0.018, 0.006]	0.308	−0.009	[−0.021, 0.003]	0.127	−0.009	[−0.021, 0.003]	0.135	−0.009	[−0.021, 0.002]	0.119
ES	0.005	[−0.007, 0.017]	0.427	0.010	[−0.003, 0.022]	0.134	0.010	[−0.002, 0.023]	0.108	0.009	[−0.004, 0.021]	0.176
O	**0.011**	[0.000, 0.022]	0.041	0.008	[−0.003, 0.019]	0.145	0.007	[−0.004, 0.018]	0.222	0.007	[−0.004, 0.018]	0.219
E	0.003	[−0.009, 0.014]	0.622	0.002	[−0.010, 0.013]	0.772	0.002	[−0.010, 0.013]	0.737	0.002	[−0.009, 0.014]	0.706
A	−0.005	[−0.020, 0.010]	0.503	−0.008	[−0.022, 0.007]	0.323	−0.007	[−0.022, 0.008]	0.333	−0.008	[−0.023, 0.007]	0.308
Cognitive ability				0.000	[−0.004, 0.004]	0.985	−0.000	[−0.004, 0.004]	0.987	0.000	[−0.004, 0.004]	0.926
Parental SES				0.000	[−0.004, 0.001]	0.875	0.000	[−0.001, 0.001]	0.871	−0.000	[−0.001, 0.000]	0.759
Gender				**0.029**	[0.009, 0.050]	0.006	**0.029**	[0.009, 0.050]	0.006	**0.030**	[0.009, 0.050]	0.005
Migration background				**0.042**	[0.011, 0.072]	0.008	**0.043**	[0.012, 0.074]	0.006	**0.041**	[0.011, 0.072]	0.009
Cognitive ability × C							−0.000	[−0.005, 0.004]	0.926			
Cognitive ability × ES							−0.002	[−0.007, 0.002]	0.339			
Cognitive ability × E							0.001	[−0.004, 0.005]	0.792			
Cognitive ability × O							**0.005**	[0.001, 0.009]	0.023			
Cognitive ability × A							0.001	[−0.005, 0.007]	0.761			
SES × C										0.000	[−0.000, 0.001]	0.376
SES × ES										0.000	[−0.001, 0.001]	0.751
SES × O										**0.001**	[0.000, 0.001]	0.013
SES × E										0.000	[−0.001, 0.001]	0.941
SES × A										0.000	[−0.001, 0.001]	0.727
Pseudo R^2	0.009		0.237	**0.029**		0.010	**0.037**		0.014	**0.040**		0.007

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 1,933. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

TABLE 7 | Average marginal effects for actual dropout regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	AME	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***	**AME**	**$CI_{95\%}$**	***p***
C	**−0.022**	[−0.039, −0.004]	0.014	**−0.025**	[−0.043, −0.008]	0.004	**−0.024**	[−0.042, −0.007]	0.006	**−0.027**	[−0.044, −0.009]	0.003
ES	−0.002	[−0.019, 0.016]	0.855	0.001	[−0.017, 0.019]	0.908	0.001	[−0.018, 0.019]	0.951	0.001	[−0.017, 0.019]	0.932
O	0.012	[−0.004, 0.027]	0.143	0.012	[−0.004, 0.027]	0.147	0.011	[−0.004, 0.027]	0.159	0.009	[−0.007, 0.025]	0.253
E	0.014	[−0.002, 0.031]	0.095	0.013	[−0.004, 0.030]	0.132	0.014	[−0.003, 0.031]	0.117	0.013	[−0.004, 0.030]	0.140
A	**0.028**	[0.005, 0.051]	0.016	**0.027**	[0.004, 0.049]	0.020	**0.027**	[0.004, 0.050]	0.019	**0.029**	[0.007, 0.052]	0.011
Cognitive ability				**−0.007**	[−0.013, −0.001]	0.009	**−0.007**	[−0.012, −0.001]	0.016	**−0.007**	[−0.012, −0.002]	0.011
Parental SES				0.000	[−0.001, 0.001]	0.764	0.000	[−0.001, 0.001]	0.682	0.000	[−0.001, 0.001]	0.912
Gender				0.004	[−0.026, 0.035]	0.776	0.004	[−0.026, 0.035]	0.774	0.005	[−0.025, 0.036]	0.741
Migration background				**0.059**	[0.010, 0.109]	0.019	**0.060**	[0.011, 0.110]	0.017	**0.058**	[0.008, 0.107]	0.023
Cognitive ability × C							0.005	[−0.002, 0.011]	0.164			
Cognitive ability × ES							−0.004	[−0.011, 0.003]	0.230			
Cognitive ability × E							0.003	[−0.003, 0.010]	0.300			
Cognitive ability × O							0.001	[−0.005, 0.007]	0.779			
Cognitive ability × A							−0.002	[−0.011, 0.006]	0.600			
SES × C										0.000	[−0.001, 0.001]	0.393
SES × ES										0.000	[−0.001, 0.001]	0.817
SES × O										**0.001**	[0.000, 0.002]	0.011
SES × E										0.000	[−0.001, 0.001]	0.522
SES × A										−0.001	[−0.002, 0.000]	0.162
Pseudo R^2	**0.010**		0.013	**0.019**		0.001	**0.022**		0.004	**0.026**		0.001

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 1,984. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

TABLE 8 | Unstandardized regression coefficients for final VET grade regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	b	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*
C	0.044	[−0.011, 0.100]	0.116	**0.058**	[0.002, 0.114]	0.041	**0.058**	[0.002, 0.114]	0.042	**0.060**	[0.003, 0.116]	0.038
ES	0.038	[−0.018, 0.093]	0.183	0.031	[−0.026, 0.088]	0.287	0.032	[−0.025, 0.089]	0.267	0.030	[−0.027, 0.087]	0.305
O	**0.065**	[0.017, 0.113]	0.008	0.048	[−0.001, 0.097]	0.055	0.045	[−0.004, 0.094]	0.073	0.047	[−0.002, 0.096]	0.062
E	**0.068**	[0.016, 0.119]	0.011	**0.073**	[0.021, 0.125]	0.006	**0.075**	[0.023, 0.127]	0.005	**0.072**	[0.020, 0.124]	0.007
A	−0.041	[−0.112, 0.030]	0.256	−0.045	[−0.116, 0.025]	0.209	−0.047	[−0.118, 0.024]	0.196	−0.048	[−0.119, 0.023]	0.185
Cognitive ability				**0.035**	[0.018, 0.053]	0.000	**0.035**	[0.017, 0.053]	0.000	**0.035**	[0.017, 0.052]	0.000
Parental SES				0.002	[−0.001, 0.005]	0.121	0.002	[−0.000, 0.005]	0.114	0.002	[−0.001, 0.005]	0.127
Gender				0.026	[−0.069, 0.122]	0.588	0.029	[−0.066, 0.125]	0.546	0.027	[−0.069, 0.122]	0.583
Migration background				−0.061	[−0.252, 0.130]	0.533	−0.051	[−0.243, 0.141]	0.602	−0.066	[−0.258, 0.126]	0.499
Cognitive ability × C							−0.001	[−0.023, 0.020]	0.926			
Cognitive ability × ES							−0.006	[−0.027, 0.014]	0.540			
Cognitive ability × E							−0.009	[−0.028, 0.010]	0.371			
Cognitive ability × O							0.014	[−0.004, 0.032]	0.115			
Cognitive ability × A							−0.011	[−0.040, 0.019]	0.475			
SES × C										−0.001	[−0.004, 0.002]	0.500
SES × ES										0.000	[−0.003, 0.004]	0.914
SES × O										0.002	[−0.001, 0.005]	0.150
SES × E										0.001	[−0.002, 0.004]	0.601
SES × A										0.002	[−0.002, 0.007]	0.272
R^2	**0.026**		0.001	**0.050**		0.000	**0.055**		0.000	**0.055**		0.000

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 813. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

Final VET Grade

The sixth success indicator was the final VET grade. **Table 8** indicates that personality alone explained 2.6% of the overall variance (Model I), with high Openness ($b = 0.065$) and high Extraversion ($b = 0.068$) associated with a better final VET grade. Adding the covariates in Model II increased the overall explained variance to 5.0%. In addition, the pattern showed some changes. The positive effect of Extraversion increased ($b = 0.073$) and was incremental; the positive effect of Openness vanished; and a positive effect of Conscientiousness emerged ($b = 0.058$). With regard to the covariates, Model II showed only an association with high cognitive ability ($b = 0.035$). After standardizing the independent variables, this association ($b_{std} = 0.420$) was somewhat larger than for Conscientiousness ($b_{std} = 0.232$) and Extraversion ($b_{std} = 0.292$). There were no interactive effects.

Satisfaction With VET

The seventh success indicator was satisfaction with VET after 1 year in a VET position. As can be seen from **Table 9**, a high score on both Conscientiousness ($b = 0.129$) and Emotional Stability ($b = 0.107$) was associated with the likelihood of being satisfied with VET. Personality traits explained 1.1% of the overall variance (Model I). Taking all predictor variables jointly into account, Model II, which explained 1.8% of the overall variance, revealed that the positive association with Conscientiousness increased and was incremental ($b = 0.152$). Furthermore, the positive effect of Emotional Stability disappeared, and there was also a positive effect of being male ($b = -0.181$). After the variables were standardized, Conscientiousness ($b_{std} = 0.608$) showed an even larger effect than gender.

Supplementary Figure S6 illustrates that Agreeableness compensated for low cognitive ability ($b = -0.068$; Model III).

DISCUSSION

The objective of the present paper was to examine whether personality contributes to success in the transition from school to VET in Germany. For this purpose, we investigated whether the Big Five personality traits had incremental associations with transition success above and beyond sociodemographic characteristics (parental SES, gender, and migration background) and cognitive ability. We defined seven indicators of transition success: obtaining a VET position, number of acceptances for VET positions, starting a VET position, (absence of) dropout intentions, (absence of) actual dropout, final VET grade, and satisfaction with VET. Moreover, we explored possible interactions of the Big Five traits with parental SES and cognitive ability.

Additive Effects

Our findings suggest that several of the Big Five personality traits incrementally predicted at least 1 of the indicators of transition success over and above sociodemographic characteristics and cognitive ability. Among the Big Five, Conscientiousness had the most consistent positive associations with transition success.

TABLE 9 | Unstandardized regression coefficients for satisfaction with VET after 1 year in a VET position regressed on the Big Five and the covariates.

Model	I			II			III			IV		
	b	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*	*b*	$CI_{95\%}$	*p*
C	**0.129**	[0.038, 0.221]	0.006	**0.152**	[0.060, 0.245]	0.001	**0.154**	[0.061, 0.246]	0.001	**0.155**	[0.061, 0.248]	0.001
ES	**0.107**	[0.014, 0.201]	0.024	0.076	[−0.020, 0.172]	0.122	0.078	[−0.018, 0.174]	0.110	0.077	[−0.020, 0.173]	0.119
O	−0.080	[−0.163, 0.002]	0.056	−0.066	[−0.150, 0.018]	0.123	−0.073	[−0.157, 0.011]	0.090	−0.063	[−0.148, 0.021]	0.142
E	−0.014	[−0.103, 0.076]	0.761	−0.004	[−0.094, 0.086]	0.937	−0.016	[−0.106, 0.075]	0.732	−0.002	[−0.092, 0.088]	0.964
A	0.046	[−0.074, 0.165]	0.455	0.061	[−0.058, 0.181]	0.315	0.070	[−0.050, 0.190]	0.250	0.058	[−0.063, 0.179]	0.348
Cognitive ability				0.017	[−0.013, 0.048]	0.255	0.019	[−0.011, 0.049]	0.211	0.018	[−0.012, 0.048]	0.248
Parental SES				−0.000	[−0.005, 0.004]	0.832	−0.000	[−0.005, 0.004]	0.914	−0.001	[−0.005, 0.004]	0.797
Gender				**−0.181**	[−0.345, −0.017]	0.031	**−0.174**	[−0.338, −0.010]	0.037	**−0.180**	[−0.344, −0.015]	0.032
Migration background				−0.316	[−0.676, 0.043]	0.084	−0.298	[−0.657, 0.060]	0.103	−0.319	[−0.679, 0.041]	0.082
Cognitive ability × C							0.014	[−0.022, 0.050]	0.450			
Cognitive ability × ES							−0.013	[−0.049, 0.023]	0.466			
Cognitive ability × E							0.031	[−0.003, 0.066]	0.075			
Cognitive ability × O							0.019	[−0.013, 0.051]	0.251			
Cognitive ability × A							**−0.068**	[−0.116, −0.020]	0.005			
SES × C										−0.000	[−0.005, 0.005]	0.951
SES × ES										−0.000	[−0.006, 0.005]	0.916
SES × O										−0.003	[−0.008, 0.002]	0.237
SES × E										−0.001	[−0.006, 0.004]	0.673
SES × A										0.002	[−0.004, 0.009]	0.498
R^2	**0.011**		0.004	**0.018**		0.001	**0.026**		0.000	**0.019**		0.011

Model I: Big Five only; Model II: Big Five and covariates; Model III: Big Five, covariates, and interaction terms between the Big Five and cognitive ability; Model IV: Big Five, covariates, and interaction terms between the Big Five and parental SES. C: Conscientiousness; ES: Emotional Stability; O: Openness; E: Extraversion: A: Agreeableness. N = 1,528. Coefficients and R^2 significant at the $p < 0.05$ level are in bold type.

Effect sizes were small – but often as large as, or larger than, those of some of the established predictors of transition success, namely, cognitive ability and parental SES. Conscientiousness showed the most robust (incremental) predictive power for six of the seven transition success indicators: obtaining a VET position, number of acceptances for VET positions, starting a VET position, actual dropout, final VET grade, and satisfaction with VET ($-0.025 \leq$ AME ≤ -0.053; $-0.058 \leq b \leq -0.152$). This is in line with a plethora of other studies that have identified Conscientiousness as the most robust and potent predictor among the Big Five traits of educational achievement and attainment as well as career success (e.g., John et al., 1994; Poropat, 2009; Spengler et al., 2013, 2016; Woods et al., 2013; Lechner et al., 2017; Vedel and Poropat, 2017; Bergold and Steinmayr, 2018). In line with previous evidence showing links between Conscientiousness and better grades/GPA (Wintre and Sugar, 2000; Lievens et al., 2002; Trapmann et al., 2007; Poropat, 2009; Richardson et al., 2012; McAbee and Oswald, 2013; Spengler et al., 2013; Libbrecht et al., 2014; Vedel, 2014; Diedrich et al., 2018; Brandt et al., 2020) as well as satisfaction with life, work, and VET (Roberts et al., 2003; Rammstedt et al., 2017; Diedrich et al., 2018), we could support this association for almost all of our transition success indicators. A conceivable explanation is that, because of consistent performance effort during the entire vocational training period and a sense of duty and diligence, a conscientious person tends to achieve better grades, tends to be more satisfied with VET, and tends to be less likely to drop out. Furthermore, Conscientiousness manifests itself in the application behavior (in terms of the number and type of applications) and is a criterion in the selection process, thereby increasing the likelihood of obtaining a VET position and a higher number of acceptances.

The other Big Five traits had weaker and more inconsistent main effects. Extraversion (AME = 0.017; b = 0.073) and Agreeableness (AME = 0.027) also contributed incrementally to the prediction of transition success, whereas Openness and Emotional Stability had no incremental effects on transition success. Specifically, Extraversion predicted the final VET grade. This is in line with Wintre and Sugar (2000), who found Extraversion to be a predictor of GPA at university. Extraversion was also related to a higher likelihood of obtaining a VET position (but see Rammstedt et al., 2017, who reported a negative relation between Extraversion and the highest level of education). More extraverted students may have an advantage in obtaining an acceptance for a VET position because they are more socially connected and have more of the relevant "weak ties" (Granovetter, 1977, i.e., acquaintances compared to close friends or family members) than more introverted students. In addition, Extraversion is likely to manifest itself in the form of assertiveness in the application procedure, emboldening students to submit a greater number of unsolicited applications and to approach potential employers to inquire about vacant apprenticeship positions.

Agreeableness predicted a higher likelihood of dropping out of VET, a transition success indicator that has not been investigated to date in previous research. Our finding is in line

with Lechner et al. (2017) and Brandt et al. (2020), who found negative associations between high Agreeableness and school performance using the same NEPS data. However, other studies based on other (typically much longer Big Five inventories) have reported positive associations between high Agreeableness and related outcome variables – namely, educational attainment (Shanahan et al., 2014a), sales performance and performance growth (Thoresen et al., 2004), and GPA/grades (Poropat, 2009; Richardson et al., 2012; Vedel, 2014). A possible – albeit speculative – explanation for this divergence is that different facets of Agreeableness may relate differently to different success outcomes. The BFI-10+1 measure of Agreeableness focuses mainly on the trust and compliance facets of this construct, but may not fully capture other facets that might foster success. Future research using longer Agreeableness scales – ideally scales that allow for facet-level analyses – is needed to address this question.

Some effects of individual personality traits disappeared after controlling for sociodemographic characteristics and cognitive ability. This was the case mainly with Emotional Stability and Openness, the 2 personality traits that were found to have no additive effects on transition success. Without controlling for the covariates, high Emotional Stability was positively related to starting a VET position and satisfaction with VET, and high Openness was positively associated with the final VET grade and negatively associated with the intentions to drop out. Although the very limited role of Emotional Stability contradicts our expectations, it is in line with recent large-scale findings on the Big Five as predictors of educational achievement (Lechner et al., 2017; Brandt et al., 2020) and with Poropat's (2009) meta-analysis of personality–academic performance relationships based on the five-factor model. The prominent role of Openness in educational success suggested by this previous research was not borne out by our analyses with regard to transition to VET. A possible explanation for this is that Openness-related behaviors such as being intellectually curious or pursuing creative interests are simply not as relevant for the specific transition success outcomes that we investigated (e.g., number of acceptances for VET positions, dropout) than for more traditional indicators of academic success such as grades or test scores.

Among the covariates, migration background (as measured by the proxy of having German as a mother tongue) proved to be the most important predictor of transition success, showing significant relationships with four of the seven success indicators. However, only in 2 cases the effects of migration background were larger than that of the Big Five personality traits. Gender and cognitive ability also had significant associations with four of the seven success indicators, but to a lesser extent than migration background. The effect sizes of both gender and cognitive ability were smaller than those of the personality traits on three outcomes and larger on 1 outcome. Interestingly, parental SES was related to only 1 transition success indicator (starting a VET position), but with a smaller effect size than that of the significant personality trait Conscientiousness. Conscientiousness was more consistently related to our indicators of transition success than the established predictors. In detail, Conscientiousness was related to six of the success indicators, that is, to 2 indicators more than migration background, gender, and cognitive ability, and to five indicators more than parental SES. Despite their individually small effect sizes, the joint contribution of the Big Five personality traits in the prediction of transition success emerged as more robust than parental SES, cognitive ability, gender, and migration background.

As a consequence of the mostly small effect sizes, the overall explained variance – although significant – was not very high for any of the seven success indicators. However, this is in line with several previous investigations on relationships between the Big Five and educational or career outcomes (e.g., Rammstedt et al., 2016; Bergold and Steinmayr, 2018). Possible explanations are that almost everyone who applied for an apprenticeship got an acceptance, and that the generally small differences in the outcomes inevitably led to small variance.

Interactive Effects

In addition to these additive effects, we explored possible interactive effects in order to further understand how personality traits might contribute to transition success. Specifically, we explored whether personality traits moderate the association with transition success of cognitive ability and parental SES.

Our exploratory findings also offer tentative support for the idea that personality traits may moderate the effects of parental SES and cognitive ability on transition success (i.e., interactive effects). Even though we found few interactive effects overall, 2 major traits showed some systematic patterns of moderation effects: Openness and Agreeableness. Openness primarily moderated the associations of parental SES with several success indicators (AME = 0.001; $b = 0.006$), whereas Agreeableness moderated solely the associations of cognitive ability with various success indicators (AME = −0.008; $-0.068 \leq b \leq -0.056$).

The interactive effects were mostly compensatory in nature, suggesting that personality traits can partly compensate for background disadvantages (e.g., Shanahan et al., 2014a; Damian et al., 2015; Kaiser and Schneickert, 2016; Ayoub et al., 2018), as resource substitution theory (Mirowsky and Ross, 2003) would predict. For example, high Agreeableness compensated for low cognitive ability (in predicting the number of acceptances for VET positions, satisfaction with VET), and high Openness compensated for low parental SES (in predicting the intentions not to drop out of VET, actually not dropping out of VET). The latter finding is in line with previous studies that found the same pattern, namely, compensatory interactive effects between high Openness and low parental SES in predicting educational attainment and achievement (Shanahan et al., 2014a; Kaiser and Schneickert, 2016; Ayoub et al., 2018).

Other interactions appeared to be synergistic, rather than compensatory, in nature, thus resembling the Matthew effect (Damian et al., 2015), which means that personality traits relevant to success benefited especially those who were already advantaged in terms of cognitive ability or parental SES. For example, students with high cognitive ability benefited the most from low Agreeableness (in predicting obtaining a VET position) and students with high SES benefited the most from high Openness (in predicting the number of acceptances). The latter effect is in line with Kaiser and Schneickert (2016) who examined success in primary school.

Limitations and Directions for Future Research

The present study is among the first to address the role of personality in predicting successful educational transitions. Despite the advances we made, several limitations should be noted. First, and most importantly, although we aimed to identify causal effects of the Big Five by including several control variables and ensuring a correct temporal ordering of predictors and outcomes, unobserved third variables may have led to spurious effects. Thus, although plausible, the associations we found cannot be interpreted as causal. Experimental or quasi-experimental designs could help to overcome this limitation.

Second, only a short scale with 11 items was available to measure the Big Five personality traits. Although the short scale BFI-10 (+1; Rammstedt and John, 2007) has a relatively high predictive validity compared to longer scales (e.g., Thalmayer et al., 2011), the effect sizes we found are likely to be conservative because the BFI-10+1's lower reliability compared to longer scales may attenuate effect sizes, and because, with 2 (or three) items per trait, the BFI-10+1 depicts each individual trait less broadly. However, the narrower operationalization may sometimes lead to higher associations with external criteria if only certain facets of each personality trait are covered that are more predictive than the dimension as a whole (Thalmayer et al., 2011). Research using longer scales – ideally scales that allow for facet-level analyses – could provide a more robust and fine-grained picture of how personality contributes to transition success.

Third, because NEPS only provides a short test of students' cognitive ability, the internal consistency of that was relatively low in the present sample ($\alpha = 0.66$). The limited reliability of the test means that, though we found significant associations between cognitive ability and some of our success indicators, the importance of student's cognitive ability for transition success is likely to have been underestimated in the present study.

Fourth, we assumed the specific mechanisms of the Big Five traits (resource vs. selection criterion) only theoretically, and could not test them directly. Future studies are needed to reveal the mediators for the Big Five's effects on transition outcomes.

Fifth, all seven success indicators were self-reports. Therefore, the answers on these questions could be biased by common method bias and/or socially desirable responding.

Sixth, with the available dataset, it was only possible to analyze the transition of school-leavers from *Hauptschulen* (lower secondary schools providing a basic secondary education) and *Realschulen* (intermediate secondary schools) in Germany applying for a VET position. Although we expect a similar pattern for *Gymnasium* (academically oriented secondary schools) graduates (*Abiturienten*) who apply for a VET position or for tertiary education, we cannot make generalizable predictions at this point in time. Thus, future research is needed to establish whether the present findings also apply to other educational transitions and to education systems in other national and institutional contexts.

Seventh, our tests of interactive effects were purely exploratory, we tested multiple outcome variables, and the effects did not appear consistent across all outcomes. Thus, these interactive effects should only be seen as a call for future research replicating these results and deeper investigating the causal mechanism of these effects.

CONCLUSION

The present study contributes to our understanding of educational transitions by identifying Big Five personality traits as a hitherto underappreciated source of individual differences in transition success as captured by a broad range of success indicators. Our results demonstrate that several of the Big Five traits incrementally predict the successful mastery of the transition from school to VET over and above cognitive ability, parental SES, gender, and migration background. Among the variables in the model (the Big Five and the covariates), Conscientiousness proved to be the most robust (incremental) predictor of almost all the success indicators. The other Big Five traits had several additive – albeit less pervasive – associations with transition success. In addition to these additive effects, we also found evidence that personality can moderate the effects of cognitive ability and parental SES on educational transitions, and that this interaction can be both compensatory and synergistic in nature. Future research should replicate and extend these findings and generalize them to other educational transitions and education systems.

The individual effect sizes for each individual Big Five trait and success indicator were mostly small. At the same time, these effect sizes rivaled or even surpassed those of cognitive ability, parental SES, gender, and migration background. Note that these characteristics are traditionally considered to be important determinants of the success of educational transitions. Moreover, considering the combined effects of all Big Five traits on all seven success indicators, we submit that the role of personality in transition success is non-negligible and deserves greater attention in research on school-to-work transition.

Because personality traits are more malleable than sociodemographic characteristics, and hence more amenable to targeted interventions, our results also have potential practical applications. Conscientiousness and its behavioral manifestations (e.g., writing flawless VET applications and submitting them in time), for instance, could be a possible target for interventions to promote this particular personality trait and to provide specific training for those who are low in this trait, with the aim to obtain better coping strategies for educational transitions.

In sum, the findings gained from the present investigation might be of interest to educational research and policy alike. Future research could concentrate on replicating and expanding these findings. In our view, it would be particularly important to cast light on the possible mediating mechanisms linking personality to transition success. Doing so will help clarify the causes of unequal educational opportunities and make it possible to intervene purposefully.

DATA AVAILABILITY STATEMENT

The datasets analyzed in this article are not publicly available. Requests to access the datasets should be

directed to fdz@lifbi.de. All data used in this study came from Starting Cohort 4 of the German National Educational Panel Study (NEPS; Blossfeld and Roßbach, 2011; doi: 10.5157/NEPS:SC4:9.1.0). From 2008 to 2013, NEPS data were collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). Since 2014, NEPS has been carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network. NEPS data and documentation are provided to researchers in the form of scientific use files. Access to the data is subject to conclusion of a data use agreement (for details, visit: https://www.neps-data.de/data-center/data-access/data-use-agreements.aspx).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI) and in coordination with the German Standing Conference of the Ministers of Education and Cultural Affairs (KMK) and – in the case of surveys at schools – with the Educational Ministries of the respective Federal States. All data collection procedures, instruments, and documents were checked by the data protection unit of the Leibniz Institute for Educational Trajectories (LIfBi). The necessary steps are taken to protect participants' confidentiality according to national and international regulations of data security. Participation in the NEPS study is voluntary and based on the informed consent of participants. This consent to participate in the NEPS study can be revoked at any time. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

DN, DD, and CL contributed to the conception and the design of the study and edited the manuscript in several rounds. DN prepared the data, performed the statistical analysis, visualized the figures and tables, wrote the first draft of the manuscript, and conducted the revision of the manuscript. CL supervised. DD, MS, and CL reviewed and commented on the manuscript in several rounds. All authors read and approved the submitted and the final version.

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Personality Traits and Further Training

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The notion of lifelong learning is gaining importance, not only in the labor market but also in other areas of modern societies. Previous research finds variation in occupation-related training participation by worker and workplace characteristics, gender, and education. However, evidence on the individual's socio-emotional skills creating favorable conditions for overall further training is scarce. To close this research gap, we analyze the role of personality for further training participation. First, we compare how the Big Five Personality Dimensions relate to different training types by differentiating between non-formal and informal training measures. Second, we investigate how personality traits affect further training chosen for occupational *and* private reasons separately. Drawing on a sample of 10,559 individuals from the Adult Stage of the German National Educational Panel Study (NEPS), we find that throughout our estimations, openness to experience positively relates to further training participation and is the most important determinant among the Big Five Personality Dimensions. However, the relationship between personality traits and training participation varies according to the training type and the reason for participating in further training. Moreover, we find gender-specific differences in the association between personality traits and lifelong learning. We conclude that personality is an important predictor of lifelong learning decisions.

Keywords: socio-emotional skills, further training participation rates, NEPS, lifelong learning, continuing education, Big Five—personality

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INTRODUCTION

Lifelong learning is continuously gaining importance, not only in the labor market, but also in private areas of modern societies. In the labor market, technological change, and additional dynamics through globalization and cyclical fluctuations lead to rapidly evolving work environments that require individuals to develop skills throughout their occupational careers (Acemoglu and Autor, 2011). At the same time, lifelong learning increases in importance, as both the shortage of skilled labor[1] and demographic change require an increasingly later retirement age[2], which—together with personal preferences of older persons to stay active—prolongs employment careers for older individuals (Anger et al., 2018).

[1]For example, in 2018, the shortage of skilled workers has reached its peak in some industries and regions in Germany (Dettmann et al., 2018). A key competitive advantage for the future of skilled labor lies in developing the skills of the existing workforce not only through initial vocational training, but also through further training.

[2]The standard retirement age in Germany will be increasing to 67 years by 2029, and modifications to the German legislation allow more flexible models of working beyond the standard age for entry into the pension system. More than a quarter of retirees work in the three years after having reached the standard retirement age (Anger et al., 2018).

Likewise, new technologies, and in particular digitalization, affect many areas outside of the labor market and entail a significant societal change with the requirement to continuously learn new techniques. Furthermore, these developments are accompanied by trends toward increasing individualization in modern societies. Individuals, especially in societies with a steadily growing life expectancy, depend on lifelong learning as a condition for social participation.

Hence, continuous investments in human capital through further training is a prerequisite to remain active in a modern society and productive in the labor market. The OECD promotes that "workers need a broad mix of skills—strong cognitive and socio-emotional skills, as well as digital skills" to successfully navigate the future of work (OECD, 2019, p. 3). These skills can only be developed, when "individuals acquire a good level of skills proficiency in initial education so they can develop these skills further over their lifetime as well as learn new skills along the way" (OECD, 2019, p. 40). Since initial skills—as condition for lifelong learning—may not be limited to cognitive abilities, the aim of this paper is to investigate the importance of non-cognitive skills for participation in further training.

Socio-Emotional Skills, Personality Traits, and Their Development

A substantial body of literature considers socio-emotional skills and their influence on life outcomes. Socio-emotional skills "cover a wide range of personal characteristics such as personality traits, motivation, preferences and values" (Lechner et al., 2019a, p. 427). These characteristics have in common that they "can be (a) manifested in consistent patterns of thoughts, feelings and behaviors, (b) developed through formal and informal learning experiences, and (c) important drivers of socioeconomic outcomes throughout the individual's life" (OECD, 2015, p. 35).

Personality traits can be considered as a subset of socio-emotional skills (Kankaraš and Suarez-Alvarez, 2019, p. 9). They are defined as "relatively enduring, automatic patterns of thoughts, feelings, and behaviors that people exhibit in similar situations across time" (Roberts and Davis, 2016, p. 319)[3]. Like other socio-emotional skills, personality traits are in part developed by socializing and learning, and they have beneficial effects on individual education, work, and life success [for an overview, see e.g., Almlund et al. (2011), Brunello and Schlotter (2011)] as well as on societal outcomes (OECD, 2019). Personality traits can be conceived of as skills because they complement knowledge and transform cognitive skills into output (Cunningham et al., 2016, p. 7).

Many studies analyzing socio-emotional skills as determinants of life outcomes rely on the crucial assumption of stability in personality traits in adults to mitigate reverse causality concerns. In fact, however, ample evidence exists both for the malleability and for the stability of personality traits. Several studies have investigated whether personality traits change, to which extent they change, and how changes occur across the life course and in relation to specific life events [e.g., Roberts and DelVecchio (2000), Roberts et al. (2006), Specht et al. (2011), Damian et al. (2019)].

On the one hand, the literature concludes that genetics (partially) shape personality traits (Jang et al., 1996; Bouchard and Loehlin, 2001; Kandler et al., 2010) that develop throughout childhood and reach maturity in adulthood. Personality traits are shown to be increasingly stable over the life course until late middle age, when personality stability reaches a plateau (Roberts and DelVecchio, 2000; Soto, 2018), which can be mostly explained by a more stable environment (Briley and Tucker-Drob, 2014). On the other hand, previous studies find heterogeneous trait changes in childhood and adolescence, and substantial changes in young adulthood, with room for variability later in life (Roberts and Davis, 2016).

Summarizing the literature in its broad range, even if personality is not completely stable in adulthood and changes can take place throughout life (Roberts et al., 2006), the time-invariant component appears to outweigh the state-dependent component caused by situational fluctuations (Ferguson, 2010). Damian et al. (2019) confirm this finding in their study on the stability of personality traits over a 50-years-time span from adolescence to retirement age. While finding malleable personality traits across the whole life span, they acknowledge the stable component of personality. Over a much shorter time span, Specht et al. (2011) observe age effects on the Big Five Personality Dimensions for a large and representative longitudinal German sample, similar to ours, and show that changes in reaction to experiencing major life events occur in particular in young and old ages. Cobb-Clark and Schurer (2012) confirm largely stable Big Five personality traits in adulthood, particularly for working-age individuals. The literature largely agrees that few changes occur in older individuals (Costa et al., 2000; Srivastava et al., 2003), and even life-altering events such as unemployment are not observed to entail major changes in personality traits (Cobb-Clark and Schurer, 2012; Anger et al., 2017).

The literature also stresses gender differences in average traits (Bertrand, 2011). For example, Croson and Gneezy (2009) highlight differences in preferences and personality traits between men and women. Across nations, women score higher in agreeableness and conscientiousness and particularly in neuroticism (Costa et al., 2001).

Socio-Emotional Skills and Life Outcomes

In the context of life outcomes, socio-emotional skills are treated as a part of an individual's human capital (Becker, 1964), which yields returns over the life cycle. In addition, in a behavioral model of wage setting, socio-emotional skills influence wage determination by shaping an individual's utility function (Bowles et al., 2001a,b). Moreover, Roberts et al. (2007) offer a theory explaining the association between personality traits and occupational success, which includes potential channels through which personality traits may affect occupational attainment. They distinguish between personality effects through niche finding, recruitment, environmental shaping, attrition, and direct performance (Roberts et al., 2007).

Lechner et al. (2019a) present a recent overview of the empirical relevance of socio-emotional skills for education

[3]For an earlier and similar definition of personality traits see (Roberts, 2009, p. 7).

and life outcomes[4]. Comparing the effects of personality and cognitive skills, Rammstedt et al. (2017) show a strong relationship between the Big Five personality measures and literacy and numeracy skills, implying that both skills "co-shape" life outcomes. In particular, conscientiousness and emotional stability contribute to explaining a wide range of economic and life outcomes—health, life satisfaction, educational attainment, continuing education, labor force participation, and income—beyond literacy and numeracy competencies. The contribution of personality varies with the life outcome: Personality explains a greater variation in life satisfaction and health than cognitive competencies. In contrast, the contribution of personality is lower for the economic outcomes income and employment status, as well as for education and continuing education compared to competencies.

Nevertheless, personality significantly contributes to explaining variation in continuing education. In a recent study, Lechner et al. (2019b) focus on the association of grit and career success and find that grit also positively relates to the amount of training taken.

One body of the literature focuses on the effect of socio-emotional skills on educational attainment. In particular, socio-emotional skills relate to educational achievement, such as grades and achievement tests (Poropat, 2009; Borghans et al., 2016; Vedel and Poropat, 2017). In addition, previous studies provide evidence on the effect of socio-emotional skills on educational transitions (Ng-Knight and Schon, 2017) and school dropout (Heckman et al., 2001; Coneus et al., 2011). Lundberg (2013b) examines the relationship between personality traits and high school graduation, college enrollment and college graduation. She finds that the returns to the Big Five personality traits vary by family background and that openness to experience, as the most important skill in this context, can substitute for having a less-advantaged parental background. Further, openness to experience also predicts successful college completion in the US, particularly for less-advantaged students, while conscientiousness has no significant effect (Lundberg, 2013a). Similar evidence exists for Germany, where the school to college transition is facilitated by openness to experience and emotional stability, and the intent to study in college is associated with both these traits (Peter and Storck, 2015). Additional evidence reveals that not only the school to college transition, but also the subject choice depends on personality traits (Berkes and Peter, 2019).

Focusing on labor market outcomes, Heckman et al. (2006) and Borghans et al. (2008) highlight the importance of non-cognitive skills in addition to cognitive skills for the determination of employment, work experience and occupational choice. There is vast evidence that personality does not only affect career choice, but also career development and attainment over the whole working life. More specifically, the Big Five personality traits are related to occupational attainment (Hogan and Holland, 2003), and evidence exists for long-term effects of extraversion, neuroticism, conscientiousness, and agreeableness on occupational status (Judge et al., 1999). In their meta-analysis of the determinants of career success, Roberts et al. (2007) show that the Big Five personality traits are strongly related to occupational attainment. More recent studies by Spengler et al. (2015) and Spengler et al. (2018) confirm these results and show that personality traits and student behaviors have direct and indirect effects on career success defined as occupational success and income.

Likewise, empirical studies on the relationship between personality traits and income demonstrate the importance of traits, such as for example leadership skills (Kuhn and Weinberger, 2005) and the Big Five personality traits, in particular extraversion (Sutin et al., 2009) and conscientiousness (Roberts et al., 2011). Even if measured early in life, personality traits are observed to impact earnings over the whole life span (Viinikainen et al., 2010). Thus, agreeableness for example is a favorable labor market trait, associated with better job performance (Barrick and Mount, 1991) and increasing the odds for re-employment after unemployment periods (Gnambs, 2017). However, some studies also find agreeableness to be punished through lower wages (Rode et al., 2008; Heineck, 2011; Judge et al., 2012).

Recent work emphasizes that employers value socio-emotional skills more than cognitive skills. It seems that employment and wage growth are stronger for jobs with high levels of both math and social skills, showing that cognitive skills and social skills are complementary (Deming, 2017; Deming and Kahn, 2018). According to the theoretical explanation, social skills reduce coordination costs and allow workers to specialize and work together better (Deming, 2017). Moreover, workers with higher social skills are observed to sort into non-routine and social-skill intensive occupations (Deming, 2017). Finally, firms that require these two skills also perform better (Deming and Kahn, 2018).

Further Training

A separate strand of research investigates the determinants of further training participation. Previous studies on lifelong learning focus on the determinants of occupation-related further training and show that initial education has a significant impact on participation in further training over the life course (Kramer and Tamm, 2018). These studies also show that occupational training participation varies widely by worker type and workplace characteristics (Gerlach and Jirjahn, 2001; Brunello and Gambarotto, 2007; Rzepka and Tamm, 2016; Heß et al., 2019), by social group (Bilger, 2006; Leber and Möller, 2008), and by gender (Janssen and Wölfel, 2017), as well as with economic conditions (Bassanini and Brunello, 2008; Bellmann et al., 2014). When it comes to the choice of job-related training, time and financial constraints are crucial factors to deter individuals from training activities (Osiander and Stephan, 2018). While these studies focus on participation in occupational further training measures, scarce evidence exists on the determinants of general and non-work-related training activities.

Moreover, we know little about additional constraints for further training. An important constraint could be the lack of relevant non-cognitive skills, as insufficient socio-emotional

[4] Almlund et al. (2011) provide an earlier and very comprehensive overview.

skills may deter individuals from training participation. The scarce evidence on the importance of socio-emotional skills for further training activities focuses exclusively on occupational training: Caliendo et al. (2020) develop a theoretical model by including locus of control into the occupation-related training investment decisions. Using data from the German Socio-Economic Panel (SOEP) they reveal that locus of control relates to training participation through employee's expectations about future wage returns. The study closest to ours regards the Big Five personality traits and locus of control based on data from the SOEP (Offerhaus, 2012). In this study, agreeableness, extraversion and neuroticism do not affect occupation-related further training participation. In contrast, individuals who are open to new experiences and have a high internal locus of control are more likely to participate in work-related further training. However, existing studies do not differentiate between different types of training, for example course-based training vs. informal learning, which may be relevant, when it comes to personality traits as potential determinants of the initiation and continuity of different training activities. Furthermore, the importance of lifelong learning for social participation until an older age requires analyzing continuing education beyond occupation-related training.

The Present Study

In summary, we know little about how non-cognitive skills affect further training decisions. This gap is in stark contrast to the substantial prior research on socio-emotional skills and their importance for predicting educational achievement, labor market success and a broad range of life outcomes (Heckman et al., 2006; Borghans et al., 2008; Almlund et al., 2011; Heckman and Kautz, 2012; Lechner et al., 2019a). Previous studies point to increasing returns to socio-emotional skills over the past decades, specifically as complements to cognitive skills (Brunello and Schlotter, 2011; Deming, 2017; Edin et al., 2017). This increase may at least partially be driven by the growing importance of further training participation, which may be affected by socio-emotional skills.

Likewise, we know little about the effects of personality traits as a subdomain of socio-emotional skills on lifelong learning. Exceptions are the two aforementioned studies focusing on employment-related training activities without further specification of the training type. The participation in occupational further training is affected by both locus of control (Caliendo et al., 2020) and openness to experience (Offerhaus, 2012). However, given the need for continuous investments in human capital to adapt to changing environments both inside and outside of the labor market, it is important to understand which socio-emotional skills act as barriers or promote lifelong learning in general.

To close this research gap, we provide an in-depth analysis of the role of personality traits for further training participation. We focus on the Big Five Personality Dimensions and investigate first whether the relationship between personality and further training varies by training type. Differentiating between non-formal training (i.e., course-based training without a formal degree) and informal training (i.e., training without structured coursework), may be relevant, as the different training types differ in their requirement for training initiation, involvement, intensity, and continuity. As a result, personality traits may have a different impact on training for different training types. Likewise, the differentiation between employment-related training and lifelong learning for private reasons is important, as personality traits may matter differently for the participation of training inside and outside of the work environment.

Using the Adult Stage of the National Educational Panel Study (NEPS), we show that the Big Five Personality Dimensions significantly relate to further training activities, both for overall further training participation and for specific training types (i.e., differentiating between non-formal and informal training). For non-formal training, we separately look at the reasons to partake in a training activity (i.e., private as opposed to occupationally motivated reasons). The overall pattern of our results indicates that no matter which type of, or reasons for, training we analyze, openness to experience positively relates to further training participation and is the most important determinant of training activities. When differentiating between training types and when estimating separate regressions by gender, different patterns for the Big Five emerge.

Our study adds to the scarce literature on personality traits as determinants of further training participation. In addition to validating prior results on the importance of openness to experiences for occupation-related further training (Offerhaus, 2012), we expand the existing research in several ways. First, we take advantage of the high-quality data provided by the NEPS Adult Cohort study. By using this panel survey, we make use of the yearly measurements of the same individuals, both by averaging repeated measurements to reduce bias from measurement error and by accounting for unobservable heterogeneity when applying panel estimators. We exploit the detailed NEPS questions on different types of further training, as well as its distinction between different reasons for investing in continuous training. Thereby, we analyze whether different personality traits are relevant for non-formal and informal training, as well as for private compared to work-related further training decisions. Second, we use recent survey data, allowing the estimation of the relationship between personality traits and further training in current labor market conditions and societal dynamics, which are shaped by digitalization, demographic changes and a post-recession period. These rapid changes may affect the association between personality traits and training participation over time, possibly revealing that patterns observed in prior studies are changing. Third, we account for average personality differences between men and women and allow for potential gender differences in the association between personality type and training activity.

METHODS

The Data

We use longitudinal data from the German National Educational Panel Study (NEPS), which collects information on complete educational biographies, transitions in educational careers, and lifelong learning on an annual basis since 2008. The NEPS

TABLE 1 | Summary statistics.

	Full Sample			Males			Females		
	Mean	***SD***	**95% CI**	**Mean**	***SD***	**95% CI**	**Mean**	***SD***	**95% CI**
Further training (overall)	0.77	0.42	[0.77, 0.78]	0.79	0.40	[0.79, 0.80]	0.76	0.43	[0.75, 0.77]
Non-formal training	0.40	0.49	[0.40, 0.41]	0.38	0.48	[0.37, 0.39]	0.43	0.50	[0.42, 0.44]
- Privately motivated	0.27	0.45	[0.26, 0.28]	0.23	0.42	[0.22, 0.25]	0.31	0.46	[0.30, 0.33]
Informal training	0.69	0.46	[0.68, 0.69]	0.72	0.45	[0.71, 0.73]	0.66	0.47	[0.65, 0.67]
Age	49.56	9.60	[49.34,49.77]	49.39	9.44	[49.09, 49.67]	49.73	9.77	[49.42, 50.05]
Gender				0.49			0.51		
Education									
- No degree	<0.01			<0.01			<0.01		
- Lower secondary degree	0.18			0.20			0.16		
- Intermediate secondary degree	0.33			0.28			0.38		
- High school degree	0.48			0.51			0.46		
N	17,242			8,532			8,710		

Unweighted. Pooled data. Means and standard deviations (SD); 95% confidence intervals (CI). Gender and age in Wave 8. Rounded percentages for education. Source: Own calculations based on NEPS SUF SC6 9.0.1.

surveys individuals in six starting cohorts from newborn infants to adults (Anger et al., 2019), and uses short recall periods to the previous interview and assists respondents in remembering their activities through recall help. For example, preloads are integrated into the questionnaire of the current interview to help respondents anchor their answers[5]. These procedures make the data very reliable and ensure that information is correctly measured.

To investigate the effect of personality traits on further training, we use the scientific use file NEPS SUF SC 9.0.1 for the Adult Stage (Starting Cohort 6—SC6, Stage 8)[6]. The Adult Cohort is based on the population of working-age adults (in or out of employment) in Germany, born between 1944 and 1986. The respondents are asked about their life course with a focus on lifelong learning and further training.

The Participants

We restrict our sample to wave 5 (Fall 2012 to Spring 2013) and wave 8 (Fall 2015 to Spring 2016) because the Big Five are only surveyed in those years. We further exclude respondents below the age of 25 and above the age of 65 to ensure that the individuals have mostly finished their initial education and are potentially susceptible for further training. Finally, we only include individuals for whom non-missing information on further training participation or non-participation is available for both non-formal and informal training activities[7]. In our full estimation sample with all training types and reasons for training, we thus include 17,242 individual-year observations from 10,559 individuals, of which 6,683 provide the relevant information in both waves.

Table 1 reports the summary statistics for the pooled sample. They show that a little more than half of the sample is female ($N_{female} = 5{,}325$; $N_{male} = 5{,}234$) and the average age in wave 8 is around 49,6 years. The respondents in the sample are relatively highly educated: A high share of all respondents have an intermediate secondary degree (33%— "Realschule") or a high school degree (48%— "Abitur"). Men more often have a high school degree than women, whereas among women, an intermediate secondary degree is more widespread than among men.

The Measures

Further Training Types

We include information on different further training measures that the survey annually asks about. We follow the definition of Eisermann et al. (2014) and distinguish between three types of further training: First, formal further training includes all training activities after initial education, which lead to a formal degree. Initial education can be defined in different ways but usually refers to the educational career until the first employment spell or until an interruption of schooling of more than 12 months (Kruppe and Trepesch, 2017). We refrain from estimating specifications with formal further training as dependent variable because very few adults participate in this training form each year. Second, non-formal training comprises all organized training activities, which may or may not lead to a certificate. Third, informal training is defined as non-structured further training, such as on-the-job training, reading professional literature, visiting conferences, or lectures and using self-learning programs.

Table 2 provides an overview of the different training types, their definitions, sample questions from the questionnaire, and examples of what a specific type of training might be.

[5]Preloads refer to cues from previous interviews, such as a start date of an employment spell or the occupation given in the last interview.

[6]The Adult Stage originates in the survey "Working and Learning in a Changing World" (ALWA) run by the Institute for Employment Research (IAB) in 2007/2008 and integrated into NEPS in 2009 (Allmendinger et al., 2019).

[7]Through this restriction, we only exclude 0.54% of individuals from the sample.

TABLE 2 | Definition and examples for training types and motives.

	Definition	Item in questionnaire (non-comprehensive)	Example of training
Training type			
Formal	Any kind of further training after initial education, which may be a continuation or reuptake of learning activities that lead to a generally accepted degree or to a certified qualification	Now let's talk about your school education. Have you attended a general educational school since <last interview date>. (Please also consider general educational schools of the second chance education type, such as evening schools.)	High school degree, master tradesman's or craftsman's certificate, bachelor or master degree
Non-formal	Specifically organized, course-based training or seminars with or without certificates and without a generally accepted degree	Let's return to the subject of further training. Up until now you have stated that, since the last interview, you attended the following courses or training programs: <list of courses> Since the last interview, have you, in addition to this, i.e., from <last interview date> to the present, attended courses or training programs that you have not yet mentioned?	IT (Excel, Word, etc.), project management, law, cooking, yoga, languages
Informal	Non-organized learning activities that do not lead to a certification or degree; often self-organized training, on-the-job-training	Learning may also be done completely without regulated class and course routines. Since the last interview in <last interview date> did you visit special trade fairs or congresses, to learn more on your own in the professional or private field?	Trade fairs, conferences, professional talks or lectures, professional literature (books and journals), learning CDs or DVDs
Training motive (only available for non-formal training)			
Private	Non-formal training taken for private purposes only	Did you attend this course primarily for professional reasons or rather out of personal reasons? YES	Cooking, yoga, languages
Work-related	Non-formal training taken for employment-related purposes	Did you attend this course primarily for professional reasons or rather out of personal reasons? NO	IT (Excel, Word, etc.), project management, law

Text between < and > refers to Preloads, i.e., the date of the previous interview or a list of previously mentioned training. Definition according to Eisermann et al. (2014). Sample items from questionnaire from https://www.neps-data.de/Portals/0/NEPS/Datenzentrum/Forschungsdaten/SC6/10-0-0/SC6_10-0-0_W10_en.pdf. Initial training is defined as any education spell up to the first employment spell or an educational spell up to a break of more than 12 months (Kruppe and Trepesch, 2017).

In addition to this threefold definition, the NEPS provides information on the motivation for participating in a non-formal training activity (i.e., whether the training was privately or occupationally motivated)[8]. As these additional questions are only asked for a random sample of non-formal training activities, the number of observations decreases for this sample to 5,067 individuals.

The summary statistics for the pooled sample in **Table 1** shows that in the full estimation sample, around 77% of all respondents participated in further training of any type in wave 5 or 8. Men have a slightly higher participation rate compared to women (79 vs. 76%)[9]. Approximately 40% of the respondents attend non-formal training, while 69% pursue informal training. Fewer respondents (27%) participate in privately motivated further training.

Personality Traits

The personality traits we analyze are the Big Five Personality Dimensions. This psychological concept categorizes an individual's personality into five traits: Extraversion, neuroticism, agreeableness, conscientiousness and openness to experience. Each trait consists of characteristics that describe the personality dimension. The personality traits are measured by the well-established "Big Five Inventory Short Scale," the BFI-10 (Rammstedt and John, 2007). This scale includes 11 items asking the respondent to answer on a five-point Likert scale ranging from "*fully disagree*" to "*fully agree*." Each trait is measured by two items with the exception of agreeableness, which is measured by three items (**Table 3**, Column 2).

To evaluate internal consistency, we compute Cronbach's Alpha and Revelle's Omega for each of the Big Five Personality Dimensions provided by the NEPS (**Table 3**, Column 3). Since the Cronbach's Alphas are "a function of the mean inter-item correlation and the number of items comprising the scale" (Gosling et al., 2003, p. 516) and given that our Big Five measures consist of only two or three items per trait, it is not surprising that the Alphas are only of moderate size. The Omegas confirm the results obtained through Cronbach's Alpha. Nevertheless, we follow Rammstedt and John (2007) and Gosling et al. (2003) in their assessments that short Big Five scales are valid, reliable and good proxies for longer scales.

Table 4 displays the means and standard deviations of the Big Five traits for the two available waves for individuals with non-missing information on personality in both waves[10]. The virtually identical mean levels of the Big Five Personality Dimensions

[8]The original question allows a third answer option "both privately and occupationally motivated". We recode this option to be occupationally motivated, as we want to separate out fully privately motivated further training activities.

[9]The difference is significant at the 0.001 significance level.

[10]However, including individuals with information on personality in only one wave virtually produces the same virtually produces the same results. Therefore we use these individuals with only one observation in our regression analyses.

TABLE 3 | The Big Five Personality Dimensions and associated traits.

Big five dimension	Item	Cronbach's alpha and Revelle's omega
Introversion vs. extraversion	is reserved is outgoing, sociable	Alpha: 0.66 Omega: 0.66
Antagonism vs. agreeableness	tends to find fault with others is generally trusting is considerate and kind to almost everyone	Alpha: 0.35 Omega: 0.41
Lack of direction vs. conscientiousness	tends to be lazy does a thorough job	Alpha: 0.43 Omega:0.43
Emotional stability vs. neuroticism	is relaxed, handles stress well gets nervous easily	Alpha: 0.49 Omega: 0.49
Closed to experience vs. openness to experience	has few artistic interests has an active imagination	Alpha: 0.47 Omega: 0.47

Source: NEPS Adult Stage Questionnaire following BFI-10 (Rammstedt and John, 2007). Own calculations based on NEPS SUF SC6 9.0.1 using the R psych package. Number of observations is 17,242.

show that the personality traits on average do not vary much for the whole sample within the 3-years' time interval.

However, mean-level changes for the whole sample may disguise individual variation in personality traits over time due to offsetting changes in a particular trait dimension among individuals [e.g., Roberts (1997), Roberts and DelVecchio (2000)], since personality may vary with specific events or with increasing age [e.g., Roberts and DelVecchio (2000), Roberts et al. (2006), Specht et al. (2011), Damian et al. (2019)], in particular given the relatively large age-range in our sample. Hence, we additionally consider intra-individual changes in personality traits across the two survey waves, and report correlations between wave 5 and wave 8 in the last column of **Table 4**. The intra-individual correlations of openness to experience and extraversion are fairly high (>0.6), while the correlations of the other personality traits are moderate (around 0.55). Given the relatively short time span of only 3 years, we attribute the observed fluctuations mainly to the measurement error from calculating the personality traits based on the two or maximum three items provided by the NEPS. Taken together with the finding in the literature that personality stability reaches a plateau in late middle age (Roberts and DelVecchio, 2000; Soto, 2018), we conclude that the personality traits, and in particular openness to experience and extraversion, do not drastically change in our sample.

Thus, we focus on the core of personality and calculate the averages of the Big Five personality measures across the two waves for individuals with two observations in our sample to use these calculated means for all waves. This allows us to proxy for the part of personality that is relatively stable over time by netting out the time-variant component caused by situational fluctuations and to reduce possible measurement error (Zimmerman, 1992). Since we acknowledge that variability in the traits is truly possible and cannot rule out significant changes in personality traits in our sample, we additionally use the wave-specific measures of the Big Five Personality Dimensions and hence also estimate the effects of time-varying personality traits on further training in our multivariate estimations.

Finally, we recognize that personality may differ between individuals at different stages in the human lifecycle and therefore use age-corrected personality measures[11]. We follow the method by Nyhus and Pons (2012) and regress each trait on age and age squared to use the predicted residuals as "age-free" measures for the analyses. This procedure picks up possible maturity and feedback effects on personality over the lifecycle, for example via an individual's job and the social environment. We normalize each Big Five trait to a mean of zero and a standard deviation of one for each wave and generate an index, which is better able to reflect the continuum of personality and allows an easier interpretation of the results.

Table 5 compares the standardized age-corrected Big Five personality measures of further training participants and non-participants used in our multivariate analyses. The *t*-tests to examine whether participants of further training activities and non-participants significantly differ in their average personality traits reveal that participants and non-participants significantly differ in four dimensions. At this descriptive level, training participants are on average more extroverted and indicate a higher level of openness to new experience, while they appear to be less conscientious and less neurotic than non-participants.

Control Variables

We use a set of covariates to reduce potential biases from confounding variables or selection when estimating the relationship between the Big Five and further training. Thus, we control for demographic variables, namely gender, age and education (no degree, lower secondary degree, intermediate secondary degree, high school degree), as they relate to the Big Five and further training participation. Furthermore, we control for the presence of children under 6 years living in the household, household income and unemployment, as these characteristics may affect the respondents in their ability to participate in further training. We additionally control for the survey wave.

Statistical Analysis

The Binary Outcome Model

We estimate binary outcome models, where an individual *i* either takes part in a training activity in a particular wave *t* or not:

$$FTP_{it} = \begin{cases} 1 & \text{if } i \text{ participates in further training in wave } t \\ 0 & \text{if } i \text{ does not participate in further training in wave } t \end{cases}$$

As we estimate the predicted probabilities of different training outcomes, FTP_{it} is a dummy for either (1) overall further training participation, (2) non-formal further training participation, or (3) informal further training participation. For non-formal further training, we additionally differentiate in (4)

[11]To be precise, we are not able to differentiate between possible age and cohort effects. Any differences in personality between birth cohorts will also be picked up by the age-correction in our sample.

TABLE 4 | Means, standard deviations and intra-individual correlations of the Big Five Personality Dimensions.

	Wave 5			Wave 8			Intra-individual correlation across waves	
	Mean	***SD***	**95% CI**	**Mean**	***SD***	**95% CI**	**CC (*p*-values)**	**95% CI**
Extraversion	3.376	0.919	[3.354, 3.398]	3.381	0.881	[3.359, 3.402]	0.653*** (<0.001)	[0.639; 0.667]
Agreeableness	3.577	0.589	[3.562, 3.591]	3.565	0.565	[3.551, 3.578]	0.542*** (<0.001)	[0.525; 0.559]
Conscientiousness	4.028	0.714	[4.011, 4.045]	3.981	0.687	[3.965, 3.998]	0.581*** (<0.001)	[0.565; 0.596]
Neuroticism	2.573	0.798	[2.554, 2.593]	2.620	0.776	[2.602, 2.639]	0.544*** (<0.001)	[0.526; 0.560]
Openness	3.480	0.908	[3.458, 3.502]	3.403	0.897	[3.381, 3.424]	0.625*** (<0.001)	[0.611; 0.640]
N	6,683			6,683			6,683	

Means and standard deviations (SD). Correlation coefficient (CC) only for individuals with non-missing observations in both waves. Non-standardized personality traits. Unweighted. Pooled data.
**p < 0.05, **p < 0.01, ***p < 0.001.*
Source: Own calculations based on NEPS SUF SC6 0.0.1.

TABLE 5 | Standardized, age-corrected Big Five Personality Dimensions of further training participants and of non-participants.

	(1)		(2)		(3)	
	With further training participation		**Without further training participation**		***t*-test**	
	Mean	**95% CI**	**Mean**	**95% CI**	***t*-value (*p*-value)**	**95% CI**
Extraversion	0.029	[0.012; 0.046]	−0.099	[−0.132; −0.067]	−7.05*** (<0.001)	[−0.164, −0.093]
Agreeableness	0.007	[−0.009; 0.024]	−0.025	[−0.059; 0.008]	−1.77 (0.076)	[−0.068, 0.003]
Conscientiousness	−0.009	[0.026; 0.008]	0.031	[−0.002; 0.063]	2.18** (0.029)	[0.004, 0.075]
Neuroticism	−0.026	[−0.043; −0.010]	0.090	[0.056; 0.124]	6.40*** (<0.001)	[0.081, 0.152]
Openness	0.089	[0.072; 0.105]	−0.305	[−0.337; −0.274]	−21.92*** (<0.001)	[−0.429, −0.359]
N	13,361		3,881		17,242	

Standardized age-corrected personality traits. Unweighted. Pooled data. Individuals may fall into different categorie (with/without further training participation) across waves.
**p < 0.5, **p < 0.01, ***p < 0.001.*
Source: Own calculations based on NEPS SUF SC6 9.0.1.

privately motivated further training participation as opposed to occupation-related training.

Our underlying assumption is that individuals choose to invest in further training, if their expected returns from participating in this training are higher than their costs. The costs can be monetary or non-monetary, such as time and effort expanded in the training. In addition to standard determinants of educational investments, such as age, personality traits may influence this cost-benefit calculation. We focus on the effect of the Big Five Personality Dimensions in our analyses and estimate a binary choice model of the following form:

$$FTP_{it} = a_0 + \mathbf{BF}_i\, a_1 + x'_{it}\, a_2 + \varepsilon_{it}$$

where FTP_{it} is the further training participation dummy for the different training types chosen by individual i in survey wave t. It equals 1 if the individual participates in further training, and zero otherwise. Because we assume in a first specification that the Big Five Personality Dimensions are stable in adults and use the mean personality trait across the available waves, the Big Five Personality Dimensions BF_i are time-invariant in most of our analyses[12]. The vector X controls for gender and for the time-varying individual characteristics of age, education, the presence of children under 6 years of age in the household, unemployment and household income. We also include time dummies in the estimations to control for wave-specific differences. The error term ε_{it} is clustered at the individual level.

The Estimation Techniques

To gain a preliminary understanding of the importance of personality traits for further training, we start by estimating linear probability models. In a first step, we do not leverage the time variation in further training and use a pooled ordinary least squares estimator (OLS) where we use all waves of each

[12]Note that the Big Five will be treated as time-variant, when we rerun the regressions in a robustness check, where we relax the assumption of stability in the traits and use the wave-specific Big Five instead.

individual without accounting for the different waves. This estimator calculates marginal effects directly and is used for ease of interpretation. In a second step, we estimate Random Effects (RE) OLS models to exploit the time variation in further training and account for unobserved heterogeneity. Any variables that are not observed in the data (i.e., unobserved heterogeneity), may be problematic if they correlate with our variables of interest. Unobserved variables potentially cause omitted variable bias, meaning our results are attributed to personality when they should be attributed to the omitted variable. Potential omitted variables in our sample might be motivation or ability. However, by using panel estimation techniques, we are able to control for these unobserved factors through an individual-specific error term capturing all unobserved time-invariant heterogeneity and thereby producing consistent results[13].

While OLS estimators are preferable because of their ease of interpretation, their caveat is that they rely on the dependent variable being continuous. However, our dependent variables only have two outcomes, namely the participation in a further training or the non-participation. Therefore, we refine the models by using a non-linear specification and choose an estimator with a normal distribution assumption, the Probit estimator. This estimator's coefficients do not directly yield marginal effects. As we are interested in the ceteris paribus effect that a change in a personality trait has on the predicted probability of further training participation, we calculate average marginal effects and present these in the tables.

The Pooled Probit estimator has the advantage that we may compare our results with these from the prior literature. However, as these results may be biased due to unobserved factors (i.e., omitted variable bias), we prefer specifications which exploit the panel data. Therefore, we take advantage of the additional information in the time variation and control for unobserved heterogeneity by estimating Random Effects Probit models.

As mentioned before, we follow the 2-fold strategy of first using the means of the Big Five measures over time to capture the stable part of personality and to reduce the potential bias resulting from measurement error, and second, estimating regressions based on time-varying Big Five measures to allow for variability in personality.

RESULTS

Overall Training Participation

First, we analyze the effect of the Big Five Personality Dimensions on overall training participation. This measure includes all non-formal and informal as well as work-related and private training activities. **Table 6** presents the coefficients for the pooled OLS and the RE estimations (panel A). We then show the average marginal effects for the Pooled Probit and RE Probit estimations (panel B). For each model, we first show the results without control variables and the results with controls in the adjoining column. We present results from OLS regressions for comparison with previous studies and as these allow for a more intuitive interpretation, but prefer the Probit specification, as this models the data more correctly. For either method, the resulting marginal effects are quite similar and therefore we merely focus on the Probit results in the following tables.

With respect to the control variables, **Table 6** reveals that in all models and specifications, women are significantly less likely to participate in further training compared to men. We also find that the likelihood to participate in further training significantly relates to age. This relationship is curvilinear with a peak at about 44 years of age in the model with additional controls. For our main variables of interest, the estimates show that extraversion and openness to experience positively relate to the predicted probability to participate in further training even after the inclusion of additional control variables. In contrast, the remaining Big Five Personality Dimensions are not significantly associated with further training participation in the specification with controls.

Since we expect a bias in the pooled estimations due to unobserved factors that may affect the outcome, we exploit the panel character of the data and control for time-invariant unobserved individual heterogeneity in the Random Effects Probit estimations. The results confirm the pattern from the pooled estimations, such that extraversion and openness to new experiences positively relate to the dependent variable. In the RE Probit estimation, the effect size of openness to experience and extraversion is slightly smaller compared to the Probit model without Random Effects. Notably, the marginal effect for openness to experience is generally larger in magnitude compared to the other personality traits.

Non-formal and Informal Further Training

We exploit the detailed information on further training available in the NEPS and differentiate in the next step between the different training types. Thus, we run separate estimations for non-formal and informal further training participation to assess whether personality traits equally relate to participation probabilities for organized training activities (non-formal further training) and self-organized and less structured further education (informal further training). Note that informal training is likely to drive the overall results of **Table 6**, as 69% of all respondents participate in informal further training, while only 40% participate in non-formal further training (as indicated by **Table 1**). **Table 7** presents the results for non-formal further training participation and for informal further training participation. When differentiating between further training types, we decrease the information density in the dependent variable (1 = any training vs. 1 = only non-formal (informal) training) leading to less precise estimations.

For the interpretation we again focus on the Random Effects Probit models with control variables. We find a recurring pattern for extraversion and openness to experience, both of which

[13]Note that we use Random Effects as opposed to Fixed Effects estimators, as the Fixed Effect's identification relies on the time-variation of our variables. As the fixed effects estimate a de-meaned model by subtracting the average of the period for each individual, many of our variables would be eliminated, as they do not vary with time, such as the Big Five, gender and education. The Random Effects model treats unobserved individual effects as stochastic variable, whereas the Fixed Effects model treats it as time constant effects (Wooldridge, 2010).

TABLE 6 | Big Five Personality Dimensions and participation in overall further training.

Panel A: Pooled OLS (top) and Random Effects (bottom)

	Pooled OLS model					
	Model 1			Model 2		
	Average ME	***p*-value**	**95% CI**	**Average ME**	***p*-value**	**95% CI**
Extraversion	0.0123***	(<0.001)	[0.00572, 0.0190]	0.0139***	(<0.001)	[0.00757, 0.0203]
Agreeableness	0.00236	(0.476)	[−0.00413, 0.00886]	0.00488	(0.126)	[−0.00137, 0.0111]
Conscientiousness	−0.0133***	(<0.001)	[−0.0197, −0.00687]	−0.00380	(0.227)	[−0.00995, 0.00236]
Neuroticism	−0.0102**	(0.003)	[−0.0169, −0.00348]	−0.00349	(0.287)	[−0.00992, 0.00294]
Openness	0.0696***	(<0.001)	[0.0632, 0.0759]	0.0540***	(<0.001)	[0.0479, 0.0602]
Age	0.0217***	(<0.001)	[0.0165, 0.0270]	0.00871**	(0.001)	[0.00348, 0.0139]
Age^2	−0.000277***	(<0.001)	[−0.000334, −0.000220]	−0.000123***	(<0.001)	[−0.000180, −0.0000666]
Gender	−0.0509***	(<0.001)	[−0.0639, −0.0379]	−0.0433***	(<0.001)	[−0.0558, −0.0308]
Additional controls	No			Yes		
N	17,242			17,242		
	Random Effects model					
Extraversion	0.0120***	(0.001)	[0.00507, 0.0190]	0.0137***	(<0.001)	[0.00708, 0.0204]
Agreeableness	0.00357	(0.302)	[−0.00321, 0.0104]	0.00552	(0.098)	[−0.00102, 0.0121]
Conscientiousness	−0.00989**	(0.004)	[−0.0165, −0.00325]	−0.00212	(0.515)	[−0.00850, 0.00426]
Neuroticism	−0.00941**	(0.008)	[−0.0163, −0.00249]	−0.00382	(0.260)	[−0.0105, 0.00283]
Openness	0.0622***	(<0.001)	[0.0554, 0.0690]	0.0492***	(<0.001)	[0.0427, 0.0557]
Age	0.0209***	(<0.001)	[0.0153, 0.0266]	0.00913**	(<0.001)	[0.00356, 0.0147]
Age^2	−0.000269***	(<0.001)	[−0.000330, −0.000208]	−0.000127***	(<0.001)	[−0.000187, −0.0000668]
Gender	−0.0511***	(<0.001)	[−0.0656, −0.0366]	−0.0438***	(<0.001)	[−0.0576, −0.0301]
Additional controls	No			Yes		
N	17,242			17,242		

Panel B: Pooled Probit (top) and Random Effects Probit (bottom)

	Pooled OLS model					
	Model 1			Model 2		
	Average ME	***p*-value**	**95% CI**	**Average ME**	***p*-value**	**95% CI**
Extraversion	0.0123***	(0.001)	[0.00535, 0.0192]	0.0132***	(<0.001)	[0.00675, 0.0197]
Agreeableness	0.00323	(0.352)	[−0.00358, 0.0100]	0.00539	(0.096)	[−0.000966, 0.0117]
Conscientiousness	−0.0134***	(<0.001)	[−0.0202, −0.00650]	−0.00361	(0.268)	[−0.00999, 0.00277]
Neuroticism	−0.0100**	(0.005)	[−0.0170, −0.00309]	−0.00312	(0.343)	[−0.00955, 0.00332]
Openness	0.0682***	(<0.001)	[0.0616, 0.0747]	0.0518***	(<0.001)	[0.0456, 0.0580]
Age	0.0199***	(<0.001)	[0.0143, 0.0254]	0.00801**	(0.005)	[0.00247, 0.0136]
Age^2	−0.000255***	(<0.001)	[−0.000314, −0.000195]	−0.000112***	(<0.001)	[−0.000171, −0.0000532]
Gender	−0.0499***	(<0.001)	[−0.0643, −0.0355]	−0.0420***	(<0.001)	[−0.0556, −0.0285]
Additional controls	No			Yes		
N	17,242			17,242		
	Random Effects model					
Extraversion	0.0122***	(<0.001)	[0.00540, 0.0190]	0.0131***	(<0.001)	[0.00674, 0.0195]
Agreeableness	0.00431	(0.202)	[−0.00231, 0.0109]	0.00599	(0.059)	[−0.000225, 0.0122]
Conscientiousness	−0.0106**	(0.002)	[−0.0173, −0.00391]	−0.00246	(0.442)	[−0.00874, 0.00381]
Neuroticism	−0.00925**	(0.007)	[−0.0160, −0.00254]	−0.00339	(0.289)	[−0.00966, 0.00288]

(Continued)

TABLE 6 | Continued

Panel B: Pooled Probit (top) and Random Effects Probit (bottom)

	Random Effects model					
	Model 1			Model 2		
	Average ME	***p*-value**	**95% CI**	**Average ME**	***p*-value**	**95% CI**
Openness	0.0616***	(<0.001)	[0.0551, 0.0681]	0.0476***	(<0.001)	[0.0414, 0.0538]
Age	0.0197***	(<0.001)	[0.0141, 0.0252]	0.00857**	(0.002)	[0.00308, 0.0141]
Age^2	−0.000252***	(<0.001)	[−0.000311, −0.000193]	−0.000117***	(<0.001)	[−0.000176, −0.0000592]
Gender	−0.0500***	(<0.001)	[−0.0644, −0.0356]	−0.0419***	(<0.001)	[−0.0554, −0.0284]
Additional controls	No			Yes		
N	17,242			17,242		

Average marginal effects (ME) with p-values in parentheses and confidence interval (CI) in square brackets.
**p < 0.05, ** p < 0.01, *** p < 0.001.*
Panel A: Average marginal effects of pooled ordinary least squares (OLS) and random effects estimation. Robust standard errors clustered at the individual level (10,559 individuals).
Panel B: Average marginal effects of pooled probit and random effects probit estimation. Robust standard errors are clustered at the individual level (10,559 individuals).
Model 1 in each panel contains the following control variables: Gender (female = 1), age, and a wave indicator. Model 2 contains the following additional control variables: Children under six years in the household (yes = 1), education (no degree, lower secondary degree, intermediate secondary degree, high school degree), household income, unemployment (yes = 1).
Source: Own calculations based on NEPS SUF SC6 9.0.1.

are significantly and positively associated with the training probabilities for non-formal as well as for informal further training. The coefficient for openness to new experiences is smaller in the non-formal further training estimation than in the informal training estimation.

Differentiating between training types also reveals different effects for agreeableness, which is positively related to non-formal further training probabilities, but not to informal further training probabilities.

Gender Differences in Non-formal Further Training

The overall effect differs by gender, as men are more likely to participate in further training, as is shown in **Table 6**. However, we observe differential gender effects by the type of further training, as becomes evident in **Table 7**[14]. Women are more likely than men to participate in non-formal further training, but less likely to participate in informal further training. As this result shows interesting gender differences, we investigate these opposing effects more in-depth. Therefore, we estimate the equations with non-formal further training as dependent variable separately for men and women. **Table 8** reveals that for both men and women, the results for openness to new experiences remain robust, but the effects of openness to experience are larger for women than they are for men. Additionally, further training decisions of both men and women slightly increase with extraversion.

Moreover, we observe gender differences for agreeableness, conscientiousness and neuroticism. Agreeableness positively relates to non-formal further training participation for women only. In contrast, conscientiousness and neuroticism negatively relate to womens', but not mens', non-formal training participation. The marginal effect sizes relate to those of extraversion.

Privately Motivated Non-formal Further Training

For the subsample of non-formal further training, information on the reasons for partaking in the training activity is available. These reasons can be private or occupationally motivated. **Table 9** shows that consistent with **Table 1**, women are more likely to participate in private further training activities than men. We additionally observe that the direction of the age coefficients reverses.

Consistent with the previous results, openness to experience positively relates to privately motivated training—albeit with a smaller magnitude. Surprisingly, extraversion does not seem to be associated with participation in privately motivated further training. However, in contrast to **Table 8**, we now observe that training activities are slightly yet positively associated with neuroticism. Furthermore, conscientiousness negatively relates to privately motivated further training.

Robustness Checks With Time-Varying Personality Traits

In response to the potential caveat that the means of the individual Big Five Personality Dimensions within individuals may not adequately capture the variability of personality traits, we re-estimate our main regressions with time-varying personality traits. To allow for a detailed comparison between the two methods, the results are displayed in **Tables A1–A4**. We show that for each regression, the patterns of the Big Five remain the same. Hence, we do not find substantial differences in the estimation results when we estimate the regressions with averages of the Big Five or with time-variant Big Five.

[14] A suest-test shows that the gender differences are statistically significant (chi squared = 117.89).

TABLE 7 | Big Five Personality Dimensions and non-formal and informal further training participation.

Panel A: Participation in non-formal further training

	Pooled OLS model					
	Model 1			Model 2		
	Average ME	*p*-value	95% CI	Average ME	*p*-value	95% CI
Extraversion	0.0141***	(<0.001)	[0.00621, 0.0221]	0.0143***	(<0.001)	[0.00652, 0.0222]
Agreeableness	0.0109**	(0.005)	[0.00327, 0.0186]	0.0132***	(0.001)	[0.00559, 0.0208]
Conscientiousness	−0.0123**	(0.002)	[−0.0201, −0.00445]	−0.00710	(0.073)	[−0.0148, 0.000653]
Neuroticism	−0.0103*	(0.010)	[−0.0181, −0.00243]	−0.00547	(0.167)	[−0.0132, 0.00229]
Openness	0.0402***	(<0.001)	[0.0324, 0.0480]	0.0320***	(<0.001)	[0.0243, 0.0398]
Age	0.0318***	(<0.001)	[0.0253, 0.0383]	0.0205***	(<0.001)	[0.0139, 0.0271]
Age^2	−0.000380***	(<0.001)	[−0.000449, −0.000310]	−0.000250***	(<0.001)	[−0.000321, −0.000179]
Gender	0.0449***	(<0.001)	[0.0285, 0.0614]	0.0521***	(<0.001)	[0.0359, 0.0683]
Additional controls	No			Yes		
N	17,242			17,242		
	Random Effects model					
Extraversion	0.0135***	(0.001)	[0.00565, 0.0213]	0.0139***	(<0.001)	[0.00620, 0.0217]
Agreeableness	0.0105**	(0.006)	[0.00297, 0.0181]	0.0127***	(0.001)	[0.00525, 0.0202]
Conscientiousness	−0.0112**	(0.004)	[−0.0189, −0.00350]	−0.00650	(0.096)	[−0.0142, 0.00116]
Neuroticism	−0.0110**	(0.005)	[−0.0187, −0.00329]	−0.00651	(0.096)	[−0.0142, 0.00116]
Openness	0.0393***	(<0.001)	[0.0316, 0.0469]	0.0314***	(<0.001)	[0.0237, 0.0391]
Age	0.0322***	(<0.001)	[0.0258, 0.0386]	0.0212***	(<0.001)	[0.0146, 0.0278]
Age^2	−0.000385***	(<0.001)	[−0.000453, −0.000316]	−0.000259***	(<0.001)	[−0.000329, −0.000188]
Gender	0.0449***	(<0.001)	[0.0286, 0.0613]	0.0518***	(<0.001)	[0.0357, 0.0679]
Additional controls	No			Yes		
N	17,242			17,242		

Panel B: Participation in informal further training

	Pooled Probit model					
	Model 1			Model 2		
	Average ME	*p*–value	95% CI	Average ME	p–value	95% CI
Extraversion	0.0101*	(0.011)	[0.00236, 0.0179]	0.0125***	(0.001)	[0.00524, 0.0199]
Agreeableness	0.00276	(0.475)	[−0.00482, 0.0103]	0.00505	(0.162)	[−0.00203, 0.0121]
Conscientiousness	−0.0110**	(0.005)	[−0.0186, −0.00338]	0.00114	(0.753)	[−0.00598, 0.00826]
Neuroticism	−0.0100*	(0.011)	[−0.0178, −0.00231]	−0.00250	(0.496)	[−0.00970, 0.00470]
Openness	0.0793***	(<0.001)	[0.0721, 0.0866]	0.0596***	(<0.001)	[0.0526, 0.0666]
Age	0.0145***	(<0.001)	[0.00808, 0.0208]	0.00323	(0.313)	[−0.00304, 0.00951]
Age^2	−0.000190***	(<0.001)	[−0.000258, −0.000122]	−0.0000509	(0.135)	[−0.000118, 0.0000158]
Gender	−0.0742***	(<0.001)	[−0.0904, −0.0581]	−0.0664***	(<0.001)	[−0.0816, −0.0512]
Additional controls	No			Yes		
N	17,242			17,242		
	Random Effects Probit model					
Extraversion	0.0108**	(0.005)	[0.00323, 0.0183]	0.0128***	(<0.001)	[0.00572, 0.0200]
Agreeableness	0.00439	(0.240)	[−0.00293, 0.0117]	0.00610	(0.083)	[−0.000796, 0.0130]
Conscientiousness	−0.00831*	(0.026)	[−0.0157, −0.000973]	0.00178	(0.614)	[−0.00515, 0.00872]
Neuroticism	−0.00788*	(0.036)	[−0.0153, −0.000495]	−0.00196	(0.580)	[−0.00892, 0.00500]

(Continued)

TABLE 7 | Continued

Panel B: Participation in informal further training

	Random Effects Probit Model					
	Model 1			Model 2		
	Average ME	*p*–value	95% CI	Average ME	p–value	95% CI
Openness	0.0686***	(<0.001)	[0.0614, 0.0759]	0.0526***	(<0.001)	[0.0456, 0.0595]
Age	0.0137***	(<0.001)	[0.00737, 0.0199]	0.00344	(0.275)	[−0.00274, 0.00962]
Age^2	−0.000182***	(<0.001)	[−0.000249, −0.000115]	−0.0000526	(0.116)	[−0.000118, 0.0000130]
Gender	−0.0750***	(<0.001)	[−0.0911, −0.0589]	−0.0668***	(<0.001)	[−0.0819, −0.0517]
Additional controls	No			Yes		
N	17,242			17,242		

Average marginal effects (ME) with p-values in parentheses and confidence interval (CI) in square brackets.
**p < 0.05, **p < 0.01, ***p < 0.001.*
Panel A: Average marginal effects of pooled probit and random effects probit estimation. Robust standard errors clustered at the individual level (10,559 individuals). Model 1 in each panel contains the following control variables: Gender (female = 1), age, and a wave indicator. Model 2 contains the following additional control variables: Children under six years in the household (yes = 1), education (no degree, lower secondary degree, intermediate secondary degree, high school degree), household income, unemployment (yes = 1).
Source: Own calculations based on NEPS SUF SC6 9.0.1.

DISCUSSION

Our analyses based on the Adult Stage of the NEPS reveal a number of findings that expand the existing literature on the relationship between the Big Five personality traits and further training participation.

We exploit the panel character of the dataset and take advantage of yearly measurements of the same individuals, both by averaging repeated measurements to reduce bias from measurement error and by accounting for unobservable heterogeneity by using panel estimators. We show that the relationship between personality and further training participation is not simply a spurious correlation.

We exploit the high-quality data stemming from detailed NEPS questions on different types of further training, as well as its distinction between different reasons for investing in continuous training. Our in-depth-analyses show that differentiating between different training types (i.e., non-formal and informal, as well as work-related and private training) is important, as the five personality traits relate to these training outcomes differently.

We also shed light on gender and age effects for further training participation and highlight that the results are not generalizable over all training types, and hence differentiation is necessary. Finally, we reveal that consistent patterns for personality traits exist across all estimations, namely that openness to new experiences and extraversion positively relate to further training participation, no matter the training type. We discuss these results in detail in this section.

Age and Further Training

The overlying pattern that emerges from our data with respect to age is that the likelihood to participate in further training increases until middle adulthood—with a peak at nearly 40 years—and then decreases with each additional year. According to human capital theory, older individuals arrive at different cost-benefit calculations because, due to their shorter remaining lifetime and professional career, the returns to educational investments are less likely to exceed their costs. However, when focusing on private training, we find that the sign of the coefficients reverses for private training. This finding indicates that occupational training investments drive the age effect and that the cost-benefit calculations in a private setting are different from those in an occupational context[15].

Lower costs may also explain this age effect, as individuals grow older and hence may have more time for leisure training activities due to fewer family obligations. This age effect may also indicate that older individuals exploit private further training opportunities to remain up-to-date in terms of social participation. Thus, it seems that societal and private benefits are more likely to outweigh costs with age.

In addition, we explore how the importance of personality traits changes across age. Thereby we calculate the marginal effects of the Random Effects Probit specification (**Table 6**) for the two significant personality traits—openness to experience and extraversion—at each age. The results as shown in **Supplementary Figures 1, 2** illustrate that the marginal effects decrease with age. However, as the confidence bands overlap for each age, this result merely shows a tendency. We presume that the marginal effects are not statistically different from each other, as more observations are needed to conclusively regard the importance of personality across age.

[15]In addition to the differential outcomes of privately motivated and work-related training, the costs may vary substantially both in size and in the financial burden to the individual, in particular when private training is compared with employer-provided training measures.

TABLE 8 | Big Five Personality Dimensions and participation in non–formal training by gender.

	Males					
	Pooled Probit model			Random Effects Probit model		
	Average ME	***p*–value**	**95% CI**	**Average ME**	***p*-value**	**95% CI**
Extraversion	0.0147**	(0.010)	[0.00358, 0.0258]	0.0145**	(0.010)	[0.00351, 0.0255]
Agreeableness	0.0104	(0.053)	[−0.000129, 0.0210]	0.00968	(0.069)	[−0.000772, 0.0201]
Conscientiousness	−0.000571	(0.917)	[−0.0113, 0.0102]	−0.000336	(0.951)	[−0.0110, 0.0103]
Neuroticism	0.00271	(0.634)	[−0.00842, 0.0138]	0.00180	(0.749)	[−0.00923, 0.0128]
Openness	0.0178**	(0.002)	[0.00663, 0.0290]	0.0181**	(0.001)	[0.00702, 0.0291]
Age	0.0215***	(<0.001)	[0.0124, 0.0306]	0.0224***	(<0.001)	[0.0134, 0.0314]
Age^2	−0.000278***	(<0.001)	[−0.000375, −0.000181]	−0.000287***	(<0.001)	[−0.000384, −0.000191]
Additional controls	Yes			Yes		
N	8,532			8,532		
	Females					
Extraversion	0.0136*	(0.015)	[0.00260, 0.0246]	0.0130*	(0.019)	[0.00214, 0.0239]
Agreeableness	0.0168**	(0.003)	[0.00586, 0.0276]	0.0167**	(0.002)	[0.00600, 0.0275]
Conscientiousness	−0.0131*	(0.021)	[−0.0243, −0.00202]	−0.0121*	(0.030)	[−0.0231, −0.00117]
Neuroticism	−0.0124*	(0.024)	[−0.0232, −0.00161]	−0.0137*	(0.012)	[−0.0243, −0.00304]
Openness	0.0445***	(<0.001)	[0.0338, 0.0553]	0.0430***	(<0.001)	[0.0324, 0.0536]
Age	0.0181***	(<0.001)	[0.00841, 0.0278]	0.0190***	(<0.001)	[0.00935, 0.0287]
Age^2	−0.000207***	(<0.001)	[−0.000310, −0.000103]	−0.000217***	(<0.001)	[−0.000320, −0.000114]
Additional controls	Yes			Yes		
N	8,710			8,710		

Average marginal effects (ME) with p-values in parentheses and confidence interval (CI) in square brackets.
**p < 0.05, **p < 0.01, ***p < 0.001.*
Robust standard errors clustered at the individual level. 5,234 males and 5,325 females.
All models contain the following additional control variables: Children under six years in the household (yes = 1), education (no degree, lower secondary degree, intermediate secondary degree, high school degree), household income, unemployment (yes = 1) and a wave indicator. The dependent variable is non-formal further training participation (= 1). A suest-test confirms that the genders significantly differ from each other.
Source: Own calculations based on NEPS SUF SC6 9.0.1.

Personality Traits and Further Training Participation

We first look at overall further training participation i.e., we do not differentiate between different training types in a first step. The results show a positive relationship between extraversion and further training participation, indicating that outgoing and social individuals are more likely to partake in further training than reserved individuals are. Openness to new experiences also positively relates to overall further training participation.

Estimating Pooled Probit models allows us to compare our results with prior results presented by Offerhaus (2012). While we corroborate these earlier results for the positive effect of openness to experience, extraversion was not significant in the previous study.

Compared to the other personality traits, the average marginal effects for openness to experience are larger in magnitude. Thus, openness to experience seems to be the trait most affecting lifelong learning participation decisions. We want to highlight that the marginal effect for openness to experience is smaller in the sample for non-formal training, than it is for overall and informal training. This finding may be driven by the fact that most non-formal further training is occupation-related, as shown in **Table 1**, where only 27% of the randomly drawn non-formal training are privately motivated. Training activities for occupational reasons may hinge less strongly on openness to experience because the decision to partake in a further training measure is likely not only taken by the employee, but by the employer or at least in accordance with the employer.

When we differentiate between non-formal and informal further training, the main patterns for extraversion and openness to experience remain the same. We also observe a positive relationship between agreeableness and non-formal further training, while this personality trait does not relate to informal further training. We assume that agreeable individuals do not refuse to partake in non-formal courses, particularly as employers often require them. They might however be more reluctant to ask for informal training opportunities.

Overall, we can confirm the importance of openness to experiences for further training participation (Offerhaus 2012). Using recent survey data from the NEPS on adults living in Germany, we show that despite rapid changes in labor market conditions and societal dynamics shaped by digitalization, demographic changes and a post-recession period, the relationship between personality traits and further training holds.

TABLE 9 | Big Five personality dimensions and privately motivated non-formal further training participation.

	Pooled Probit model					
	Model 1			Model 2		
	Average ME	*p*-value	95% CI	Average ME	*p*-value	95% CI
Extraversion	0.0117	(0.056)	[−0.000295, 0.0238]	0.0115	(0.061)	[−0.000530, 0.0236]
Agreeableness	−0.00289	(0.630)	[−0.0147, 0.00888]	−0.00298	(0.620)	[−0.0148, 0.00881]
Conscientiousness	−0.0199***	(0.001)	[−0.0316, −0.00823]	−0.0209***	(<0.001)	[−0.0326, −0.00919]
Neuroticism	0.0135*	(0.036)	[0.000884, 0.0261]	0.0129*	(0.045)	[0.000271, 0.0256]
Openness	0.0212***	(<0.001)	[0.00937, 0.0330]	0.0210***	(0.001)	[0.00905, 0.0329]
Age	−0.0351***	(<0.001)	[−0.0451, −0.0252]	−0.0326***	(<0.001)	[−0.0429, −0.0224]
Age^2	0.000402***	(<0.001)	[0.000293, 0.000511]	0.000377***	(<0.001)	[0.000265, 0.000488]
Gender	0.0755***	(<0.001)	[0.0516, 0.0994]	0.0755***	(<0.001)	[0.0514, 0.0997]
Additional controls	No			Yes		
N	6,364			6,364		
	Random Effects Probit Model					
Extraversion	0.0109	(0.074)	[−0.00107, 0.0229]	0.0109	(0.076)	[−0.00114, 0.0229]
Agreeableness	−0.00152	(0.799)	[−0.0132, 0.0102]	−0.00173	(0.772)	[−0.0134, 0.00998]
Conscientiousness	−0.0191**	(0.001)	[−0.0307, −0.00756]	−0.0200***	(0.001)	[−0.0316, −0.00837]
Neuroticism	0.0139*	(0.028)	[0.00150, 0.0264]	0.0134*	(0.034)	[0.000984, 0.0259]
Openness	0.0202***	(0.001)	[0.00845, 0.0319]	0.0199***	(0.001)	[0.00809, 0.0318]
Age	−0.0350***	(<0.001)	[−0.0449, −0.0251]	−0.0325***	(<0.001)	[−0.0427, −0.0223]
Age^2	0.000402***	(<0.001)	[0.000293, 0.000510]	0.000376***	(<0.001)	[0.000265, 0.000487]
Gender	0.0763***	(<0.001)	[0.0525, 0.100]	0.0765***	(<0.001)	[0.0525, 0.101]
Additional controls	No			Yes		
N	6,364			6,364		

Average marginal effects (ME) with p-values in parentheses and confidence interval (CI) in square brackets.
**p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the individual level (5,067 individuals). Model 1 contains the following control variables: Gender (female = 1), age, and a wave indicator. Model 2 contains the following additional control variables: Children under six years in the household (yes = 1), education (no degree, lower secondary degree, intermediate secondary degree, high school degree), household income, unemployment (yes = 1).*
Random sample of respondents with participation in non-formal further training, who were asked whether their non-formal further training was privately motivated (= 1), occupationally motivated (= 0) or both (= 0).
Source: Own calculations based on NEPS SUF SC6 9.0.1.

When we look at privately motivated training, we find that openness to experience consistently positively relates to further training participation. Extraversion, however, does not. We additionally find that participation increases with higher scores of neuroticism. This result emphasizes the role of structured training offers, as neurotic individuals may appreciate organized further training in private life to feel more assured and less stressed about their privately motivated endeavors. Furthermore, conscientiousness negatively relates to privately motivated training. We hypothesize that conscientious individuals may not partake in a privately motivated training, when they simultaneously have to meet work requirements. Thus, when job responsibilities and deadlines conflict with a training opportunity, conscientious individuals may favor job requirements over the training.

Gender Differences in the Relationship Between the Big Five and Further Training

In most specifications, we find that women are less likely to participate in further training. This result is consistent with findings for Switzerland, where women participate less in employer-provided training compared to men. Surprisingly, this finding cannot be explained by part-time work and part-time vs. full-time inequalities (Backes-Gellner et al., 2014). However, in prior results for Germany, summarized by Dietz and Zwick (2020), female training participation seems to be similar to that of men and it is assumed that men are more likely to participate in employer-initiated training, while women seem to be responsible themselves for their training endeavors.

However, we do observe different gender effects when we differentiate between non-formal and informal further training participation. The results from **Table 7** indicate that the overall negative effect for women presented in **Table 6** is driven by informal further training participation[16]. We propose three possible explanations for these gender differences: First, we suggest that due to working part-time and family obligations,

[16]Note, that the gender effect merely reflects the number of trainings. A report shows that men and women additionally differ in training content and length (Janssen and Wölfel, 2017).

women on average have fewer opportunities to participate in informal training activities both at work and during leisure time. Second, the effect on non-formal training may partly be driven by private training, which women are more likely to attend even during leisure time (compare **Table 1**). Thus, women who participate in structured classes for leisure activities are likely to drive this result. Third, many regulated occupations, such as for example occupations in the medical sector, require obligatory further training in regular intervals. Given the higher share of women in these occupations, for example in nursing, the obligatory character of further training may drive the results.

Notably, we also find differences for the relationship between the Big Five personality traits and non-formal further training as outcome when we estimate the specification separately for men and women. For women, agreeableness is negatively correlated to non-formal further training participation. Similarly, the marginal effect for conscientiousness is negative. A possible explanation is that highly conscientious women are inclined to prioritize their job or family duties at the expense of training investments. Finally, we also observe a negative relationship between neuroticism and non-formal further training for women. Overall, these results imply that personality traits play a different role for men and women. Particularly it seems that personality traits are more important for women's further training participation than for men's.

Limitations and Outlook

Our analyses face some limitations, which should be mentioned: First, we do not claim causality with our study, as we only show correlations. Second, while NEPS is of high data quality and allows in-depth investigations of further training participation, the sample is selective in terms of an education bias, which means that we likely regard a sample that is more educated than the population.

Third, we are limited in the measurement of the Big Five. On the one hand, the personality traits were only measured in two waves, which means we might be dealing with measurement error. On the other hand, the Big Five are measured via the short-scale following Rammstedt and John (2007). While the short-scale does not capture as much detailed information as the full scale, it nevertheless has some non-negligible advantages, as it reduces respondent burden and saves time. In addition, previous studies have demonstrated that the short scale captures 70% of the long-scales variance (Rammstedt and John, 2007) and show that short scales are reliable and valid proxies for longer scales (Gosling et al., 2003; Rammstedt and John, 2007). Nevertheless, the short scale lends itself to higher measurement error compared to the long-scale. In addition, due to decreased initial variations and measurement of only two items per personality trait, we may only be estimating lower bounds (Spengler et al., 2013) of the relationship between personality traits and further training participation.

Notably, we find that our main results do not change when we estimate the regressions using wave-specific personality measures instead of the averages of the Big Five. This result may imply that we indeed capture a stable part of personality, which does not change across the waves in our sample. Averages therefore capture the effects of the Big Five well. At the same time, the time lapse between the measurements of the Big Five is not very long (i.e., 3 years) and therefore it might still be possible that personality changes can occur in this sample when a longer period becomes available.

These limitations also imply space for future research, for which we want to highlight some possibilities. While we find that openness to experience is the most important personality trait affecting lifelong learning, we want to stress that other personality traits also matter. Further research is needed to identify the skills most relevant for specific training activities, particularly when regarding training contents and lengths (Janssen and Wölfel, 2017), as these training characteristics may interact with personality. In doing so, the relationship between socio-emotional and cognitive skills should also be taken into account, as non-cognitive and cognitive skills may co-shape competencies (Rammstedt et al., 2017; Lechner et al., 2019c) and thereby future training outcomes. This notion implies that focusing on one personality trait in isolation, such as openness to experience, without enhancing other skills may not yield the desired results.

Policy Implications

Our results imply two main policy recommendations. First, because we find differential effects for different groups of individuals and personality types, we propose group-specific and even individual-specific further training policies. In addition to obvious groupings along gender and age differences, we highlight the importance of personality differences. Therefore, we suggest personality-specific counseling in addition to differentiations that are more common. For example, adults with low openness to new experiences may need more support from employers or employment agencies to realize the benefits of further training investments. Furthermore, incentives given to individuals to foster further training participation could be modeled to individuals with different personality traits.

Second, we suggest policies that aim at fostering personality traits promoting lifelong learning. As socio-emotional skills change and evolve progressively when children grow into adults, investments into these skills are important, in particular since children with well-developed socio-emotional skills also seem to have an advantage in building cognitive skills (OECD, 2019). Thus, based on empirical evidence on the malleability of personality traits in early phases of the lifecycle and the possibility to strengthen traits in childhood, we suggest addressing policies toward individuals early in life to lay the foundation children for lifelong learning[17].

Overall, a one-size fits-all approach may not work and more differentiated policy approaches are needed to foster both favorable socio-emotional skills early on and continuing learning over the whole life course.

[17] For example, Heckman et al. (2013) show that the long-term success of an early childhood intervention program can be primarily attributed to lasting changes in non-cognitive skills. Additional evidence suggests that supporting children and teenagers through mentoring programs (Kosse et al., 2019) promotes personality development. An extensive overview of interventions to foster non-cognitive skills for all possible age groups (Kautz et al., 2014) further suggest that comprehensive interventions need to consider contextual factors, the desired outcomes and the outcome-determining personality traits in order to successfully prepare individuals for the future.

CONCLUSION

We investigate the relationship between personality traits and further training participation for occupational *and* private reasons and for different training types, namely non-formal and informal training measures. Based on data from the NEPS, we show that the Big Five Personality Dimensions play an important role for the further training participation decision of adults. Irrespective of the type of further training and of the motivation for the training, openness to new experiences and extraversion show a strong positive relationship with further training probabilities. The importance of the remaining four personality traits differ with the type of further training chosen, and with the motive behind further training (i.e., occupational vs. private training activities). Additionally, gender differences in the magnitude and significance become apparent for different personality traits, particularly for non-formal and informal further training. Despite the heterogeneous effects of the individual Big Five Personality Dimensions, we conclude that personality is an important determinant of further training activities.

We contribute to the literature by exploiting the high quality panel data of the NEPS Adult Cohort, which allows us conducting in-depth-analyses and controlling for unobserved heterogeneity. Thereby, we present first results showing that the relationship between personality and further training is not simply a spurious correlation. Our findings indicate that the distinction between further training activities is important to understand which personality traits are associated with different training decisions. In the context of the labor market, our results indicate that occupational further training is a possible channel to explain the importance of personality traits, in particular openness to experience, for labor market success. Personality also plays a role in lifelong learning in a private setting and has the potential to improve life outcomes, leisure activities and societal participation.

DATA AVAILABILITY STATEMENT

This paper uses data from the National Educational Panel Study (NEPS): Starting Cohort Adults, doi: 10.5157/NEPS:SC6:9.0.1. From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network. All documentation concerning NEPS and including questionnaires and data manuals are made available by the LIfBi (https://www.neps-data.de/Data-Center/Data-and-Documentation/Starting-Cohort-Adults/Documentation). A list of publications with NEPS SC6 data is equally available from the LIfBi (https://www.neps-data.de/Project-Overview/Publications). The NEPS data is available to the research community via the Research Data Center of the LIfBi (https://www.neps-data.de/Data-Center/Data-Access). Due to the German Data Protection legislation, we cannot make the original NEPS data or the dataset we generated available. Researchers can however apply for data access via the LIfBi. We will make all our do-files available to researchers upon request for replication studies.

ETHICS STATEMENT

The NEPS study is conducted under the supervision of the German Federal Commissioner for Data Protection and Freedom of Information (BfDI) and in coordination with the German Standing Conference of the Ministers of Education and Cultural Affairs (KMK) and - in the case of surveys at schools - the Educational Ministries of the respective Federal States. All data collection procedures, instruments, and documents were checked by the data protection unit of the Leibniz Institute for Educational Trajectories (LIfBi). The necessary steps are taken to protect participants' confidentiality according to national and international regulations of data security. Participation in the NEPS study is voluntary and based on the informed consent of participants. This consent to participate in the NEPS study can be revoked at any time.

AUTHOR CONTRIBUTIONS

SA, MB, and M-CL developed the idea, discussed the structure, content of the paper, and interpreted the results together. MB ran the estimations. M-CL wrote the first draft of the paper and the revised version. SA and M-CL refined the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.510537/full#supplementary-material

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CONCEPTUAL ANALYSIS
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Towards an Integrative Taxonomy of Social-Emotional Competences

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Social-emotional competences are critical for positive development and significantly predict educational and occupational attainment, health, and well-being. There is however a lack of consensus about the number of core competences, and how these are defined and operationalized. This divergence in approach challenges future research as well as the scientific usefulness of the construct. In an effort to create an integrative framework, this focused review evaluates different approaches of conceptualizing and assessing social-emotional competences. Building on shared conceptions, an integrative taxonomy "DOMASEC" is introduced, specifying core domains and manifestations of social-emotional competences that bridge across frameworks focusing on social and emotional learning, personality traits (such as the Big Five) and self-determination theory. Core domains include intrapersonal, interpersonal and task-oriented competencies, differentiating between affective, cognitive, and behavioral manifestations of competences across these domains. It is argued that the integrative taxonomy facilitates the conceptual specification of key constructs, that it helps to better organize the multitude of terms and definitions used, and to guide the conceptualization and operationalization of social-emotional competences and their various facets.

Keywords: social-emotional competences, integrative taxonomy, conceptualization, core domains, manifestations, self-determination

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INTRODUCTION

Social and emotional competences are increasingly recognized as important predictors of valued life outcomes, such as educational and occupational attainment, health and wellbeing (OECD, 2015). They are considered to be essential in tackling key developmental tasks, such as succeeding in education, in the workplace, in social relationships, and life in general (Gutman and Schoon, 2016). Moreover, social-emotional competences are relevant in enabling individuals exposed to numerous risk factors, such as poverty or family adversity, to succeed against the odds (Elias and Haynes, 2008; Domitrovich et al., 2017; Schoon and Lyons-Amos, 2017). Indeed, they are thought to be as important as cognitive competences in shaping one's life (Heckman and Kautz, 2012). There is however no consensus yet about the number of core competences, and how these are defined and operationalized. The lack of shared definitions and approaches in assessment poses challenges to future empirical research and raises questions regarding the usefulness of social-emotional competences as a scientific construct (Pellegrino and Hilton, 2012). To advance the field, there is thus a need to more clearly delineate and distinguish core domains and manifestations of social-emotional competences. The aim of this focused review is to introduce an integrative framework for the study of social-emotional competences, building on shared conceptions in the field. First, a summary of the overarching terms and shared attributes underlying different

conceptualizations of social-emotional competences is provided. Next, an integrative taxonomy of core domains and manifestations of social-emotional competences is introduced, highlighting in particular the role of the individual as an agent in their own development. Then different approaches for assessing the different domain and manifestations of social-emotional competences are discussed and suggestions for possible avenues for future research are made.

CONCEPTUALIZING SOCIAL-EMOTIONAL COMPETENCES

The conceptualization and measurement of social-emotional competences is not a straightforward task, because the term refers to a set of more specifically delineated competences. The notion of social-emotional competences is generally used as an umbrella term, referring to a range of capabilities that enable individuals to express, regulate and understand their thoughts, emotions, behaviors in every-day situations and interactions with others, and to adjust to changing conditions. Moreover, social-emotional competences are known under different terms, such as "non-cognitive," "character" or "soft" skills, contrasting them to the more directly assessable cognitive competences (Duckworth and Yeager, 2015; Abrahams et al., 2019). The terms skill and competence are sometimes used interchangeably, although there is potentially a difference in scope, with competence being the broader term, incorporating a set of skills (National Research Council, 2012; OECD, 2015). In empirical research, approaches to operationalize social-emotional competences and skills vary across laboratories and across disciplines.

There is considerable variability in the number and nature of the social-emotional competences included in different approaches and frameworks (Abrahams et al., 2019; Jones et al., 2019). Many authors differentiate between intrapersonal competences (such as self-control and emotion regulation) and interpersonal competences (such as perspective taking, and relationship skills) enabling effective functioning and interactions with others (Malti and Noam, 2016; Domitrovich et al., 2017). Some use the Big Five personality dimensions as a guidepost (De Fruyt et al., 2015; Abrahams et al., 2019), while others focus on distinct competences or skills, such as the ability for self-regulation (Blair, 2002; Moffitt et al., 2011), or goal-directed efforts such as grit or persistence (Duckworth et al., 2007). In addition, there are approaches to bundle different indicators into a composite, not differentiating between distinct dimensions (Liu, 2019).

Efforts to specify the communalities of social-emotional competences can be grouped into three major approaches: First, classifications related to the development of screening instruments such as the Achenbach System of Empirically-Based Assessment (Achenbach, 2019), or the Strengths and Difficulties Questionnaire (Goodman et al., 2000) derived from clinical observations. These instruments have strong psychometric properties and are used for the identification of emotional and behavioral adjustment in general population and clinical samples. They are however, mostly focused on the identification of adjustment problems instead of strengths or competences.

Second, conceptual approaches adopted by the Collaborative for Academic, Social Emotional Learning (CASEL) aim to enable the development of core social and emotional competencies that contribute to children's school success and life outcomes. Rooted in theories of progressive education, transactional models of human development, and the emotional intelligence literature (Osher et al., 2016), fundamental goals of the CASEL framework are to promote positive learning environments that are supportive and engaging and to foster the development of five interrelated sets of competencies comprising intrapersonal skills (such as self-awareness, self-management), interpersonal skills (social awareness, relationship skills), and task performance (responsible decision-making). These core competences are considered to enable student's capacity to integrate emotion, reflection and behavior across everyday personal and social challenges (Durlak et al., 2015). A major aspect of the SEL approach is its developmental-contextual focus, accounting for developmental processes involved in socio-emotional learning and the associated empirical evidence confirming the role of interventions and contextual influences in promoting the development of key skills and competences (Durlak et al., 2011; Jones et al., 2019). Notable gaps in the SEL research framework are the need for practical, reliable and valid assessments of specific SEL skills, and the need to clarify terminology and align language and frameworks (Osher et al., 2016). Yet, there have been recent advances in the development of valid and reliable assessment scales, and the factor structure of SEL framework could be confirmed (Mantz et al., 2018; Gresham et al., 2020). This evidence is mirrored in findings confirming the factor structure underlying the assessment of emotional intelligence along indicators of self-awareness, self-management, social awareness, relationship management, and problem solving (Boyatzis, 2018).

Third, data-driven efforts such as the use of psycholexical analysis aim to group different descriptions of personality into a smaller number of overarching constructs. Resulting frameworks, such as the Big Five model, reflect personality traits comprising self-management (conscientiousness), engaging with others (extraversion), collaboration with others (agreeableness), negative emotion regulation (neuroticism), and open-mindedness (openness to experiences) (John et al., 2008; Abrahams et al., 2019). Terms such as personality traits are used refer to relative stable dispositions that account for consistencies in behavior, thought and feeling across situations and over time (Costa et al., 2019). There is however also evidence of developmental processes (Caspi et al., 2005), suggesting that personality traits are both stable and malleable (Damian et al., 2019), pointing to the role of environmental factors, such as life events (Bleidorn et al., 2018), as well as interventions (Roberts et al., 2017) to contribute to that change. The underlying five factor personality structure, derived from the exploration of English lexical personality terms, has been confirmed across many cultures (McCrae et al., 2005). However, approaches using indigenous lexical study could not fully replicate the five factor personality structure (De Raad et al., 2010). Moreover,

indigenous lexical studies conducted in Asia identified an additional factor of interpersonal relatedness (Cheung et al., 2008, 2011) which is not represented in the Big Five Framework. In addition, the Big Five Framework as such does not account for competences reflecting self-awareness, such as self-concepts, or the ability to correctly understand the social cues of others (John et al., 2008), and a broader approach is needed to comprehensively classify key competences.

Advancing the field is however hampered by the situation, that despite considerable overlap and similarities in the constructs derived from these different approaches. The conceptualization of social and emotional competences has been afflicted by what some authors call the "jingle and jangle fallacy" (Borghans et al., 2008; Jones et al., 2016). The "jingle fallacy" refers to the use of a same term for different constructs, while the "jangle fallacy" refers to the use of different terms for similar constructs. Moreover, variability in terms can be justified due to processes of developmental maturation and change over time. For example, initially reactive forms of self-control in children develop into more intentional and flexible forms of self-regulation (Montroy et al., 2016; Booth et al., 2018). There are thus multiple challenges in moving forward toward a consensual definition, including differences in terminology (which can vary according to discipline or field of study), differences in focus, and aspects of developmental change.

Despite differences in terminology and assessment, there is agreement in that social and -emotional competences refer to individual-level capabilities involved in understanding and accepting oneself, in negotiating every-day situations and interactions with others, to deal with challenges and to adjust to changing conditions. Social-emotional competences (1) are conceptually different from academic abilities and subject-matter achievement; (2) originate through reciprocal interactions between biological predispositions and contextual influences; (3) develop progressively as children mature; (4) are shaped through socialization experiences and learning (in formal and informal settings) and are thus understood to be malleable and responsive to intervention; (5) are manifested in more or less consistent patterns of thoughts, feelings and behaviors, although they can vary across contexts and over time; (6) are dependent on situational factors for their expression; and (7) are crucial to success in school, across a wide range of socio-economic outcomes in later life, as well as health and wellbeing (Blair, 2002; De Fruyt et al., 2015; Duckworth and Yeager, 2015; Gutman and Schoon, 2016; Domitrovich et al., 2017; Bailey et al., 2019).

TOWARD AN INTEGRATIVE TAXONOMY OF SOCIAL-EMOTIONAL COMPETENCES

Previous efforts to create an integrated taxonomy of social-emotional competences argued for the alignment of all existing constructs within a single existing framework, such as the Big Five (Abrahams et al., 2019), which would help to reduce complexity and generate a common language. However, as argued above, the Big Five Framework is not broad nor specific enough to capture competences relevant across different cultural contexts. The evidence suggests that models with fewer factors are more robust, in particular when replicated across different cultural contexts (De Raad et al., 2010). In addition, some have argued that it is necessary to differentiate between skills and traits (Duckworth and Yeager, 2015) and to draw a clear conceptual distinction between traits that reflect what someone tends to do, and capacities that reflect what someone is capable of doing (Soto et al., 2020). Other integrative efforts to create new frameworks are based on a review of existing research on social-emotional competences, including taxonomies derived from Social and Emotional Learning (SEL) and Big Five frameworks (National Research Council, 2012; OECD, 2015). For example, the framework developed by the National Research Council (National Research Council, 2012) identified three core 21st century skill clusters comprising intrapersonal, interpersonal, and cognitive competences—the latter also including information literacy, i.e., using knowledge effectively. The OECD Definition and Selection of key Competences (DESECO) Framework (which was developed in collaboration with a wide range of experts from different academic disciplines, countries and international organizations) also identified three core skill domains, comprising social, emotional as well as cognitive skills including the ability to act autonomously, to interact in socially heterogeneous groups, and to use tools interactively (Rychen and Salganik, 2003). These competences are considered necessary to enable full participation in society, in particularly regarding participation in the work force—with relevance also in developing and transition countries. However, including skills that reflect the effective use of tools or information/knowledge moves these conceptual frameworks beyond the focus of social-emotional core competences.

Focusing on competences commonly found in SEL-focused frameworks, the Harvard-based "Taxonomy Project" aimed to identify areas of overlap and distinction between different personality and SEL-focused frameworks (Berg et al., 2017; Jones et al., 2019). The objective of the Taxonomy Project was not to develop a new framework or privileging one framework over another—but to generate a taxonomy of social-emotional skills designed to link terms across frameworks. This work resulted in the development of an online repository, including a tool (Explore SEL) that connects over 60 conceptual frameworks, illustrating how different social and emotional constructs are related to one another and across disciplines. The taxonomy groups skills into six domains (cognitive, emotional, social, values, perspectives, and self-image/identity) and their domain-specific facets. For example, terms within the emotional domain are grouped into subdomains of empathy/perspective taking, emotional knowledge and expression, and emotional, and behavioral regulation. These domains and subdomains have been empirically identified, yet there is no conceptual specification of them and the coding is described as a work in progress.

The DOMASEC Classification

Building on this previous work, I propose a two-level taxonomy of key domains and manifestations of social-emotional competences (DOMASEC) which serves to better organize the multiple terms and constructs used in the

study of social-emotional competences across disciplines. The DOMASEC model is not intended as a new framework, but as an integrative approach linking across existing frameworks, such as CASEL, the Big Five and others, aligning language with the aim to offer conceptual clarity and to help with the identification and classification of constructs, and where applicable to assess and measure social and emotional competences. The model is guided by developmental-contextual approaches (Bronfenbrenner and Morris, 2006), acknowledging that human development does not take place in a social vacuum and recognizing the bi-directional influences between a developing individual and a changing context that produce continuity and change in individual characteristics over time (Sameroff, 2010). It also builds a bridge to self-determination theories (SDT) (Ryan and Deci, 2017) which emphasize the human need to learn, to extend oneself, and to apply one's talents.

Core domains of the DOMASEC model comprise orientations toward the self (intrapersonal competences), toward others (interpersonal competences), and toward developmental tasks (such as succeeding in education, making decisions about employment, or adapting to changing conditions). The core domains reflect the ways in which individuals perceive themselves, interact with others, and engage with their environment, e.g., the challenges or tasks they encounter, or the goals they set themselves. Together these domains emphasize the role of the individual as an actor, and the need to engage in and to adapt to different and changing challenges and demands over the life course. At the second level, a differentiation is made between the affective, cognitive, and behavioral manifestations of functioning across different domains. Affective manifestations reflect the positive or negative feelings about the self, others, or different tasks. Cognitions indicate the believes, thoughts and knowledge about the self, others, or different tasks, and behavior the manifest conduct and approach.

It is important to take into account different domains and manifestations of social-emotional competences, since some individuals might show effective task-performance and act in correspondence with socially accepted norms and expectations, despite being emotionally unbalanced. Or, they might be well attuned in regulating their interactions with others, but not in concentrating their commitment to specific tasks. The identification of different core domains and manifestations of emotions, thoughts and behaviors within and across these domains is considered necessary to facilitate the conceptual specification of key constructs, directing focus to the most salient aspects of their expression. Considering the multiple domains and manifestations of social-emotional competences enables the assessment of variations in adjustment and the identification of potential competence profiles.

Table 1 gives examples of prototypical competences for each of the manifestations across domains. The taxonomy differentiates variations in emotional response toward the self (such as feelings of self-esteem), toward others (empathy), or toward specific tasks (such interest or valuing them). Moreover it takes into account cognitions or believes about the self (self-concept), about others (perspective taking), or specific tasks (foresight), as well as behavioral manifestations, such as self-regulation, ways of regulating one's interaction with others (cooperation), and efforts to achieve a task or goal. These manifestations change or can vary depending on developmental maturity or different socio-cultural contexts. Nonetheless, the differentiation of the three manifestations facilitates conceptual clarity when trying to classify different constructs, including multi-dimensional constructs, such as grit. Grit comprises passion (an affective aspect) and perseverance, i.e., task-focused behavior directed at the achievement of longer-term goals (Duckworth et al., 2007). Both facets can be captured within the DOMASEC framework, facilitating a better understanding of multiple competences necessary to pursue and achieve a task.

The aim of the DOMASEC taxonomy is to be broad enough to integrate social-emotional competences studied across different disciplines, and to be specific enough to enable the grouping of social-emotional competences according to their core domains and their most central manifestations. In particular, the DOMASEC specification of core domains will facilitate the classification of competences recognized across different fields.

Integration of Different Frameworks

The DOMASEC taxonomy is not intended to be a grand theory of human development, it rather aims to facilitate the classification of social-emotional competences studied across different disciplines within an integrative framework. One of the central goals of scientific taxonomies is the specification of overarching domains within which large numbers of specific instances can be understood in a simplified way. It is hoped that the DOMASEC framework, as a generally accepted taxonomy, would facilitate the accumulation and communication of empirical findings by offering a standard vocabulary, or nomenclature.

Table 1 illustrates how the DOMASEC model maps onto different frameworks, such as the Big Five, the CASEL constructs, and other competences specified in prominent classification frameworks (see the Explore SEL online tool). For instance, the DOMASEC framework maps onto the Big Five factors (Abrahams et al., 2019; Costa et al., 2019) which can be grouped as aspects of affective responses toward the self (neuroticism); as behavioral orientations toward the self (conscientiousness) or others (extraversion); or a cognitive response toward a task (openness). Agreeableness also reflects an orientation toward others, but is more difficult to allocate, as it involves a more or less even balance of affective, cognitive and behavioral aspects (Wilt and Revelle, 2015). It's defining facets comprise modesty, trust, and empathy (John et al., 2008) which can be considered as reflections of affective (empathy), cognitive (trust) or behavioral (modesty) aspects of other-orientation. Here agreeableness is grouped as a behavioral aspect of other-orientation, given the centrality of the modesty facet across different Big Five frameworks, such as the lexical approach, the NEO-PI-R and the CPI-Big Five. Notably, the DOMASEC model enables the classification of different sub-facets within each of the Big Five factors and facilitates a more differentiated understanding and conceptualization of key competences. Take another example, the construct of openness, which has been defined as "the breadth, depth, originality, and complexity of an individual's *mental and experiential life*." (John et al., 2008). Within the DOMASEC framework different facets of openness

TABLE 1 | Domains and manifestations of socio-emotional competences (DOMASEC).

Domains/manifestations	Examples of prototypical competences	Examples from other frameworks			Basic psychological needs
		Big Five	**CASEL**	**Other (see Explore SEL)**	
Self-orientation					**Autonomy**
Affect	Self-esteem	Neuroticism		• Happiness	
Cognition	Self-concept		Self-awareness	• Self-efficacy • Self-reflection • Identity	
Behavior	Self-regulation	Conscientiousness	Self-management	• Self-control • Emotion regulation • Stress regulation	
Other-orientation					**Relatedness**
Affect	Empathy			• Compassion	
Cognition	Perspective taking		Social awareness	• Trust • Tolerance • Respect for others	
Behavior	Cooperation	Extraversion agreeableness	Relationship skills	• Connection • Caring • Pro-social behavior • Leadership	
Task-orientation					**Competence**
Affect	Value/ Interest			• Zest • Passion	
Cognition	Foresight	Openness	Responsible decision making	• Optimism • Purpose • Inquisitiveness • Imagination/creativity	
Behavior	Task-performance			• Persistence/effort • Initiative • Innovation	

could be grouped as cognitive orientations toward a task, while others might be considered as cognitive orientations toward the self or others. The first decision in the classification process will be the identification of the core domain, i.e., the focus of orientation toward the self, toward others or a task, followed by a consideration of the most salient form of manifestation, i.e., the affective, cognitive, or behavioral expression.

The DOMASEC model also maps onto a range of other frameworks, such the five competence clusters of the CASEL framework (Durlak et al., 2015), differentiating between cognitive and behavorial manifestations of orientations toward the self (self-awareness, self-management), toward others (social awareness, relationship skills), and toward developmental tasks (responsible decision making). In addition, the two-level DOMASEC taxonomy facilitates a clearer distinction between the core domains and associated feelings, cognitions and behaviors, which do not necessarily have to be consistent across the different domains.

In addition, the three DOMASEC domains capture the central dimensions of internalizing (orientation toward the self) and externalizing adjustment problems as well as prosocial behavior (both reflecting orientation toward others) generally assessed in widely used screening instruments (Goodman et al., 2000; Achenbach, 2019). The three DOMASEC domains also emulate the core skill clusters identified in previous research, i.e., intrapersonal, interpersonal, and cognitive competences (National Research Council, 2012; OECD, 2015), yet the focus is on social-emotional competences not including academic or knowledge skills—instead emphasizing task-oriented competences. The three domains of the DOMASEC taxonomy also correspond to the three-component model of virtue or character strength comprising self-control, caring, and inquisitiveness (McGrath et al., 2018). Self-control can be understood to reflect self-orientation, caring as an aspect of other-orientation, and inquisitiveness as an aspect of task-orientation. The three components of virtue show a considerable degree of overlap with the VIA Classification of Strengths and Virtues (McGrath et al., 2018) and also the Big Five Framework. Despite this overlap the classifications of virtues and personality are however not redundant, highlighting the

limitations of a global measure of personality aiming to include all potentially important components of that construct (McGrath et al., 2020).

Moreover, the specification of the three core domains builds a bridge to self-determination theory (SDT) (Ryan and Deci, 2017), opening up new dialogues between interlinked fields of inquiry concerned about the study of human development and wellbeing. SDT specifies a set of innate, universal basic psychological needs for experiencing autonomy, relatedness, and competence. The fulfillment of these basic needs is essential for psychological growth and effective functioning. Autonomy refers to the need to manage one's emotions and behavior, to be able to self-determine what to do. Relatedness refers to the need to care about and be cared about by others, and competence refers to the need to contribute to a cause, to feel challenged and being effective. Within self-determination theory the term competence does not refer to an attained skill or capability, but rather is understood as a felt sense of being effective in interactions with the wider environment, to experience opportunities to exercise and express one's capacities (Ryan and Deci, 2017). Within the DOMASEC classification this aspect denotes engagement with the environment, orientation toward the different tasks encountered, and the way individuals approach, adapt to or change their environment to address their needs.

Linking the DOMASEC framework to self-determination theory highlights the role of the individual as an active agent in their own development, and the fact that social-emotional competences develop over time, in interaction with significant others and changing contextual influences. It has been argued that SDT has the capacity to integrate different personality models, including the Big Five framework (Prentice et al., 2019; Ryan et al., 2019), and has the capacity to coordinate complex research findings concerning personality development, motivation, and wellbeing (Ryan et al., 2019). In particular, aspects of self-determination are relevant to understand the person as agent, as a motivated being making choices and planning their lives (McAdams and Olson, 2010), and can thus be helpful to inform strategies for building up social-emotional competences and the design of effective interventions. The development and maintenance of social-emotional competences can be facilitated if the needs for autonomy, relatedness and competence are met. For example, there is evidence to suggest that interventions aiming to support feelings of autonomy, relatedness and belonging can promote learning performance and persistence among students (Vansteenkiste et al., 2004; Skinner et al., 2009), or persistence in and adherence to physical exercise practice (Van den Berghe et al., 2014; Rodrigues et al., 2018). Linking the DOMASEC taxonomy to theories of self-determination and personality development thus facilitates recommendations for the design of developmentally appropriate interventions aiming to promote the development of social-emotional competences.

The DOMASEC taxonomy is designed to be broad enough to capture key aspects of different sets of constructs, to classify social-emotional competences studied across different disciplines, and to be specific enough to enable the grouping of social-emotional competences according to their core domains and their most central manifestations. Comparing the DOMASEC taxonomy with some of the frequently used frameworks used in the study of social-emotional learning, personality and character strengths illustrates its potential as an integrative tool. Future research should aim to link the DOMASEC framework to other classification tools with the objective to specify the core constructs and their different facets within the different cells of the grid in more detail, minimizing or eliminating overlap. Good examples of how this can be achieved can be found in the already mentioned online search tool (Explore SEL: http://exploresel.gse.harvard.edu/about/), or recent work mapping processes associated with executive functioning, a key feature of self-regulation, which also takes into account variations in expression across different developmental stages (Bailey et al., 2018). In addition, the taxonomy is useful to identify potential evidence gaps in current research. For example, relative many studies address issues related to the pre-cursors and long-term outcomes of self-control or self-regulation. There are, however, fewer studies examining the antecedents, development and outcomes associated with empathy or prosocial behavior, possibly due to the lack of strong measures for their assessment (Jones et al., 2016).

Assessment of Social-Emotional Competences

The DOMASEC taxonomy also informs the assessment of social-emotional competences. Indeed, the grid structure could serve as a blueprint to facilitate test specification, or the cataloging of existing measurement tools (see also Bailey et al., 2018). There is a wide range of instruments, tapping into the different components and facets of social-emotional competences. Yet, while instruments to assess self-oriented competences such as self-regulation or self-concept are relatively common, there are fewer instruments to assess emotional competences that are, for example relevant for interaction with others, such as empathy (Halle and Darling-Churchill, 2016; Jones et al., 2016). A comprehensive assessment of social-emotional competences, however, should provide information about a range of different competences across different domains, involving different manifestations. Having information on multiple competences also enables the assessment of how these competences combine in individuals, giving insights into variations in competence profiles.

In developing new assessment instruments aiming for a more comprehensive appraisal of competence profiles, the standard requirements for a reliable and valid assessment should be fulfilled, as well as a number of practical considerations (Campbell et al., 2016; Jones et al., 2016): (a) measures should be developmentally appropriate in scope and content; moreover, they should enable researchers to assess the development of competences at earlier and later ages; (b) should be culturally appropriate; (c) should cover a comprehensive set of domains; (d) the administration of the assessment should not take too long, and should not put too much burden on the respondents; (e) to ensure consistency in administration there should not be too many training requirements for the administrator or observer; (f)

there should be consideration for contextual issues of assessment, taking into account the setting of the assessment, as well as variations in expression across subgroups in the population or across different cultures.

Many available assessment instruments were developed for use in small-scale or specialized studies (Halle and Darling-Churchill, 2016). However, only a relative small number of these measures are suitable for administration in different types of studies, such as studies conducted across diverse populations and cultures, large scale surveys, studies focusing on social-emotional competences among very young children, or those aiming to assess continuity and change in social-emotional competences over time (Jones et al., 2016). For example, there is a scarcity of measures that are suitable for use with small children, instruments that cover a comprehensive range of competences, or enable the assessment of growth and development (Halle and Darling-Churchill, 2016).

Nonetheless, a key message is that social-emotional competences can be measured with relative precision and accuracy. Methods used to quantify the way individuals feel, think and behave across different situations have advanced considerably, in particular through the use of new technologies or involving multi-method multiple-informant approaches (Duckworth and Yeager, 2015; Abrahams et al., 2019). For example, computer-based problem scenarios (Rausch et al., 2019), interactive computer games (Day et al., 2019), or opportunistic measures derived from observing and coding the behaviors of individuals engaged in standardized assessment programs (Zamarro et al., 2018) can be used to balance the strengths and limitations of self-reports and direct assessments of social-emotional competences. Information about differences in behavior in different settings enables a better assessment of the multiple ways in which social-emotional competences manifest, how they develop over time, and how they vary across different contexts. Ideally, future assessments of social-emotional competences should provide information not only on single competences, but on a broader range of competences assessed across multiple domains and manifestations. A more comprehensive assessment would enable a more holistic understanding of how competences combine in individuals, and their relative and combined effect in shaping important life outcomes. Moreover, assessment tools that capture multiple components of social-emotional competences can be helpful to inform the planning of effective interventions, addressing specific strengths and deficits.

CONCLUSION

Socio-emotional competences are critical for positive development and attainment across multiple domains, including education, employment, health and wellbeing (OECD, 2015). However, progress in empirical studies regarding the antecedents, correlates and long-term benefits of social-emotional competences is hampered by the lack of consensus about the number of key competences, how they are defined and operationalised. The conceptualization and measurement of social-emotional competences is not a straightforward task, because the term refers to a set of different capabilities. The proposed integrative taxonomy "DOMASEC" is understood as a framework supporting collaborative efforts to clearly delineate and distinguish core domains and manifestations of social-emotional competences and to facilitate conceptual clarity. Core domains include intrapersonal, interpersonal and task-oriented competencies, which are manifested in associated feelings, cognitions and behaviors. The DOMASEC typology helps to better organize the multitude of terms and definitions used, and to guide the conceptualization and operationalisation of social-emotional competences and their various facets. Providing a bridge between existing frameworks of social and emotional learning, personality traits (such as the Big Five), and the 21st century skill clusters the DOMASEC framework aims to generate a new dialogue between interlinked yet till now separated strands of investigation and to achieve a much needed consensus. Moreover, linking the DOMASEC specification of core domains to self-determination theories highlights the role of the individual as an active agent in their own development, and the fact that social-emotional competences develop over time, in interaction with significant others and changing contextual influences. This in turn, facilitates recommendations for the design of developmentally appropriate interventions aiming to promote the development of social-emotional competences.

It is hoped that the proposed taxonomy serves to connect different approaches regarding conceptualization and measurement, and hopefully bring about a consensus regarding the specification and delineation of core socio-emotional competencies and their assessment. Future work should focus in more detail on the specification of the different facets of socio-emotional competences, their comprehensive assessment across cultures, and review variations in the manifestation of distinct socio-emotional competences over time to reflect their formation, growth and possible changes.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

IS conceptualized, drafted, and edited the focused review.

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Incremental Validity of Character Strengths as Predictors of Job Performance Beyond General Mental Ability and the Big Five

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Over the last decades, various predictors have proven relevant for job performance [e.g., general mental ability (GMA), broad personality traits, such as the Big Five]. However, prediction of job performance is far from perfect, and further potentially relevant predictors need to be investigated. Narrower personality traits, such as individuals' character strengths, have emerged as meaningfully related to different aspects of job performance. However, it is still unclear whether character strengths can explain additional variance in job performance over and above already known powerful predictors. Consequently, the present study aimed at (1) examining the incremental validity of character strengths as predictors of job performance beyond GMA and/or the Big Five traits and (2) identifying the most important predictors of job performance out of the 24 character strengths, GMA, and the Big Five. Job performance was operationalized with multidimensional measures of both productive and counterproductive work behavior. A sample of 169 employees from different occupations completed web-based self-assessments on character strengths, GMA, and the Big Five. Additionally, the employees' supervisors provided web-based ratings of their job performance. Results showed that character strengths incrementally predicted job performance beyond GMA, the Big Five, or GMA plus the Big Five; explained variance increased up to 54.8, 43.1, and 38.4%, respectively, depending on the dimension of job performance. Exploratory relative weight analyses revealed that for each of the dimensions of job performance, at least one character strength explained a numerically higher amount of variance than GMA and the Big Five, except for individual task proactivity, where GMA exhibited the numerically highest amount of explained variance. The present study shows that character strengths are relevant predictors of job performance in addition to GMA and other conceptualizations of personality (i.e., the Big Five). This also highlights the role of socio-emotional skills, such as character strengths, for the understanding of performance outcomes above and beyond cognitive ability.

Keywords: character strengths, job performance, general mental ability, Big Five, incremental validity

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INTRODUCTION

Job performance is seen as a decisive production resource, especially in industrial societies. Therefore, among the core goals of personnel selection is to hire applicants who will perform well in the future. Over the last 30 years, researchers have investigated various variables in order to identify relevant predictors of job performance. These potential predictors include (but are not limited to) broad *personality traits* (e.g., Tett et al., 1991; Barrick et al., 2001; Salgado, 2003), *general mental ability* (Schmidt and Hunter, 1998; Salgado and Anderson, 2003; Hülsheger et al., 2007; e.g., Kramer, 2009; GMA), as well as narrow traits, such as *self-esteem* (e.g., Judge and Bono, 2001; Sekiguchi et al., 2008), facets of conscientiousness (e.g., Dudley et al., 2006), or assertiveness as facet of extraversion (e.g., Bergner et al., 2010). However, prediction of job performance is far from perfect, and further potentially relevant predictors need to be investigated to further improve it.

As a result of the positive psychology movement, perspectives and constructs that were long neglected in psychological research (e.g., Seligman and Csikszentmihalyi, 2000) are increasingly taking center stage. Among these is the concept of "character strengths" (e.g., Peterson and Seligman, 2004), which represents a positive perspective on personality traits as opposed to more neutral (e.g., the Big Five traits, such as extraversion or conscientiousness; Ostendorf, 1990) or negative ones (e.g., the Dark Triad of narcissism, psychopathy, and Machiavellianism; Paulhus and Williams, 2002). These character strengths may be useful additional predictors of job performance and, therefore, are the center of attention in the present paper.

Character Strengths

According to Peterson and Seligman (2004), character strengths are individual differences that are positively valued across cultures and find expression in individuals' thoughts (e.g., considering the consequences of one's behavior before acting), feelings (e.g., enjoying teamwork), and behaviors (e.g., engaging in learning activities). Character strengths are narrow, trait-like personality characteristics; they exhibit a reasonable amount of stability over time and situations, but are nevertheless influenced by life circumstances and might therefore change over the life course or as the result of training (Peterson and Seligman, 2004; see also Gander et al., 2021). Peterson and Seligman (2004) identified 24 character strengths through intensive research employing numerous historical, philosophical, and psychological sources, with the aim of more systematically describing personality from a positive perspective. These character strengths are distinct from one another and measurable. **Table 1** presents the 24 character strengths included in the Values in Action classification of strengths (Peterson and Seligman, 2004) as well as short descriptions defining them.

The character strengths are clustered into six groups (see **Table 1**). This was done on theoretical grounds rather than empirically (e.g., by factorial analyses) (Peterson and Seligman, 2004). By definition, character strengths contribute to individuals' fulfillment, flourishing, and thriving (Peterson and Seligman, 2004). Accordingly, research has shown meaningful relations between specific character strengths and favorable outcomes in different areas of life, including *physical health* (e.g., Proyer et al., 2017), *life satisfaction* (e.g., Park et al., 2004; Buschor et al., 2013), *psychological well-being* (e.g., Harzer, 2016), *school achievement* (e.g., Weber, 2018), and *vocational orientation among young people* (e.g., Proyer et al., 2012).

Several studies have highlighted the role of character strengths in the work context. The results stem from samples around the globe (e.g., Canada, Germany, Israel, Pakistan, Switzerland, and the US). For example, character strengths are related to work-related well-being. Specifically, higher scores on character strengths were associated with higher scores on beneficial outcomes, such as positive affect, work engagement, sense of meaning, job satisfaction, and lower stress (Peterson et al., 2010; Harzer and Ruch, 2015; e.g., Harzer et al., 2017; Heintz and Ruch, 2021). Another crucial work-related outcome is job performance.

Job Performance

Job performance is a multi-faceted construct, as employees exhibit different performance-related behaviors at different times depending on the situation (e.g., Williams and Anderson, 1991; Borman et al., 1995; Coleman and Borman, 2000; Motowidlo, 2000; Viswesvaran and Ones, 2000; Griffin et al., 2007). Therefore, several dimensions of job performance have been considered in research.

Firstly, there are aspects of job performance that positively influence organizational effectiveness (e.g., Viswesvaran and Ones, 2000). These are in-role behavior (also known as task performance; e.g., Williams and Anderson, 1991) and extra-role behavior (also known as contextual performance or organizational citizenship behavior; e.g., Motowidlo, 2000). The latter includes aspects, such as job dedication (work motivation), interpersonal facilitation (support of co-workers), and organizational support (loyalty) (e.g., Coleman and Borman, 2000). In their model of positive work role performance, Griffin et al. (2007) offered a more fine-grained perspective on *productive work behavior* by distinguishing between proficiency of work-related behavior, adaptivity to change, and proactivity to improve processes on the individual, team, and organizational levels. Proficiency refers to the fulfillment of prescribed or predictable requirements of one's work role; adaptivity is related to coping with, reacting to, and supporting change; proactivity means initiating change in a self-started and future-directed way (Griffin et al., 2007). **Figure 1** provides an overview of all components included in the model by Griffin et al. (2007) as well as brief definitions of the components in order to define productive work behavior as examined in the present paper.

Secondly, there are dimensions of job performance that negatively influence organizational effectiveness (e.g., Viswesvaran and Ones, 2000). These are termed *counterproductive work behavior* (also known as deviant behavior; e.g., Bennett and Robinson, 2000; Marcus and Schuler, 2004). Counterproductive work behavior or deviance at work "violates significant organizational norms and, in so doing, threatens the well-being of the organization or its members, or both" (Bennett and Robinson, 2000, p. 349). This behavior can be directed at the organization itself (organizational

TABLE 1 | The 24 character strengths included in the Values in Action classification of strengths (Peterson and Seligman, 2004) and short descriptions defining the strengths.

1. Cognitive strengths that entail the acquisition and use of knowledge
Creativity [originality, ingenuity]: thinking of novel and productive ways to conceptualize and do things; includes but is not limited to artistic achievement
Curiosity [interest, novelty-seeking, openness to experience]: taking an interest in all of ongoing experience for its own sake; finding subjects and topics fascinating; exploring and discovering
Judgment [open-mindedness, critical thinking]: thinking things through and examining them from all sides; not jumping to conclusions; being able to change one's mind in light of evidence; weighing all evidence fairly
Love of learning: mastering new skills, topics, and bodies of knowledge, whether on one's own or through formal instruction; related to curiosity but goes beyond it to describe the tendency to systematically add to what one knows
Perspective [wisdom]: being able to provide wise counsel to others; having ways of looking at the world that make sense to oneself and to others
2. Emotional strengths that involve the exercise of will to accomplish goals in the face of opposition, external or internal
Bravery [valor]: *not* shrinking from threat, challenges, difficulty, or pain; speaking up for what is right even in the face of opposition; acting on one's convictions even if unpopular; includes but is not limited to physical bravery
Perseverance [persistence, industriousness]: finishing what one starts; persisting in a course of action in spite of obstacles; "getting it out the door"; taking pleasure in completing tasks
Honesty [authenticity, integrity]: speaking the truth but also more broadly presenting oneself and acting in a genuine and sincere way; being without pretense; taking responsibility for one's feelings and actions
Zest [vitality, enthusiasm, vigor, energy]: approaching life with excitement and energy; not doing things halfway or halfheartedly; living life as an adventure; feeling alive and activated
3. Interpersonal strengths that involve "tending and befriending" others
Capacity to love and be loved [short name: love]: valuing close relations with others, in particular those in which sharing and caring are reciprocated; being close to people
Kindness [generosity, nurturing, care, compassion, altruistic love, "niceness"]: doing favors and good deeds for others; helping them; taking care of them
Social intelligence [emotional intelligence, personal intelligence]: being aware of the motives and feelings of other people and oneself; knowing what to do to fit into different social situations; knowing what makes other people tick
4. Civic strengths that underlie healthy community life
Teamwork [citizenship, social responsibility, loyalty]: working well as a member of a group or team; being loyal to the group; doing one's share
Fairness: treating all people the same according to notions of fairness and justice; not letting personal feelings bias one's decisions about others; giving everyone a fair chance
Leadership: encouraging a group of which one is a member to get things done and at the same time maintain good relations within the group; organizing group activities and seeing that they happen
5. Strengths that protect against excess
Forgiveness [mercy]: forgiving those who have done wrong; accepting the shortcomings of others; giving people a second chance; not being vengeful
Modesty [humility]: letting one's accomplishments speak for themselves; not regarding oneself as more special than one is
Prudence: being careful about one's choices; not taking undue risks; *not* saying or doing things that one might later regret
Self-regulation [self-control]: regulating what one feels and does; being disciplined; controlling one's appetites and emotions
6. Transcendental strengths that forge connections to the larger universe and provide meaning
Appreciation of beauty and excellence [awe, wonder, elevation; short name: appreciation]: noticing and appreciating beauty, excellence, and/or skilled performance in various domains of life, from nature to art to mathematics to science to everyday experience
Gratitude: being aware of and thankful for the good things that happen; taking time to express thanks
Hope [optimism, future-mindedness, future orientation]: expecting the best in the future and working to achieve it; believing that a good future is something that can be brought about
Humor [playfulness]: liking to laugh and tease; bringing smiles to other people; seeing the light side of life; making (not necessarily telling) jokes
Spirituality [religiousness, faith, purpose]: having coherent beliefs about the higher purpose and meaning of the universe; knowing where one fits within the larger scheme of things; having beliefs about the meaning of life that shape one's conduct and provide comfort

The character strengths are grouped together theoretically based on their content. The labels and expressions in brackets emphasize the family resemblance among the concepts to acknowledge the heterogeneity of strengths and minimize subtle (political or otherwise) connotations (Peterson and Seligman, 2004).

deviance; e.g., taking property from work without permission) or at organizational members (interpersonal deviance; e.g., making fun of someone at work) (Bennett and Robinson, 2000).

According to a number of meta-analyses (e.g., Schmidt and Hunter, 1998; Salgado and Anderson, 2003; Salgado et al., 2003; Hülsheger et al., 2007; Salgado and Moscoso, 2019) utilizing different data from different cultures and countries, GMA is a robust predictor of task performance (comparable with individual task proficiency) and overall productive work behavior (often termed overall job performance in the literature). The correlation between GMA and overall job performance is around 0.50. Research on the relationships between GMA and the other dimensions of productive and counterproductive work behavior is relatively scarce. However, Gonzalez-Mulé et al. (2014) in a meta-analysis showed that GMA is significantly positively related to organizational citizenship behavior (comparable with team-level and organization-level performance; correlation around 0.20) as well as negatively related to organizational deviance (correlation around −0.20). There was no systematic relationship between GMA and interpersonal deviance.

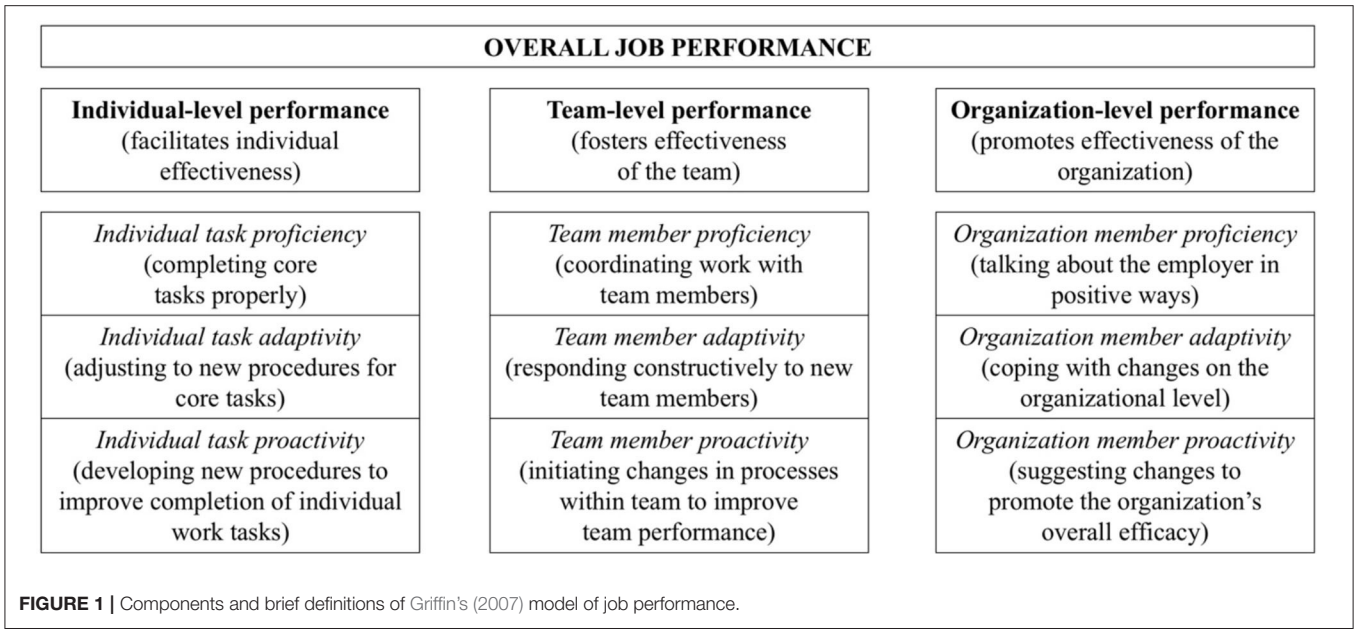

FIGURE 1 | Components and brief definitions of Griffin's (2007) model of job performance.

Due to the low incremental validity of other predictors beyond GMA, GMA has often been considered the best predictor of task performance and overall job performance (e.g., Schmidt and Hunter, 1998). Nevertheless, a number of meta-analyses (e.g., Barrick and Mount, 1991; Salgado, 1997, 2002; Hurtz and Donovan, 2000) have shown that personality traits, such as the Big Five, are potent predictors of job performance as well. For example, conscientiousness was the best predictor of overall job performance, task performance, team-level performance, and counterproductive work behavior among the Big Five across different occupations (correlations around 0.20). However, especially when focusing on specific occupations (e.g., customer service) and dimensions of job performance (e.g., counterproductive work behavior), the remaining Big Five dimensions were significant predictors as well.

Character Strengths and Job Performance

Several studies have investigated the relations between character strengths and various dimensions of job performance, such as *individual-level performance* and its subdimensions (e.g., Cosentino and Castro Solano, 2012; Harzer and Ruch, 2014; Littman-Ovadia and Lavy, 2016; Harzer et al., 2017), *team-level and organization-level performance* and their subdimensions (e.g., Harzer and Ruch, 2014; Harzer et al., 2017; Littman-Ovadia and Raas-Rothschild, 2018), as well as *counterproductive work behavior* and its subdimensions (e.g., Littman-Ovadia and Lavy, 2016; Harzer et al., 2017). Research has repeatedly shown that character strengths are systematically correlated with various dimensions of job performance. For example, perseverance and honesty were positively related to individual-level performance; teamwork and fairness were positively related to team-level performance; and forgiveness and fairness were negatively related to counterproductive work behavior. This is in line with the definition of character strengths as personality traits that contribute to individuals' successes and performances in life (Peterson and Seligman, 2004).

However, the question arises as to what extent character strengths exhibit incremental validity as predictors of job performance beyond common predictors utilized in industrial and organizational psychological research and practice. The incremental validity of character strengths beyond GMA is of interest, as GMA is often considered the best predictor of job performance (e.g., Schmidt and Hunter, 1998). Therefore, examining whether or not other potential predictors of job performance significantly improve the prediction of job performance beyond GMA is of particular interest. Character strengths and GMA are two distinct psychological constructs that show by definition no substantial overlap (e.g., Peterson and Seligman, 2004), which implies that such personality characteristics may be very potential candidates explaining variance in job performance beyond GMA. However, to the best of our knowledge, no empirical evidence on the relations between character strengths and GMA is available so far. Nevertheless, as character strengths show substantial relations with various dimensions of job performance and are theoretically distinct from GMA, it is hypothesized that character strengths exhibit incremental validity beyond GMA.

The incremental validity of character strengths beyond the Big Five is of interest as well, because both character strengths and the Big Five describe individuals' personality traits. The question is whether or not character strengths—as the more recent conceptualization of personality traits—add new information to the prediction of job performance beyond the Big Five. Character strengths differ from personality traits, such as the Big Five, in several aspects. Firstly, character strengths are narrow traits, whereas the Big Five are broader. Secondly, positively valued, desirable traits were intentionally excluded from the Big Five approach, as Allport (1937) regarded character traits

(i.e., valued traits) as unnecessary to describe personality. The question arises whether or not character strengths as morally valued traits add information beyond the Big Five that are by definition neutral, descriptive, non-evaluative traits (Allport, 1937). Thirdly, character strengths fulfill a number of criteria (e.g., they are valued across cultures and contribute to living a fulfilled life; Peterson and Seligman, 2004) that are not equally applicable to the Big Five traits. Nevertheless, some character strengths do meaningfully overlap with selected Big Five traits (e.g., perseverance as a character strength and conscientiousness as a Big Five trait), but the size of the correlation coefficients indicates that the concepts are unique despite some overlapping aspects (e.g., Macdonald et al., 2008; Noftle et al., 2011; McGrath et al., 2020). Fourthly, some character strengths go beyond the traditional Big Five (especially those related to transcendental strengths). Therefore, as character strengths show substantial relations with various dimensions of job performance and are largely theoretically and empirically distinct from the Big Five, it is hypothesized that character strengths exhibit incremental validity beyond the Big Five.

The Present Study

The present study aimed at examining the following research questions: do character strengths predict a significant amount of variance in job performance beyond GMA and the Big Five? Which predictors among character strengths, GMA, and the Big Five are the most important ones?

Therefore, the main goal of the present study was the investigation of the incremental validity of character strengths as predictors of job performance beyond (a) GMA, (b) the Big Five, and (c) GMA and the Big Five combined by utilizing stepwise regression analyses. Additionally, we aimed at identifying the most important predictors of job performance out of the 24 character strengths, GMA, and the Big Five by utilizing exploratory relative weight analyses. This would also provide relevant information on the relative importance of the character strengths vs. GMA vs. the Big Five in the prediction of job performance.

A sample of employees from various occupations has been collected in order to examine the goals of the present study on a more general instead of a job-specific level. In line with well-known meta-analyses (Schmidt and Hunter, 1998; e.g., Salgado and Anderson, 2003), GMA and the Big Five were conceptualized on a broad level in the present study. In order to achieve a fine-grained overview of the interplay between character strengths as narrow traits and job performance, (1) a measure based on the positive work role performance model by Griffin et al. (2007) was utilized to assess productive work behavior and its dimensions on different levels of abstraction from broad (i.e., overall job performance) to narrow (e.g., individual task proficiency). Furthermore, (2) counterproductive behavior was operationalized using a measure of deviant behavior at work and its dimensions interpersonal deviance and organizational deviance (Bennett and Robinson, 2000).

We decided to combine supervisory ratings for the dimensions of job performance with self-ratings of character strengths and the Big Five as well as test data for GMA to control for inflated correlations due to common method variance (Doty and Glick, 1998). Utilizing only supervisory ratings, self-descriptions, or test data may lead to inflated correlation coefficients.

MATERIALS AND METHODS

Procedure and Participants

In order to obtain a heterogeneous, ideally representative sample of German employees, supervisors from various companies and sectors (e.g., air traffic and air traffic control, counseling, engineering, finance, health care, IT, craftsmen) were recruited for participation. Supervisors were informed about the study directly and using the snowball system *via* email and social networks (e.g., Xing, LinkedIn). Once supervisors and their employees decided to participate, the supervisors registered themselves and their employees by providing everyone's email address in an online registration form created using the Internet platform Unipark (http://www.unipark.com/en/). Automatically generated individual links to an anonymized online survey (also created using the Internet platform Unipark) were then sent by email to each of the employees to obtain their self-ratings in character strengths and the Big Five and to the supervisors to obtain supervisor ratings of the employees' productive and counterproductive behavior. At the end of the online survey, employees were instructed to follow a link to the Hogrefe Test System in order to complete the test of GMA. Before filling out the online survey, employees received basic information regarding the study and subsequently expressed their (dis)interest of participation (i.e., informed consent). Participants did not receive any payment for their participation, but employees had the opportunity to receive automatically generated individual feedback on their character strengths as well as extensive material on interpreting and processing the feedback. Employees and supervisors filled out the online surveys independently of each other and did not have access to each other's answers. Both the employees and the supervisors were informed about this in advance.

The sample of *employees* consisted of $N = 169$ German-speaking participants (male: $n = 94$; female: $n = 75$) from various occupational groups. The participants' mean age was $M = 38.36$ years ($SD = 9.01$, ranging from 22 to 61 years). They were highly educated, as $n = 71$ indicated having a university degree (i.e., bachelor's or master's) and $n = 18$ a doctoral degree; $n = 75$ had completed an apprenticeship, and $n = 5$ had finished secondary school. Their average length of tenure in the occupation was $M = 10.97$ years ($SD = 7.99$, ranging from 0.33 to 39.96 years). The participants were all working at least 50% of full-time hours, with about three quarters ($n = 131$) working full-time and $n = 35$ working part-time (i.e., 50–85% of a full-time position); $n = 3$ did not respond to the question. The gender distribution, average age, and share of full-time and part-time workers in the present sample were very similar to that of the German workforce as a whole, but the education of the present sample of employees was higher than on the population level (Statistisches Bundesamt, 2018; Bundesagentur für Arbeit, 2019).

The sample of *supervisors* consisted of $N = 27$ German-speaking participants (male: $n = 19$; female: $n = 8$) with a mean age of $M = 46.26$ years ($SD = 7.35$, ranging from 33 to 56 years). Each supervisor rated 1–13 employees ($M = 6.26$, $SD = 2.70$, $Md = 7.00$). The mean rating for how well they know their employees (1 = *not at all* to 5 = *partially* and 9 = *very well*) was $M = 7.48$ ($SD = 1.37$, ranging from 5 to 9). They had known their employees for $M = 6.31$ years on average ($SD = 2.76$, ranging from 1.83 to 13.17 years). This indicates that the supervisors knew their employees very well and were therefore able to judge their behavior at the workplace.

Measures

Employees' Self-Assessments

Character Strengths

For the self-assessment of 24 character strengths, the German version of the *Values in Action Inventory of Strengths* (Peterson et al., 2005; German version: Ruch et al., 2010; VIA-IS) was utilized in its 120-item short form (VIA-IS120; Littman-Ovadia, 2015). This short form comprises five items for each of the 24 character strengths in the VIA classification (Peterson and Seligman, 2004). Participants rated the extent to which each item describes them well on a 5-point answer scale ranging from 1 = *not like me at all* to 5 = *very much like me*. For example, the character strength of perseverance is measured by items, such as "I never quit a task before it is done." Reliability of the VIA-IS120 scales ranged from $\alpha = 0.64$ to $\alpha = 0.90$, with a median of $\alpha = 0.78$ (Littman-Ovadia, 2015). The relations between the short form scales and the longer 240-item form scales ranged from $r = 0.84$ (honesty) to $r = 0.96$ (hope and teamwork) (Littman-Ovadia, 2015), which indicates satisfactory construct validity. For the purpose of the present study, 24 variables were computed by calculating the mean of the respective items, which represent the participants' levels of each of the 24 character strengths.

General Mental Ability

For the self-assessment of GMA, the short form (Part 1) of the *Revised Culture Fair Intelligence Test Scale 2* (*CFT 20-R*; Weiß, 2006) was utilized in its computer-based version (i.e., Hogrefe Test System; www.testzentrale.de/etesting/hogrefe-testsystem-hts). The CFT 20-R assesses fluid intelligence using 56 items grouped into four types of non-verbal figural tasks (i.e., 15 series, 15 classifications, 15 matrices, 11 topologies). Answers to the tasks were given in multiple-choice format and under time-limited conditions (i.e., 4 min for series and classifications and 3 min for matrices and topologies). The short form of the CFT 20-R showed a split-half reliability of $r = 0.90$ (Weiß, 2006). All four types of non-verbal figural tasks showed high loadings on a general fluid ability factor, indicating the factorial validity of the CFT 20-R (Weiß, 2006). Additionally, the CFT 20-R showed convergent validity, as it substantially correlated with other measures of intelligence (Weiß, 2006). For the purpose of the present study, one variable was computed as the number of correct answers (i.e., raw score) to represent participants' level of GMA (GMA).

Big Five

For the self-assessment of the Big Five personality traits neuroticism (N), extraversion I, culture (Cu), agreeableness (A), and conscientiousness (Co), the *Minimal Redundancy Scales—25* (*MRS-25*; Ostendorf, 1990; Schallberger and Venetz, 1999) was utilized. This measure is based on the lexical approach research tradition (e.g., Ostendorf, 1990). The MRS-25 comprises a total of 25 items presented as bipolar adjective ratings (i.e., five items for each of the five personality factors). Participants rated the extent to which each item describes them well on a six-point bipolar rating-scale (1 = *strongly agree with the adjective on the left pole* to 6 = *strongly agree with the adjective on the right pole*). Sample items are "hardy vs. vulnerable" (N), "talkative vs. silenI(E), "original vs. conventional" (Cu), "peaceable vs. quarrelsome" (A), and "ambitious vs. aimless" (Co). The MRS-25 was found to be a reliable instrument (e.g., median of $\alpha = 0.81$ in four different samples; Schallberger and Venetz, 1999). Furthermore, its stable factor structure provides strong evidence of factorial validity (Schallberger and Venetz, 1999). Although research on its construct validity is relatively scarce yet, studies have shown meaningful correlation pattern with other personality constructs (e.g., Schallberger and Venetz, 1999; Ruch et al., 2018). For the purpose of the present study, five variables were computed by calculating the means of the respective items, which represent the participants' levels of the five Big Five personality traits (i.e., neuroticism, extraversion, culture, agreeableness, conscientiousness).

Supervisor Ratings of Employees' Job Performance

Productive Work Behavior

For supervisor ratings of employees' productive work behaviors, the *Work Role Performance Scale* (*WRPS*; Griffin et al., 2007; German version: Harzer et al., 2017) was utilized. Employees' productive work behaviors are measured at three levels (i.e., individual, team, and organization level) with respect to three different aspects (i.e., proficiency, adaptivity, and proactivity). The WRPS comprises 27 items assessing the dimensions of performance in a specific work role as stipulated in the model of positive work role behaviors by Griffin et al. (2007). The supervisors are asked to rate how often their employees had carried out the described behavior in the last 1 year on a 5-point answer scale ranging from 1 = *(almost) never* to 5 = *very often*. For example, the individual task proficiency is measured by items, such as "He/she has carried out the core parts of his/her job well," and team member adaptivity is measured by items, such as "He/she has responded constructively to changes in the way his/her team works." Harzer et al. (2017) reported reliabilities ranging from $\alpha = 0.73$ (proficiency and individual level performance) to $\alpha = 0.92$ (proactivity) and $\alpha = 0.90$ for overall performance. For the purpose of the present study and in accordance with **Figures 1**, 13 variables have been computed by calculating the means of the respective items, which represent the participants' levels in (1) individual task proficiency, (2) individual task adaptivity, (3) individual task proactivity, (4) team member proficiency, (5) team member adaptivity, (6) team member proactivity, (7) organization member proficiency, (8) organization member adaptivity,

(9) organization member proactivity, (10) individual-level performance (i.e., composite score of individual task proficiency, adaptivity, and proactivity), (11) team-level performance (i.e., composite score of team member proficiency, adaptivity, and proactivity), (12) organization-level performance (i.e., composite score of organization member proficiency, adaptivity, and proactivity), and (13) overall job performance (i.e., composite score of all dimensions [1] to [9]).

Counterproductive Work Behavior

For supervisor ratings of employees' counterproductive work behavior, the *Workplace Deviance Scale* (*WDS*; Bennett and Robinson, 2000; German version: Harzer et al., 2017) was utilized. The WDS comprises 19 items assessing employees' deviant and counterproductive behaviors at the workplace. It includes the subscales of interpersonal deviance (7 items; deviant behaviors directly harmful to other individuals within the organization) and organizational deviance (12 items; deviant behaviors directly harmful to the organization). The supervisors were asked to indicate the frequency with which their employees engaged in the described behaviors over the past year on a 7-point answer scale ranging from 1 = *never* to 7 = *daily*. An example item for interpersonal deviance is "He/she made fun of someone at work" and for organizational deviance "He/she has taken property from work without permission." Harzer et al. (2017) reported internal consistencies of $\alpha = 0.71$ and $\alpha = 0.74$ for interpersonal deviance and organizational deviance, respectively. For the purpose of the present study, three variables were computed by calculating the means of the respective items, which represent the employees' levels of (1) interpersonal deviance, (2) organizational deviance, and (3) overall deviant behavior at work [i.e., composite score of (1) and (2)].

Control Variables

Sex and age were included as control variables for two reasons. Firstly, a meta-analysis indicated systematic relations between character strengths and these demographic variables (Heintz et al., 2019). Secondly, age (as a proxy for work experience) has been shown to have an impact on job performance (e.g., Quińones et al., 1995).

Data Screening

In order to ensure their trustworthiness and accuracy, the data were screened thoroughly. The raw data encompass 175 employees with complete data on the self-rating measures (i.e., VIA-IS120, MRS-25) and supervisor-rated measures (i.e., WRPS, WDS). A total of 6 cases were excluded from the data analyses: $n = 2$ because of answer styles and contradictory answers by the employees, $n = 1$ because the employee's sex differed between the self- and supervisor ratings, and $n = 3$ because the supervisors indicated that they did not know the evaluated employee well enough. Consequently, the final data set included $N = 169$ cases.

Furthermore, there was substantial dropout on the CFT 20-R data, because employees needed to change to a different online platform after filling out the self-assessment measures in order to complete the CFT 20-R (i.e., from the Unipark to the Hogrefe Test System). As some employees did not do so, CFT 20-R scores were available for 106 of the 169 cases. However, employees who filled out the CFT 20-R did not differ significantly from those who did not complete the CFT 20-R with respect to gender ratio [$\chi^2(1) = 0.00$, $p = 0.989$], age [$t_{(167)} = -1.02$, $p = 0.310$], education [$\chi^2(5) = 9.15$, $p = 0.103$], tenure [$t_{(167)} = 0.18$, $p = 0.862$], or any of the measures from the self- and supervisor ratings [$V_{Pillai'sTrace} = 0.28$, $F_{MANOVA(41,127)} = 1.22$, $p = 0.199$]. Additionally, Little's MCAR test indicated that the data were missing completely at random [$\chi^2(48) = 56.40$, $p = 0.190$]. Therefore, using the R package "mice," incomplete data were imputed *via* chained equations (van Buuren and Groothuis-Oudshoorn, 2011). A total of 40 data sets were imputed with 20 iterations each in order to obtain satisfactory imputations (Graham et al., 2007; Graham, 2009; van Buuren and Groothuis-Oudshoorn, 2011). Inspection of the imputed data showed that they were trustworthy (van Buuren and Groothuis-Oudshoorn, 2011): (a) imputed values were within the range of possible scores on the CFT 20-R, (b) there was high convergence among the imputed data sets, and (c) density plots of the observed and imputed CFT 20-R raw scores were highly similar. As it was not possible to work with 40 data sets for all the subsequent data analyses, these were merged into one data set utilizing the R package "sjmisc" (Lüdecke, 2018). Densities of the mean values of the 40 imputed data sets and the final merged CFT 20-R raw scores were highly similar, indicating a highly satisfactory merging process.

RESULTS

Preliminary Analyses

In order to examine the utilized measures (i.e., VIA-IS120, CFT 20-R, MRS-25, WRPS, WDS), minima, maxima, means, standard deviations, and reliability coefficients (Cronbach's alpha) were computed for all scales. Furthermore, correlations between the variables and employees' sex and age were calculated (see **Table 2** for employees' self-assessments and **Table 3** for supervisors' ratings of their employees).

Tables 2, **3** show that all measures demonstrated satisfactory variability with the exception of counterproductive work behavior (WDS). The minima and maxima indicated that the sample consisted of participants having low to high scores on the variables. The scale reliability coefficients were satisfactory for research purposes. As there were small- to medium-sized systematic correlations between the utilized measures and employees' sex and age, these demographic variables were included as control variables in the subsequent data analyses in order to prevent any bias in the results due to these variables. Skewness and kurtosis of all the measures indicated normal distribution for all variables except the counterproductive work behavior (WDS). The variables representing counterproductive work behavior were substantially L-shaped; therefore, they were *inversely* transformed (Tabachnick and Fidell, 2001) for further use in subsequent analyses.

To obtain an overview of the relations of character strengths, GMA, and the Big Five with productive and counterproductive work behavior, zero-order and partial correlations were computed between (a) the VIA-IS120 scales, CFT 20-R,

TABLE 2 | Employees' self-assessment of character strengths, GMA, and the Big Five: minima, maxima, means, standard deviations, Cronbach's alpha coefficients of VIA-IS120 scales, CFT 20-R, and MRS-25 scales, and correlations between VIA-IS120 scales, CFT 20-R, and MRS-25 scales and participants' sex and age.

						Correlation with participants'	
Variable	**Min**	**Max**	***M***	***SD***	**α**	**Sex**	**Age**
VIA-IS120							
Creativity	1.00	5.00	2.70	0.98	0.91	0.12	0.07
Curiosity	1.20	5.00	2.98	0.94	0.91	0.20**	0.10
Judgment	1.60	5.00	3.41	0.80	0.89	−0.14	0.33***
Love of learning	1.00	5.00	2.73	1.00	0.91	0.07	0.34***
Perspective	1.40	4.80	2.97	0.84	0.80	−0.17*	0.46***
Bravery	1.60	5.00	3.31	0.85	0.82	−0.15*	0.31***
Perseverance	1.60	5.00	3.56	0.87	0.90	−0.09	0.31***
Honesty	1.80	5.00	3.65	0.71	0.77	0.24**	0.27***
Zest	1.80	5.00	3.53	0.76	0.77	−0.01	0.19*
Love	1.20	5.00	3.21	0.89	0.90	0.30***	0.13
Kindness	1.40	5.00	3.46	0.80	0.86	0.40***	0.11
Social intelligence	1.40	5.00	3.43	0.79	0.88	0.36***	0.10
Teamwork	1.40	5.00	3.56	0.86	0.88	0.30***	0.14
Fairness	1.40	5.00	3.76	0.90	0.91	0.22**	0.23**
Leadership	1.00	5.00	2.81	1.22	0.92	−0.04	0.44***
Forgiveness	1.60	5.00	3.67	0.72	0.77	0.15	0.27***
Modesty	1.00	5.00	3.38	0.80	0.81	0.00	0.38***
Prudence	1.60	5.00	3.31	0.73	0.77	0.16*	0.31***
Self-regulation	1.40	5.00	3.28	0.86	0.81	0.10	0.20**
Appreciation	1.00	5.00	2.61	1.05	0.94	0.65***	−0.11
Gratitude	1.20	4.80	3.12	0.80	0.86	0.26**	0.16*
Hope	1.60	4.80	3.43	0.64	0.65	0.13	0.12
Humor	1.00	5.00	2.99	0.88	0.87	0.04	0.10
Spirituality	1.00	5.00	2.31	1.09	0.96	0.07	0.25**
CFT 20-R							
GMA	31.00	54.00	43.54	6.17	0.89	−0.10	0.08
MRS-25							
Neuroticism	1.40	5.80	2.94	0.87	0.75	0.40***	−0.21**
Extraversion	1.80	6.00	4.31	1.08	0.91	0.13	−0.07
Culture	1.80	5.80	3.59	0.87	0.77	0.23**	−0.19*
Agreeableness	2.20	6.00	4.38	0.75	0.78	0.31***	0.08
Conscientiousness	2.80	6.00	4.68	0.70	0.84	0.05	0.21**

N = 169. Sex: 1 = male, 2 = female. Edu = highest educational degree. Ten = tenure (years of work experience in the current profession). Pearson correlations between variables and sex, age, and tenure. Spearman's rho correlations between variables and highest educational degree. VIA-IS120 = Values in Action Inventory of Strengths (Littman-Ovadia, 2015). CFT 20-R = Revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006). GMA = General mental ability. MRS-25 = Minimal Redundancy Scales (Ostendorf, 1990).
**p < 0.05; **p < 0.01; ***p < 0.001.*

and MRS-25 scales and (b) the WRPS scales and WDS scales. Due to the large number of correlation coefficients, a Bonferroni correction was employed to control for Type I error, conservatively adjusting the alpha level to 0.0016 (0.05/30, because there were 24 VIA-IS120 scales, 1 CFT 20-R score, and 5 MRS-25 scales). Partial correlations (control variables: employees' sex and age) are presented in **Table 4** (please see **Supplementary Table 1** for zero-order correlations among the study variables).

Table 4 shows that there were numerous significant positive correlations between character strengths and the dimensions of productive work behavior as well as negative correlations between character strengths and counterproductive work behavior. Due to high variability in the data and the high reliability of the scales, correlation coefficients representing the relations between character strengths and the various dimensions of job performance were higher than in previous research, but the correlation patterns were similar (e.g., Cosentino and Castro Solano, 2012; Harzer and Ruch, 2014; Littman-Ovadia and Lavy, 2016; Harzer et al., 2017). More specifically, perseverance, teamwork, and leadership most often exhibited the numerically highest correlation coefficients within each of the columns of **Table 4**. Perseverance showed the numerically strongest correlations with (the dimensions of)

TABLE 3 | Supervisor ratings of employees' productive and counterproductive work behavior: minima, maxima, means, standard deviations, Cronbach's alpha coefficients of WRPS and WDS scales, and correlations between WRPS and WDS scales and employees' sex and age.

						Correlation with employees'	
Variable	**Min**	**Max**	***M***	***SD***	**α**	**Sex**	**Age**
WRPS							
Overall job performance	1.52	4.78	3.11	0.74	0.94	−0.05	0.29***
Individual-level performance	1.56	5.00	3.38	0.79	0.94	−0.07	0.28***
Individual task proficiency	2.00	5.00	4.16	0.88	0.95	−0.09	0.28***
Individual task adaptivity	1.00	5.00	3.10	0.88	0.90	−0.03	0.19*
Individual task proactivity	1.00	5.00	2.88	0.91	0.91	−0.06	0.28***
Team-level performance	1.22	4.78	3.24	0.77	0.92	0.05	0.22**
Team member proficiency	1.33	5.00	4.05	0.87	0.92	0.14	0.10
Team member adaptivity	1.33	5.00	3.11	0.81	0.78	0.03	0.19*
Team member proactivity	1.00	4.67	2.55	0.95	0.91	−0.04	0.28***
Organization-level performance	1.22	5.00	2.71	0.81	0.93	−0.10	0.31***
Organization member proficiency	1.33	5.00	3.74	0.86	0.86	0.01	0.29***
Organization member adaptivity	1.00	5.00	2.30	0.92	0.90	−0.12	0.22**
Organization member proactivity	1.00	5.00	2.07	0.96	0.91	−0.15*	0.31***
WDS							
Overall deviant behavior at work	1.00	2.70	1.20	0.30	0.80	0.00	−0.19*
Interpersonal deviance	1.00	3.14	1.15	0.38	0.85	−0.17*	−0.02
Organizational deviance	1.00	3.17	1.25	0.38	0.75	0.12	−0.28***

N = 169. Sex: 1 = male, 2 = female. Edu = highest educational degree. Ten = tenure (years of work experience in the current profession). Pearson correlations between variables and sex, age, and tenure. Spearman's rho correlations between variables and highest educational degree. WRPS = Work Role Performance Scale (Griffin et al., 2007). WDS = Workplace Deviance Scale (Bennett and Robinson, 2000).

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

individual-level performance, teamwork with (the dimensions of) team-level performance as well as (the dimensions of) counterproductive work behavior, and leadership with (the dimensions of) organization-level performance. However, other character strengths were numerically strong correlates of various dimensions of productive and counterproductive work behavior as well (e.g., honesty for individual task proficiency, social intelligence for team member proficiency, fairness and forgiveness for counterproductive behavior). Furthermore, the character strengths were numerically less strongly related to interpersonal deviance than the other dimensions of productive and counterproductive work behavior.

The effect size of the correlation between GMA and overall job performance was similar to those reported in meta-analyses (Schmidt and Hunter, 1998; Salgado et al., 2003; e.g., Hülsheger et al., 2007). Furthermore, the correlations between the Big Five and job performance were stronger than those reported in meta-analyses (e.g., Barrick and Mount, 1991; Salgado, 1997; Hurtz and Donovan, 2000; Dudley et al., 2006). Nevertheless, in line with the results of these meta-analyses, conscientiousness most often exhibited the numerically strongest relations to the dimensions of productive work behavior among the Big Five.

Regression Analyses

In order to examine the incremental validity of character strengths as predictors of job performance beyond GMA and the Big Five, several hierarchical linear regression analyses were computed. The R package "personality factors" was utilized to estimate Olkin–Pratt adjusted R^2 and ΔR^2, which is recommended for regression models with largely different numbers of predictors and collinearity among predictors (Anglim and Grant, 2014). *Firstly*, we were interested in the incremental validity of character strengths as predictors of job performance beyond GMA. Therefore, a hierarchical linear regression analysis was computed for each of the dimensions of productive and counterproductive work behavior (controlling for sex and age[1]) as the dependent variable. In the first step, CFT 20-R raw scores (controlling for sex and age) were entered as independent variables (method: Enter), whereas in the second step, those variables among the VIA-IS120 scales (controlling for sex and age) that were significantly related to the dependent variable of interest (as presented in **Table 4**) were entered as independent variables (method: Enter). Changes in the explained variance (Olkin–Pratt adjusted ΔR^2) of the dependent variables from Step 1 to Step 2 were of particular interest. If there was a significant increase in the explained variance, character strengths exhibited incremental validity beyond GMA (and the control variables sex and age).

Secondly, we were interested in the incremental validity of character strengths as predictors of job performance beyond the Big Five. The logic and analysis procedure were congruent

[1]The R package "personality factors" only allows for hierarchical regression analyses with two steps. We therefore regressed all variables with sex and age and saved the residuals to compute scores for all scales controlling for sex and age.

TABLE 4 | Partial correlations (controlled for employees' sex and age) between employees' self-assessed character strengths, GMA, and the Big Five (VIA-IS120 scales, CFT 20-R, MRS-25 scales) and supervisor ratings of employees' productive and counterproductive work behavior (WRPS and WDS scales).

	WRPS													WDS		
		Individual task				Team member				Organization member						
Variable	**Overall**	**Total**	**Prof**	**Adapt**	**Proact**	**Total**	**Prof**	**Adapt**	**Proact**	**Total**	**Prof**	**Adapt**	**Proact**	**Overall**	**Int**	**Org**
VIA-IS120																
Creativity	0.37	0.41	0.29	0.44	0.34	0.33	0.19	0.39	0.30	0.30	0.29	0.32	0.19	−0.24	−0.01	−0.35
Curiosity	0.38	0.39	0.25	0.41	0.36	0.32	0.16	0.33	0.35	0.34	0.29	0.37	0.25	−0.14	0.02	−0.20
Judgment	0.52	0.56	0.55	0.52	0.42	0.44	0.28	0.46	0.41	0.45	0.44	0.43	0.31	−0.32	−0.07	−0.42
Love of learning	0.45	0.41	0.29	0.38	0.40	0.44	0.31	0.41	0.44	0.40	0.38	0.34	0.34	−0.30	−0.21	−0.26
Perspective	0.48	0.44	0.44	0.42	0.31	0.46	0.38	0.44	0.38	0.45	0.46	0.39	0.34	−0.44	−0.21	−0.46
Bravery	0.47	0.53	0.49	0.54	0.36	0.36	0.20	0.42	0.32	0.43	0.44	0.42	0.30	−0.30	−0.04	−0.43
Perseverance	0.63	0.68	0.73	0.61	0.46	0.53	0.43	0.54	0.43	0.55	0.59	0.51	0.37	−0.48	−0.16	−0.58
Honesty	0.61	0.53	0.56	0.48	0.37	0.59	0.55	0.59	0.42	0.57	0.57	0.52	0.42	−0.49	−0.25	−0.52
Zest	0.45	0.49	0.47	0.47	0.36	0.40	0.34	0.38	0.32	0.38	0.47	0.36	0.20	−0.38	−0.12	−0.45
Love	0.32	0.27	0.27	0.24	0.19	0.39	0.39	0.36	0.27	0.23	0.29	0.18	0.16	−0.38	−0.24	−0.34
Kindness	0.52	0.42	0.44	0.40	0.27	0.57	0.57	0.55	0.39	0.45	0.48	0.41	0.32	−0.49	−0.27	−0.47
Social intelligence	0.50	0.40	0.46	0.32	0.28	0.60	0.64	0.54	0.41	0.41	0.49	0.33	0.29	−0.53	−0.36	−0.46
Teamwork	0.64	0.52	0.56	0.44	0.37	0.74	0.80	0.66	0.49	0.53	0.60	0.45	0.38	−0.63	−0.38	−0.58
Fairness	0.60	0.52	0.52	0.47	0.38	0.63	0.60	0.58	0.47	0.53	0.57	0.45	0.39	−0.57	−0.35	−0.54
Leadership	0.66	0.52	0.44	0.49	0.43	0.61	0.46	0.61	0.53	0.73	0.63	0.65	0.65	−0.44	−0.20	−0.45
Forgiveness	0.49	0.41	0.39	0.39	0.30	0.54	0.54	0.48	0.41	0.41	0.50	0.34	0.27	−0.54	−0.38	−0.45
Modesty	0.32	0.31	0.29	0.31	0.21	0.34	0.35	0.29	0.24	0.25	0.33	0.23	0.11	−0.28	−0.12	−0.32
Prudence	0.33	0.37	0.34	0.37	0.26	0.29	0.19	0.32	0.25	0.28	0.33	0.28	0.13	−0.17	−0.03	−0.22
Self-regulation	0.41	0.46	0.48	0.41	0.32	0.36	0.33	0.33	0.29	0.32	0.40	0.28	0.18	−0.40	−0.19	−0.42
Appreciation	0.11	0.06	0.07	0.07	0.03	0.16	0.18	0.16	0.08	0.09	0.15	0.06	0.03	−0.19	−0.12	−0.13
Gratitude	0.32	0.32	0.36	0.27	0.23	0.37	0.38	0.36	0.24	0.21	0.31	0.19	0.07	−0.37	−0.23	−0.32
Hope	0.44	0.42	0.42	0.35	0.33	0.42	0.34	0.40	0.37	0.39	0.48	0.30	0.26	−0.40	−0.21	−0.40
Humor	0.48	0.42	0.31	0.47	0.31	0.43	0.30	0.45	0.38	0.50	0.45	0.46	0.42	−0.31	−0.07	−0.37
Spirituality	0.09	0.10	0.10	0.05	0.12	0.12	0.12	0.08	0.10	0.04	0.06	0.04	0.02	−0.14	−0.09	−0.09
CFT 20-R																
GMA	0.39	0.44	0.36	0.41	0.39	0.37	0.34	0.32	0.31	0.27	0.22	0.24	0.26	−0.27	−0.05	−0.33
MRS-25																
Neuroticism	−0.27	−0.28	−0.28	−0.22	−0.24	−0.25	−0.21	−0.18	−0.26	−0.21	−0.22	−0.13	−0.22	0.32	0.18	0.31
Extraversion	0.30	0.23	0.34	0.11	0.14	0.35	0.45	0.26	0.21	0.27	0.33	0.19	0.22	−0.45	−0.26	−0.43
Culture	0.32	0.33	0.30	0.33	0.23	0.30	0.28	0.30	0.22	0.26	0.27	0.23	0.19	−0.36	−0.19	−0.38
Agreeableness	0.34	0.29	0.35	0.23	0.18	0.38	0.43	0.32	0.24	0.30	0.33	0.26	0.21	−0.38	−0.30	−0.30
Conscientiousness	0.40	0.36	0.41	0.32	0.22	0.37	0.34	0.36	0.27	0.38	0.37	0.34	0.30	−0.36	−0.15	−0.40

N = 169. WRPS = Work Role Performance Scale (Griffin et al., 2007): Overall = Overall job performance, Total = Composite score of 3 respective scales, Prof = Proficiency, Adapt = Adaptivity, Proact = Proactivity. WDS = Workplace Deviance Scale (Bennett and Robinson, 2000): Overall = Overall deviant behavior at work, Int = Interpersonal deviance, Org = Organizational deviance. VIA-IS120 = Values in Action Inventory of Strengths (Littman-Ovadia, 2015). R^2 = multiple correlation coefficient including all character strengths that were significantly related at $p < 0.0016$; CFT 20-R = Revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006); GMA = general mental ability; MRS-25 = Minimal Redundancy Scales (Ostendorf, 1990). Significance cut-off: correlation coefficients ≥|0.25| were significant at $p < 0.0016$.

with the regression analyses examining the incremental validity of character strengths beyond GMA. However, in Step 1, the MRS-25 scales (controlling for sex and age) were entered as independent variables (method: Enter) instead of CFT 20-R raw scores (controlling for sex and age).

Thirdly, we were interested in the incremental validity of character strengths as predictors of job performance beyond GMA and the Big Five combined. Therefore, in Step 1, the CFT 20-R raw scores and MRS-25 scales (all controlling for sex and age) were entered as independent variables (method: Enter). **Tables 5**–**7** present the results of the hierarchical linear regression analyses examining the incremental validity of character strengths as predictors of job performance beyond GMA, the Big Five, as well as GMA plus the Big Five, respectively.

Overall, the results of the regression analyses indicated that character strengths exhibited incremental validity as predictors of all dimensions of productive and counterproductive work behavior beyond GMA and/or the Big Five (except

TABLE 5 | Hierarchical linear regression analyses: explained variance (Olkin–Pratt adjusted) in dependent variables by GMA (Step 1; method: Enter; CFT 20-R) and character strengths (Step 2; method: Enter; VIA-IS120 scales with partial correlation coefficients ≥0.25 in accordance with **Table 4**).

	Step 1: GMA	Step 2: Character strengths	
Dependent variable	R^2	ΔR^2	Total R^2
WRPS			
Overall job performance	0.146	0.508	0.654
Individual-level performance	0.191	0.398	0.588
Individual task proficiency	0.126	0.489	0.615
Individual task adaptivity	0.161	0.362	0.523
Individual task proactivity	0.152	0.205	0.356
Team-level performance	0.134	0.507	0.641
Team member proficiency	0.111	0.532	0.643
Team member adaptivity	0.099	0.477	0.576
Team member proactivity	0.092	0.286	0.379
Organization-level performance	0.068	0.548	0.616
Organization member proficiency	0.042	0.510	0.552
Organization member adaptivity	0.054	0.454	0.508
Organization member proactivity	0.061	0.397	0.458
WDS			
Overall deviant behavior at work	0.066	0.390	0.456
Interpersonal deviance	0.000	0.155^{ns}	0.155
Organizational deviance	0.107	0.327	0.434

N = 169. All data were corrected for effects of sex and age before being entered into the regression analyses. GMA = general mental ability; CFT 20-R = Revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006).

ΔR^2 = incrementally explained variance; p = significance level; WRPS = Work Role Performance Scale (Griffin et al., 2007); WDS = Workplace Deviance Scale (Bennett and Robinson, 2000). Only character strengths that showed a significant correlation (p < 0.0016) with the dimension of productive or counterproductive work behavior of interest were considered here. ^{ns} = ΔR^2 was not statistically significant.

TABLE 6 | Hierarchical linear regression analyses: explained variance (Olkin–Pratt adjusted) in dependent variables by the Big Five (Step 1; method: Enter; MRS-25 scales) and character strengths (Step 2; method: Enter; VIA-IS120 scales with partial correlation coefficients ≥0.25 in accordance with **Table 4**).

	Step 1: Big Five	Step 2: Character strengths	
Dependent variable	R^2	ΔR^2	Total R^2
WRPS			
Overall job performance	0.237	0.410	0.647
Individual-level performance	0.204	0.368	0.572
Individual task proficiency	0.255	0.353	0.608
Individual task adaptivity	0.179	0.341	0.521
Individual task proactivity	0.086	0.235	0.321
Team-level performance	0.241	0.393	0.634
Team member proficiency	0.295	0.337	0.632
Team member adaptivity	0.189	0.388	0.577
Team member proactivity	0.112	0.265	0.377
Organization-level performance	0.182	0.431	0.613
Organization member proficiency	0.205	0.325	0.530
Organization member adaptivity	0.133	0.376	0.509
Organization member proactivity	0.102	0.347	0.449
WDS			
Overall deviant behavior at work	0.324	0.162	0.486
Interpersonal deviance	0.110	0.040^{ns}	0.149
Organizational deviance	0.310	0.171	0.480

N = 169. All data were corrected for effects of sex and age before being entered into the regression analyses. MRS-25 = Minimal Redundancy Scales (Ostendorf, 1990). ΔR^2 = incrementally explained variance; p = significance level; WRPS = Work Role Performance Scale (Griffin et al., 2007); WDS, Workplace Deviance Scale (Bennett and Robinson, 2000). Only character strengths that showed a significant correlation (p < 0.0016) with the dimension of productive or counterproductive work behavior of interest were considered here. ^{ns} = ΔR^2 was not statistically significant.

interpersonal deviance). The results of the regression analyses with respect to the interpersonal deviance outcome need to be treated with caution, as the residuals did not exhibit a normal distribution.

More specifically, **Table 5** shows that explained variance in the dependent variables (except interpersonal deviance) significantly increased by between 20.5 (individual task proactivity) and 54.8% (organization-level performance) by adding character strengths as independent variables in addition to GMA. GMA explained up to 19.1% of the variance in the dependent variables. **Table 6** shows that explained variance in the dependent variables (except interpersonal deviance) significantly increased by between 16.2 (overall deviant behavior at work) and 43.1% (organization-level performance) by adding character strengths as independent variables in addition to the Big Five. The Big Five explained up to 32.4% of the variance in the dependent variables. **Table 7** shows that explained variance in the dependent variables (except interpersonal deviance) significantly increased by between 10.7 (organizational deviance) and 38.4% (organization-level performance) by adding character strengths as independent variables in addition to GMA and the Big Five. GMA and the Big Five combined explained up to 37.5% of the variance in the dependent variables.

Relative Weight Analyses

Because relative weight analyses adequately take into account the multicollinearity of predictors (Johnson, 2000; Tonidandel and LeBreton, 2015), they were conducted to explore the relative importance of the job performance predictors of interest in the present study (i.e., 24 character strengths, GMA, 5 Big Five). The relative weight analyses were computed using RWA-web (Tonidandel and LeBreton, 2015) to obtain an overview of significant predictors of the various dimensions of job performance. The predictors were sex- and age-corrected VIA-IS120 scales, CFT 20-R raw scores, and MRS-25 scales. As recommended by Tonidandel et al. (2009) as well as Tonidandel and LeBreton (2015), confidence intervals for the relative weights of the predictors and significance tests were based on 10,000 bootstrapped samples, and bias-corrected and accelerated 95% confidence intervals were used. Results from these analyses are presented in **Table 8** for

TABLE 7 | Hierarchical linear regression analyses: explained variance in dependent variables (Olkin–Pratt adjusted) by GMA and the Big Five (Step 1; method: Enter; CFT 20-R and MRS-25 scales) and character strengths (Step 2; method: Enter; VIA-IS120 scales with partial correlation coefficients ≥0.25 in accordance with **Table 4**).

	Step 1: GMA and Big Five	Step 2: Character strengths	
Dependent variable	R^2	ΔR^2	Total R^2
WRPS			
Overall job performance	0.341	0.310	0.651
Individual-level performance	0.345	0.237	0.582
Individual task proficiency	0.342	0.264	0.606
Individual task adaptivity	0.298	0.234	0.532
Individual task proactivity	0.205	0.144	0.349
Team-level performance	0.336	0.306	0.642
Team member proficiency	0.375	0.275	0.650
Team member adaptivity	0.258	0.322	0.580
Team member proactivity	0.179	0.200	0.379
Organization-level performance	0.226	0.384	0.610
Organization member proficiency	0.227	0.314	0.542
Organization member adaptivity	0.170	0.335	0.506
Organization member proactivity	0.144	0.316	0.460
WDS			
Overall deviant behavior at work	0.356	0.127	0.483
Interpersonal deviance	0.104	0.044^{ns}	0.148
Organizational deviance	0.370	0.107	0.477

N = 169. All data were corrected for effects of sex and age before being entered into the regression analyses. GMA = general mental ability; CFT 20-R = Revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006); MRS-25 = Minimal Redundancy Scales (Ostendorf, 1990); ΔR^2 = incrementally explained variance; p = significance level; WRPS = Work Role Performance Scale (Griffin et al., 2007); WDS = Workplace Deviance Scale (Bennett and Robinson, 2000). Only character strengths that showed a significant correlation (p < 0.0016) with the dimension of productive or counterproductive work behavior of interest were considered here. ^{ns} *= ΔR^2 was not statistically significant.*

overall job performance, individual-level performance, team-level performance, and organization-level performance (WRPS) as well as overall deviant behavior at work (WDS). Results for the more fine-grained subdimensions of productive and counterproductive work behavior (i.e., individual task, team member, and organization member proficiency, adaptivity, and proactivity, respectively; interpersonal and organizational deviance) are presented in **Supplementary Table 2**.

Table 8 shows that the combination of the predictors explained between 59.5 and 71.9% of the variance in overall job performance, individual-level performance, team-level performance, and organization-level performance as well as overall deviant behavior at work. Explained variance in the more fine-grained subdimensions of productive and counterproductive work behavior ranged between 34.1 (interpersonal deviance) and 71.9% (team member proficiency) (see **Supplementary Table 2**). However, none of the predictors exhibited a significant relative weight for interpersonal deviance, which might have been due to the lack of normality of the residuals; therefore, the results with respect to interpersonal deviance should be treated with caution.

Up to 16 of the 24 character strengths were significant predictors of the various dimensions of job performance (except for interpersonal deviance). GMA was a significant predictor for overall job performance, individual-level performance and its subdimensions (i.e., individual task proficiency, adaptivity, proactivity), team-level performance and its subdimensions (i.e., team member proficiency, adaptivity, proactivity), and organizational deviance, but not for organization-level performance and its subdimensions, overall deviant behavior at work or interpersonal deviance. Among the Big Five, conscientiousness followed by agreeableness and extraversion were particularly relevant predictors for the various dimensions of job performance.

For each of the dimensions of job performance, at least one character strength explained a numerically larger amount of variance than GMA and the Big Five, with the exception of individual task proactivity, where GMA exhibited the numerically highest amount of explained variance (see **Table 8** and **Supplementary Table 2**). To conduct an exploratory investigation of the most relevant predictors among the character strengths, we took a closer look at which character strengths had a significant relative weight and a percentage of predicted variance ≥5%. Some of the character strengths seemed to be relevant more often than others. For example, teamwork explained up to 21.8% of the variance in the dimensions of job performance (except individual task adaptivity and proactivity, organization member adaptivity and proactivity, interpersonal deviance). Furthermore, leadership explained up to 34.4% of the variance in the dimensions of job performance (except all dimensions of deviant behavior at work, individual task, and team member proficiency). Perseverance explained up to 17.6% of the variance in the dimensions of job performance (except team member total, proficiency, and proactivity; organization member proactivity; interpersonal deviance). Of note, the interpersonal character strengths kindness and social intelligence were relevant predictors for team member adaptivity and proactivity as well as team member total. Additionally, judgment was especially relevant for individual-level performance and its subdimensions individual task proficiency, adaptivity, and proactivity. Further details can be found in **Table 8** and **Supplementary Table 2**.

DISCUSSION

In the present study, we aimed at investigating the incremental validity of character strengths as predictors of job performance beyond GMA and the Big Five. Furthermore, we aimed at identifying the most important predictors of job performance out of the 24 character strengths, GMA, and the Big Five. In order to achieve a fine-grained overview of the interplay between character strengths and job performance, nine different subdimensions of productive work behavior and two different dimensions of counterproductive work behavior as well as their composites were investigated.

TABLE 8 | Relative weights (RW) and percentages of explained criterion variance (%) for all character strengths, GMA, and the Big Five (VIA-IS120 scales, CFT 20-R, and MRS-25 scales) for overall job performance, individual-level performance, team-level performance, and organization-level performance (WRPS scales) as well as overall deviant behavior at work (WDS).

	WRPS								WDS	
	Overall job performance		Individual-level performance		Team-level performance		Organ.-level performance		Overall	
Predictor	**RW**	**%**	**RW**	**%**	**RW**	**%**	**RW**	**%**	**RW**	**%**
VIA-IS120										
Creativity	0.020*	2.8	0.031	4.6	0.016*	2.3	0.009	1.4	0.006	1.0
Curiosity	0.014	1.9	0.016	2.5	0.008	1.1	0.014	2.1	0.007	1.2
Judgment	0.036*	5.0	0.050*	7.6	0.023*	3.3	0.026*	3.8	0.013	2.3
Love of learning	0.035*	4.9	0.031	4.6	0.037*	5.2	0.026*	3.9	0.011	1.8
Perspective	0.020*	2.7	0.015	2.2	0.017*	2.4	0.024*	3.5	0.028	4.7
Bravery	0.019*	2.6	0.029	4.3	0.008	1.2	0.019*	2.7	0.008	1.3
Perseverance	0.054*	7.4	0.080*	12.0	0.028*	4.0	0.041*	6.1	0.030	5.0
Honesty	0.033*	4.6	0.024	3.6	0.033*	4.6	0.038*	5.5	0.021	3.5
Zest	0.019*	2.7	0.029	4.4	0.011	1.6	0.014	2.1	0.017	2.8
Love	0.008	1.0	0.005	0.8	0.014	1.9	0.005	0.7	0.016	2.7
Kindness	0.026*	3.6	0.016	2.3	0.036*	5.1	0.022*	3.2	0.025	4.2
Social intelligence	0.022*	3.0	0.011	1.7	0.044*	6.2	0.015	2.2	0.027	4.6
Teamwork	0.062*	8.7	0.034*	5.2	0.112*	15.8	0.037*	5.5	0.065*	10.8
Fairness	0.028*	3.8	0.019	2.8	0.034*	4.8	0.024*	3.5	0.035*	5.9
Leadership	0.108*	15.0	0.049*	7.4	0.069*	9.7	0.191*	28.1	0.020	3.4
Forgiveness	0.019*	2.7	0.011	1.6	0.029*	4.1	0.015	2.2	0.040*	6.7
Modesty	0.007	0.9	0.006	0.9	0.009	1.3	0.005	0.7	0.010	1.6
Prudence	0.010	1.4	0.015	2.2	0.007	1.0	0.008	1.1	0.012	2.0
Self-regulation	0.013	1.8	0.021	3.2	0.010	1.3	0.007	1.0	0.029	4.8
Appreciation	0.007	1.0	0.010	1.5	0.005	0.7	0.006	0.9	0.003	0.5
Gratitude	0.009	1.3	0.013	1.9	0.017*	2.4	0.003	0.5	0.019	3.2
Hope	0.013*	1.8	0.013	1.9	0.011	1.6	0.013	1.9	0.011	1.8
Humor	0.030*	4.2	0.018	2.7	0.021*	3.0	0.045*	6.6	0.008	1.3
Spirituality	0.001	0.2	0.002	0.2	0.002	0.2	0.001	0.2	0.002	0.3
CFT 20-R										
GMA	0.035*	4.9	0.054*	8.1	0.037*	5.2	0.012	1.8	0.010	1.6
MRS-25										
Neuroticism	0.011	1.5	0.014	2.1	0.011	1.5	0.005	0.7	0.031	5.2
Extraversion	0.011	1.5	0.006	0.9	0.015	2.2	0.011	1.6	0.036*	6.0
Culture	0.012	1.6	0.017	2.5	0.009	1.2	0.007	1.1	0.026	4.4
Agreeableness	0.015*	2.0	0.010	1.5	0.017*	2.5	0.013	1.9	0.016	2.7
Conscientiousness	0.022*	3.1	0.017	2.6	0.018*	2.6	0.023	3.4	0.016	2.6
R^2	0.719	100	0.664	100	0.708	100	0.681	100	0.595	100

N = 169. All data were corrected for effects of sex and age before being entered into the regression analyses. RW = raw relative weight (within rounding error, raw weights sum up to R^2); % = relative weight rescaled to as a percentage of predicted variance in the criterion attributed to each predictor (within rounding error, rescaled weights sum to 100); WRPS = Work Role Performance Scale (Griffin et al., 2007); WDS = Workplace Deviance Scale (Bennett and Robinson, 2000): Overall = overall deviant behavior at work; VIA-IS120 = Values in Action Inventory of Strengths (Littman-Ovadia, 2015); CFT 20-R = Revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006); GMA = general mental ability; MRS-25 = Minimal Redundancy Scales (Ostendorf, 1990).

**95% confidence interval did not include zero ($p < 0.05$).*

Results of preliminary correlation analyses indicated trustworthiness of data as results from previous research have been replicated. For example, perseverance, teamwork, and leadership were important correlates of job performance (e.g., Harzer and Ruch, 2014; Littman-Ovadia and Lavy, 2016; Harzer et al., 2017). As in previous research, other character strengths were also strongly and meaningfully correlated with specific dimensions of productive and counterproductive work behavior (e.g., Harzer and Ruch, 2014; Littman-Ovadia and Lavy, 2016; Harzer et al., 2017). For example, employees' honesty was positively related to supervisor-rated individual task proficiency, indicating that employees who are able to judge the quality of their work in a realistic way and contribute their share with integrity (e.g., Peterson and Seligman, 2004; Harzer and Ruch,

2014) receive higher ratings in individual task proficiency from their supervisors. Additionally, social intelligence was strongly positively related to team member proficiency, indicating that employees who understand how to fit in in different social situations and what makes other people tick (e.g., Peterson and Seligman, 2004) exhibit higher team member proficiency as rated by their supervisors. Furthermore, employees who had higher scores in fairness and forgiveness received lower scores in overall counterproductive behavior.

Regression analyses indicated incremental validity of character strengths as predictors of job performance beyond GMA and/or the Big Five personality traits (always controlling for employees' sex and age). The research question whether character strengths predict a significant amount of variance in job performance beyond GMA and the Big Five strengths can be answered with a yes. Therefore, in light of these results, character strengths can be considered highly relevant predictors of job performance in terms of productive and counterproductive work behavior above and beyond GMA or the Big Five (as well as both combined). Character strengths showed the numerically strongest incremental validity for team-level performance (especially team member proficiency beyond GMA and team member adaptivity beyond the Big Five) and organization-level performance (especially organization member proficiency beyond GMA and organization member adaptivity beyond the Big Five). This might be due to the larger number of character strengths that positively shape the nature of dyadic or group-related social situations by definition, i.e., the interpersonal strengths, such as kindness and social intelligence, as well as civic strengths, such as teamwork and leadership. Accordingly, those character strengths were among those that showed substantial relative weights in the explorative relative weight analyses. Overall, character strengths concern aspects of personality that are theoretically different from GMAs and the Big Five as argued in the Introduction of the present paper. The results regarding incremental validity indicated that those theoretical differences and empirical differences go hand in hand.

Relative weight analyses were conducted to explore the relative importance of the predictors of job performance in order to answer the research question regarding which predictors among character strengths, GMA, and the Big Five are the most important ones. The results revealed that for each of the dimensions of job performance, at least one character strength explained a numerically higher amount of variance than GMA and the Big Five, except for individual task proactivity, where GMA exhibited the numerically highest amount of explained variance. As in the correlation analyses, perseverance, teamwork, and leadership seemed to be especially relevant for numerous dimensions of job performance. These character strengths seem to be the core of positive work behavior and prevent negative work behavior across occupations; for example, high perseverance helps employees finishing job tasks and not quitting when challenges are faced (e.g., Peterson and Seligman, 2004). Additionally, teamwork supports working well with colleagues, and leadership might help employees understanding, following, and suggesting management decisions on organizational level (e.g., Peterson and Seligman, 2004). The interpersonal character strengths kindness and social intelligence were relevant predictors for team member adaptivity and proactivity as well as team-level performance. This is very meaningful as both character strengths support positive interactions among team members as team members treat each other kindly and understand own and others' emotions and behaviors (e.g., Peterson and Seligman, 2004). Additionally, judgment seemed to be especially relevant for individual-level performance and its subdimensions individual task proficiency, adaptivity, and proactivity. This is very meaningful as behaviors linked to judgment (i.e., thinking things through and examining them from all sides, not jumping to conclusions, being able to change one's mind in light of evidence, weighing all evidence fairly; e.g., Peterson and Seligman, 2004) help employees evaluating their work progress and processes and adapting them if necessary.

Strengths and Limitations of the Present Study

To the best of our knowledge, the present study is the very first to examine the incremental validity of character strengths as predictors of job performance. Like any other study, the present study has its strengths and weaknesses. The strong points concern (a) its combination of data stemming from different sources (i.e., data from self-reports, an intelligence test, and supervisor ratings), (b) the heterogeneity of the sample, and (c) conservative significance tests applying Bonferroni corrections. Due to the combination of self-reports (character strengths, the Big Five), test data (GMA), and supervisor ratings (job performance), the strong relations between character strengths and job performance cannot be contributed to common method bias (Doty and Glick, 1998). Due to the strategy applied during the recruitment process (i.e., supervisors were recruited, who invited both their poorly and strongly performing team members), the resulting sample was heterogenous with respect to all study variables (except the dimensions of counterproductive work behavior). This led to wide variance in the study variables, and no ceiling effect was observed in the dimensions of productive work behavior, as was the case in Harzer and Ruch (2014). This higher variability in the data in turn led to high reliability coefficients and high correlation coefficients. For example, the correlation between GMA and overall job performance in the present data was similar to the one reported in meta-analyses after correcting for lack of reliability and range restriction (e.g., Schmidt and Hunter, 1998). Finally, conservative significance tests were applied by systematically applying Bonferroni corrections. When identifying relevant correlates of the dimensions of productive and counterproductive work behavior, only character strengths that exhibited a correlation coefficient with a significance level of $p < 0.0016$ were considered in order to control for randomly significant correlations due to the number of significance tests.

Nevertheless, the present study has a number of limitations as well. *Firstly*, results from one relatively small sample of employees from different occupations and sectors were reported. Therefore, studies replicating the results of the present study are needed. Moreover, the results might differ when specific job groups are studied. In the present study, perseverance, teamwork, and leadership were important predictors. However, interpersonal character strengths (love, kindness, social intelligence) are

especially relevant in jobs that explicitly involve other people, such as teaching or sales (Peterson and Park, 2006), and could therefore be stronger predictors of job performance in more socially oriented jobs than in the present study. Future research may wish to investigate the role of character strengths and their incremental validity with respect to productive and counterproductive behavior in specific occupations. *Secondly*, as cross-sectional data were reported in the present study, causality could not be inferred, and experimental or longitudinal studies are needed to address this issue. *Thirdly*, in the present study, character strengths and the subdimensions of job performance were on comparable levels of specificity (i.e., narrow concepts). Furthermore, GMA and the Big Five were measured on a higher, more abstract level (i.e., broad concepts), because we wanted to study GMA and the Big Five on the same level of abstraction as reported in well-known meta-analyses (Schmidt and Hunter, 1998; e.g., Salgado and Anderson, 2003). Some studies highlight the role of narrow personality traits (e.g., facets of conscientiousness) and specific aptitudes (e.g., psychomotor abilities) as predictors of job performance (e.g., Schmidt, 2002; Dudley et al., 2006; Grobelny, 2018) as well. Additionally, character strengths and facets of the Big Five overlap (e.g., perseverance as a character strength with achievement thriving and self-discipline as facets of conscientiousness, self-regulation as a character strength with impulsiveness as a facet of neuroticism), although they are not redundant (Noftle et al., 2011; McGrath et al., 2020). Therefore, studies are needed that examine the incremental validity of character strengths beyond specific aptitudes and the facets of the Big Five in order to make sure that all variables share the same level of specificity as narrow traits. However, as the present study combines narrow with broad traits/concepts, its results add information to the bandwidth-fidelity debate (e.g., Cronbach and Gleser, 1957; Salgado et al., 2015). That is, the utilized study design offers the opportunity to get insights into the predictive validity of broad vs. narrow predictors of job performance. Additionally, job performance was operationalized on both the narrow and broad levels. The results of the present study suggest that narrow traits (i.e., character strengths) exhibit incremental validity beyond broad traits (i.e., the Big Five) as predictors of job performance narrowly and broadly construed. Moreover, relative weights of character strengths as narrow traits were numerically higher than those for the Big Five as broad traits. *Fourthly*, a floor effect occurred with respect to counterproductive work behavior (although this was not surprising, as a sample of employees with a reasonably long tenure was studied). The corresponding problem of non-normally distributed data could be solved by transforming the data. Nevertheless, the residuals for regression models with interpersonal deviance as the dependent variable lacked a normal distribution, although they were normally distributed for organizational deviance and overall deviant behavior at work. Therefore, the utilized data analysis methods were not biased for organizational deviance and overall deviant behavior at work, meaning that the results for these variables may be seen as trustworthy. However, the results for interpersonal deviance need to be treated with caution. Additionally, the relations between character strengths and counterproductive work behavior are likely underestimated due to the range restriction. Further studies are needed to obtain better insights here. *Fifthly*, no hypotheses were formulated for the relative weight analyses, which therefore were exploratory in nature. Results from these analyses may now be used for the generation of hypotheses that may be investigated in future studies. *Sixthly*, the structure of the data was nested. Therefore, hierarchical linear modeling might be warranted. However, sample size and cell size did not allow for hierarchical linear modeling. *Seventhly*, each of the dependent variables was investigated independently without taking the intercorrelations among them into account. Future research may wish to systematically investigate the influence of the nested data structure and the correlation among the dependent variables on the results.

Theoretical and Practical Implications

The results of the present study support theoretical assumptions on the role of character strengths for favorable outcomes at work. Character strengths are defined as positive traits that contribute to a satisfied and successful life (Peterson and Seligman, 2004). The present results support this proposition. Furthermore, the results of the present study show that character strengths exhibit incremental validity as predictors of job performance beyond common predictors, such as GMA and the Big Five. Moreover, relative weights indicated that specific character strengths seem to be important predictors of specific dimensions of job performance. Firstly, this highlights the role of socio-emotional skills, such as character strengths, for understanding performance and success outcomes above and beyond cognitive ability. Secondly, this shows that character strengths are relevant predictors of job performance in addition to broad conceptualizations of personality, such as the Big Five. This underscores the fact that—although the character strengths and the Big Five traits overlap to some degree—they are unique concepts that account for different parts of the variance in outcomes, such as job performance.

The present research showed that individuals with higher scores on specific character strengths receive higher performance ratings from their supervisors. Therefore, it seems meaningful to consider character strengths in personnel selection alongside other common variables. Nevertheless, there are open questions that need to be addressed before applying character strengths (and related assessment measures) as predictors of job candidates' potential future job performance. Research is needed to investigate the direction of causality between character strengths and job performance, as well as possible differences in (a) self-ratings of character strengths and (b) the criterion validity of character strengths when utilized in personnel selection processes (Harzer, 2020). Research shows that applicants' "faking" (i.e., providing more favorable self-descriptions) in personnel selection does not necessarily decrease criterion validity (e.g., Marcus, 2006, 2009). However, this needs to be demonstrated for character strengths as well before they can be utilized to predict future job performance.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

We strictly followed the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 2002, 2017) and its adaptation for Germany, with a specific focus on rules for adequate research practice (e.g., rules for informed consent and online research by the German Society of Psychology, 2016). Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CH contributed to the conception and design of the study. NB organized the database. CH and MW performed the statistical analyses and contributed to the final version of the manuscript. CH, NB, and MW wrote the first draft of the manuscript sections and approved the submitted version. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.518369/full#supplementary-material

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A Mixed-Methods Approach to Investigating Social and Emotional Learning at Schools: Teachers' Familiarity, Beliefs, Training, and Perceived School Culture

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Education advocates argue that effective schools should foster multidimensional educational goals that not only include cognitive but also non-cognitive outcomes. One important non-cognitive outcome are social and emotional skills. Previous research showed that for enhancing students' social and emotional learning (SEL) one of the most important factor is the teacher. Hence, the present study investigated teachers' familiarity, beliefs, training, and perceived school culture with regard to social and emotional learning and its facets self-awareness, self-management, and social-awareness by applying a convergent parallel mixed-method design. We conducted in-depth interviews and an online survey with secondary teachers from different countries. The reason for collecting both qualitative and quantitative data was to obtain different but complementary data on the same topic in order to bring greater insight into this research question than would have been obtained by either type of data separately. Teachers reported an uncertainty and a lack of professional skills and knowledge in delivering SEL instructions that was particularly low for self-awareness and self-management. Therefore, in both study parts, teachers expressed strong interest in receiving professional SEL training. However, schools rarely provide resources (instruction materials, specific courses or activities) or create conditions (training teachers, devoting teaching hours, increasing number of counselors at schools, receiving school administration support), that would promote teachers' instruction of SEL. The results do not only add to researchers' knowledge about teachers' SEL familiarity, beliefs, training, and school culture, but are also relevant for policymakers, administrators, and school staff by identifying critical aspects that prevent successful SEL in schools.

Keywords: social and emotional learning (SEL), self-awareness, self-management, social-awareness, teachers' attitudes, mixed-methods research

INTRODUCTION

Since educational institutions have been established, ongoing discussions about the objectives of schooling have emerged. Schools ensure that students gain skills in reading, writing, math, and science. They also promote a good comprehension of history, literature, arts, foreign languages, and diverse cultures (Greenberg et al., 2003). These knowledge and skills are undeniably important cognitive student outcomes. However, over the past decade, the attention of which outcomes students shall achieve broadened from these cognitive to so-called "non-cognitive" factors as additional important school outcomes (e.g., Rieger et al., 2017) and concepts of educating the "whole child" became more prominent (Liew and McTigue, 2010). According to multiple reviews and studies, non-cognitive factors are essential for success in education as well as in occupation (e.g., Kautz et al., 2014; Rieger et al., 2017). They are characterized as constructs that are not identified with traditional indicators of cognitive capability or intellectual functioning (Rieger et al., 2017) and are often described under such terms as socio-emotional skills, character, personality, or 21st-century skills.

One important non-cognitive facet is social and emotional learning (SEL), including, among other things, students' self-awareness, self-management, and social awareness (Durlak et al., 2011; OECD, 2015). These skills foster learners' performance (e.g., Corcoran et al., 2018) and facilitate positive social behaviors, goal orientations, emotion management, and social relationship-building skills (Elias and Arnold, 2006; OECD, 2015). Moreover, they reduce behavior problems and psychological distress (Harrell et al., 2009; Durlak et al., 2011; Sklad et al., 2012; Wigelsworth et al., 2016; Taylor et al., 2017). Hence, they are important skills that help students succeed in school, work, personal life, relationships with families and friends, and society in general (cf. Mahoney et al., 2018).

Previous studies on SEL in the school context mostly confirmed their positive effects across all grade levels (e.g., Harrell et al., 2009; Durlak et al., 2011; Sklad et al., 2012; Wigelsworth et al., 2016; Taylor et al., 2017; Corcoran et al., 2018). However, among the critical factors that influenced an effective SEL program implementation, teachers themselves were among the most crucial features (Graczyk et al., 2006; Durlak et al., 2011). Their attitudes and beliefs about SEL affected the adoption, outcome, and sustainability of SEL programs (Gingiss et al., 1994; Parcel et al., 1995; Bowden et al., 2003; Zinsser et al., 2014).

Although teachers' importance had been acknowledged early, thus far, only few qualitative and quantitative studies have examined teachers' perceptions of SEL. If so, they focused mostly on preschool and elementary school teachers (Durlak et al., 2010, 2011; Wigelsworth et al., 2016; Taylor et al., 2017). Moreover, all of the mentioned studies examined teachers' understanding of SEL in general but did not systematically target specific SEL facets. Besides the integration of structured evidence-based SEL programs, only a few studies explored schools' and teachers' own attempts, initiatives, and instructional practices to enhance students' social and emotional competencies (Zinsser et al., 2014).

The present study adds to this research gap and aims at investigating secondary school teachers' SEL familiarity, beliefs, training, and perceived school culture. In addition, the study applies a mixed-methods design, extending prior research by combining the collection of qualitative and quantitative data in order to get a more complete and nuanced picture than would have been obtained by either approach separately. This is not only valuable for researchers by enhancing their knowledge about teachers' SEL familiarity, beliefs, training, and perceived school culture. It is also important for policymakers, administrators, and school staff by identifying critical aspects that prevent successful SEL in schools.

The Concept of Social and Emotional Learning

Social and emotional learning involves processes of thinking, feeling, and behaving in order to become aware of the self and others, to regulate self-behavior and the behavior of others, and to make responsible decisions (Elias et al., 1997; Brackett and Rivers, 2014). Five interrelated core social and emotional competencies are defined: (1) self-awareness, (2) social awareness, (3) self-management, (4) relationship skills, and (5) responsible decision-making (Yopp et al., 2017). The present paper focuses on the first three competencies—self-awareness, social awareness, and self-management. These facets are less often and less explicitly addressed in teaching than relationship skills and responsible decision-making (Beland, 2007). Moreover, they can be more clearly distinguished while relationship skills and responsible decision-making are already at the intersection of a number of other SEL components (Denham and Brown, 2010).

Self-awareness is characterized as the ability to carefully identify one's emotions, thoughts, interests, and values, as well as to understand how these impact one's behavior (Eklund et al., 2018). In addition, it involves the ability to evaluate one's strengths and limitations accurately and maintain a well-grounded sense of self-efficacy and sense of self-confidence (Denham and Brown, 2010; Brackett and Rivers, 2014).

Self-management involves self-discipline, motivation, goal setting, and stress management (Dusenbury et al., 2011). It is the ability to regulate one's emotions, thoughts, and behaviors in various situations, and be able to set and monitor progress toward personal and academic aims (Brackett and Rivers, 2014; Eklund et al., 2018). Thus, it shares some similarities with the concept of self-regulated learning (Schunk and Zimmerman, 2012).

Social awareness is defined as having respect and empathy for others and understanding others' perspectives and feelings (Zins and Elias, 2007; Denham and Brown, 2010). It is also the ability to perceive similarities and differences among people (Denham and Brown, 2010).

These competencies develop at different age levels, and most structured SEL intervention programs focus on preschool or elementary school children (Durlak et al., 2010, 2011; Wigelsworth et al., 2016; Taylor et al., 2017). However, early adolescence is also an important stage to enhance SEL as the social brain changes and reorganizes structurally and functionally (Blakemore and Mills, 2014). It is a period of intensive learning,

exploring, and taking new opportunities, along with facing possible health and behavioral challenges, which can continue into adulthood (Yeager, 2017). Hence, school and teaching can still influence students' social and emotional skills even at these later stages of age.

Teachers' Social and Emotional Learning Familiarity, Beliefs, Training, and Perceived School Culture

To facilitate students' SEL, teachers need to be familiar as well as feel comfortable, committed, and trained in teaching social and emotional competencies. Moreover, the match with the culture of the school they are employed at can affect their SEL teaching practices (cf. Brackett et al., 2012).

Previous qualitative studies gave first hints that teachers seem to be not very familiar with the concept of SEL and that their knowledge is limited. For example, Esen-Aygun and Sahin-Taskin (2017) interviewed Turkish elementary school teachers and reported that most teachers had not heard about the concept of SEL. However, although they were not familiar with the concept, they did provide some activities to develop social and emotional skills when problems in the classroom came up and emphasized the importance of developing social and emotional competencies. Likewise, Triliva and Poulou (2006) interviewed Greek elementary school teachers and reported low levels of familiarity.

Beliefs indicate teachers' perceptions and judgments. They strongly influence teachers' filter of information, the framing of a situation, and guide their intentions. Hence, beliefs affect teachers' teaching practices and experiences (Pajares, 1992; Fives and Buehl, 2012; Trivette et al., 2012). Two important SEL beliefs are teachers' *comfort with and confidence in teaching SEL* as well as their *commitment to improve their own skills in teaching SEL* (Brackett et al., 2012).

While quantitative research often reports medium levels of teachers' SEL comfort (e.g., Collie et al., 2011, 2012, 2015; Brackett et al., 2012; Poulou, 2017a), more in-depth qualitative studies revealed that teachers report uncertainty in teaching SEL. For example, Buchanan et al. (2009) found that in their sample of United States kindergarten through eighth-grade teachers, only a few felt confident in teaching SEL (22%), although half of them already participated in an SEL program. Hence, quantitative and qualitative studies revealed inconsistent findings about teachers' comfort in teaching SEL.

When participating in structured SEL programs, teachers' comfort and confidence in their abilities are related to their SEL practices' effectiveness, as they are more likely to continue using a program (Buchanan et al., 2009). Teachers' comfort in teaching SEL predicts higher teaching commitment in general (Collie et al., 2011) and is related to higher levels of self-efficacy and job satisfaction (Collie et al., 2012). In addition, high levels of comfort with implementing SEL practices are related to close and supportive teacher–student relationships in elementary school (Poulou, 2017a). Zinsser et al. (2014) showed that high supportive preschool teachers were more confident in using SEL strategies than medium supportive teachers. They used more often interactional SEL practices through modeling, coaching, or scaffolding childrens' emotional experiences. A prescribed SEL curriculum was only used secondary to their interactions. In contrast, medium supportive teachers relied heavily on prescribed curricula during predefined times of the day.

An important aspect that is related to teachers' confidence and self-efficacy with providing SEL instructions is teacher training and qualification (Zins et al., 2004; Buchanan et al., 2009; Durlak, 2016). Although particularly elementary school teachers are interested in and committed to learn about how to develop SEL (Collie et al., 2011; 2015; Esen-Aygun and Sahin-Taskin, 2017; Poulou, 2017a), most studies have shown that neither pre-service nor in-service teachers receive training in teaching SEL (Jones and Bouffard, 2012; Schonert-Reichl and Zakrzewski, 2014) or in developing their own SEL competencies (Jennings and Greenberg, 2009; Oberle and Schonert-Reichl, 2017) outside of the participation in structured SEL programs. As teachers at the secondary school level are asked even less explicitly to teach SEL, training and qualification are also rather scarce (see also Oberle and Schonert-Reichl, 2017). A content analysis of required courses in teacher preparation programs in the United States revealed that only a few programs offered SEL course content (between 1% and 13% of almost 4,000 courses in 300 colleges of education; Schonert-Reichl et al., 2016).

In addition to person-centered explanations for why SEL programming promotes positive outcomes, findings indicate that it is also important to consider systemic and environmental factors (Greenberg et al., 2003). Programs that occur in classrooms or throughout the school are likely to be impacted by these environments' organizational and ecological features. A few prevention and promotion studies have begun to explore the importance of classroom, school, and neighborhood contexts on program outcomes to illustrate how a broader ecological perspective can enhance the understanding of program effects (Tolan et al., 1995; Aber et al., 1998; Metropolitan Area Child Study and Research Group, 2002; Boxer et al., 2005). When the perceived school culture matches the individual teacher's beliefs, he or she reports lower stress and greater job satisfaction (Skaalvik and Skaalvik, 2011). In elementary schools that value SEL by supporting and promoting SEL teaching, teachers were more committed to their school and teaching in general (Collie et al., 2011). In addition, high levels of elementary school principals' support are positively related—and needed—to implement SEL teaching practices effectively (Wanless et al., 2013; Schonert-Reichl et al., 2015). Asking teachers about perceived barriers for teaching SEL, one particular barrier they report is the lack of classroom time.

Differences Between Facets of Self-Awareness, Self-Management, and Social Awareness in Teachers' Social and Emotional Learning Familiarity, Beliefs, Training, and Perceived School Culture

Thus far, single facets of SEL or comparisons of different facets have been investigated rarely. For teachers' familiarity with SEL, Triliva and Poulou (2006) found that elementary school teachers were more familiar with the facet of social development as

compared to emotional learning. Schonert-Reichl et al. (2016) conducted a content analysis of required courses in teacher preparation programs, and their results revealed that only 13% of the United States teacher preparation programs offered at least one course including information on relationship skills, 7% for responsible decision-making, 6% for self-management, 2% for social awareness, and approximately 1% for self-awareness. These results emphasize that training opportunities are overall scarce but that almost no offers exist for social and self-awareness. For the perceived school culture, thus far, no studies investigating differences between facets of SEL exist.

PRESENT STUDY

The current mixed-methods study examines teachers' SEL familiarity, beliefs, training, and perceived school culture. Thus far, studies on this topic are limited and have only provided a partial view by using either a qualitative or a quantitative approach (see Zinsser et al., 2014, for an exception).

For our first research questions, we conducted semi-structured interviews in order to develop an in-depth understanding of how teachers describe SEL in general and its facets' self-awareness, self-management, and social awareness in particular (RQ 1a). In addition, we were interested in exploring how comfortable and trained teachers feel for teaching SEL (RQ 1b). Based on previous research with preschool and elementary school teachers and the assumption that secondary school teachers are less explicitly asked to address SEL, we expected that secondary school teachers would not be very familiar with and trained in teaching SEL. Moreover, we wanted to describe how supportive teachers perceive their school culture for teaching SEL (RQ 1c).

A quantitative survey focused on differences between the three facets of SEL. We examined whether there were any differences in teachers' reported self-awareness, self-management, and social awareness regarding teachers' comfort, commitment, and school culture (RQ2). Based on the qualitative results of Triliva and Poulou (2006), who found that teachers were more familiar with the facet of social development compared to emotional learning, we assumed that teachers might report to be more comfortable in teaching social awareness compared to self-awareness and self-management. For teachers' commitment toward learning about SEL, we expected high levels of commitment in general, as previous studies with elementary school teachers showed that they were highly committed to learn about how to teach SEL (Collie et al., 2011, 2015; Esen-Aygun and Sahin-Taskin, 2017; Poulou, 2017a). However, based on the finding that in teacher preparation programs, only a few offered SEL course content and, if so, they focused in particular on self-awareness and social awareness (Schonert-Reichl et al., 2016), we expected that teachers' reported commitment in learning about self- and social awareness would be higher as compared to their commitment in learning about self-management. As, thus far, no other studies have compared different facets of SEL, we did not specify any further hypotheses.

In addition, we investigated to what extent the interview results on familiarity, comfort, training, and perceived school culture agreed with the quantitative results on secondary school teachers' beliefs about the specific facets self-awareness, self-management, and social awareness (RQ3). Previous research using either qualitative or quantitative methods already points out that differences in the general level of teachers' comfort in teaching SEL exist (e.g., Triliva and Poulou, 2006; Buchanan et al., 2009; Collie et al., 2011, 2012, 2015; Brackett et al., 2012; Poulou, 2017a). However, overall, there is a need for a more complete understanding through comparing and synthesizing both personal experiences of teachers investigated with interviews that allow a thorough examination about SEL in general (i.e., qualitative data) and gaining more standardized results (i.e., quantitative data) about different facets of SEL.

MATERIALS AND METHODS

Study Design

The present study used a mixed-methods design. Mixed-methods research collects, analyzes, and mixes both quantitative and qualitative data in a single study (Creswell and Plano Clark, 2018). A convergent parallel design was applied; that means qualitative and quantitative data were collected in parallel, analyzed separately, and then merged. For the qualitative part, semi-structured in-depth interviews with secondary school teachers were conducted. Interviews have the advantage that teachers had more space to answer questions more openly and elaborately. Moreover, their individual needs and ideas could be better addressed and their context and everyday setting could be better taken into account. For the quantitative part, an online-based survey was set up. This has the advantage that an established, standardized, valid questionnaire could be adapted and used (Brackett et al., 2012) in order to compare teachers' reported comfort, commitment, and schools' culture between the three facets self-awareness, self-management, and social awareness. The integration involved merging the results from the qualitative and quantitative data so that a comparison could be made and a more complete understanding emerges than that provided by the quantitative or qualitative results alone (Heyvaert et al., 2013; Creswell and Plano Clark, 2018). **Figure 1** shows an overview of our study design.

Participants and Procedures

Qualitative Part

For the recruitment of interview participants, a purposive sampling strategy was used that enables researchers to select respondents based on specific criteria (Etikan et al., 2016). Most of the teachers were targeted based on the criterion of having experience in teaching in secondary schools with a particular emphasis on ninth-grade students. Overall, 14 respondents agreed to participate in the study. Ten of them were enrolled in a master's program on "Research on Teaching and Learning" and were classmates of the second author, who conducted the interviews in this study. Four respondents were working as full-time teachers in Kyrgyzstan and were former classmates and colleagues of the interviewer. None of them had participated in

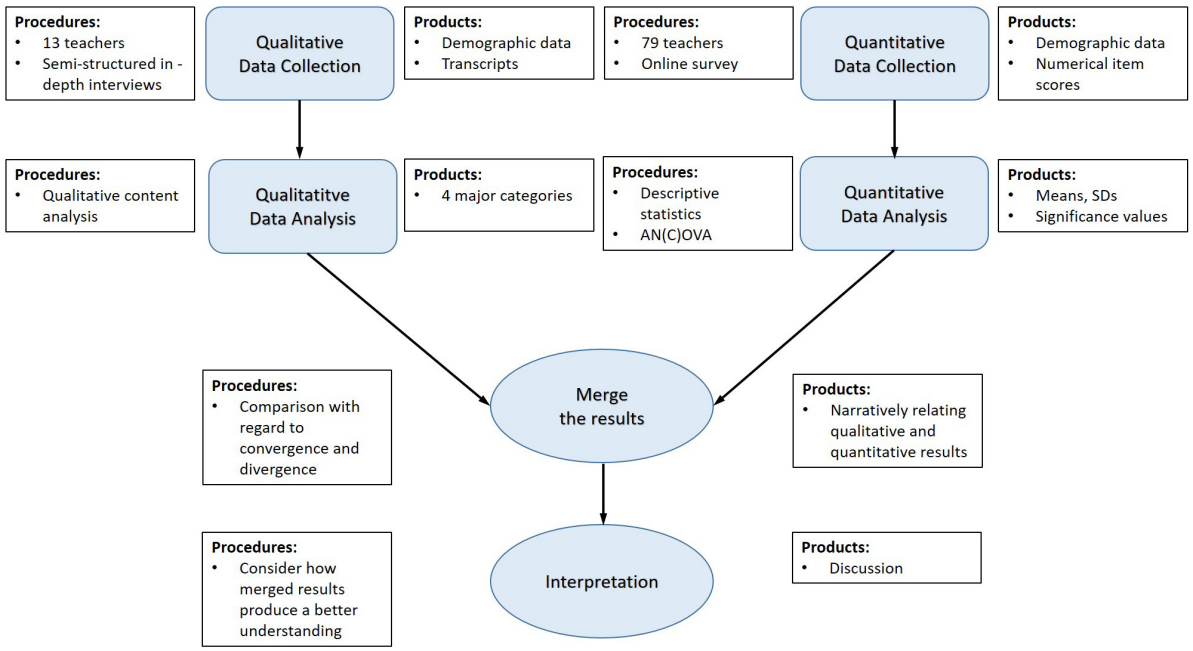

FIGURE 1 | Convergent parallel mixed-methods study design.

TABLE 1 | Description of the qualitative and quantitative sample.

		Interview		Questionnaire	
		Frequencies	***M* (*SD*)**	**Frequencies**	***M* (*SD*)**
Gender	Female	10		73	
	Male	3		6	
Subjects taught	Science and Math	3		26	
	Social Science	3		10	
	Sports	0		4	
	Languages	6		34	
	Arts	1		5	
Type of school	Private	2		11	
	Public	9		56	
	Public and private	2		12	
Country of teaching	Asia	2		12	
	Europe	4		20	
	Kyrgyzstan	4		24	
	United States	3		19	
	Others	0		4	
Grades taught	Elementary	1		1	
	Secondary	12		78	
Age			27.5 (6.8)		34.7 (11.1)
Years of experience			4.9 (4.2)		9.7 (9.4)

Total of interview respondents N = 13. Total of questionnaire respondents N = 79.

a structured SEL program yet. Research participants were invited to take part in the interview through face-to-face recruitment.

Table 1 shows the characteristics of our study participants (see also **Supplementary Appendix** A for a detailed description of the interview participants). One teacher (#8) had experience in teaching preschool students only. Hence, in order to better compare and interpret our results, we excluded this teacher from the following analyses. In sum, 13 interviews were analyzed.

Interviews lasted between 20 and 60 min, with an average interview time of 30 min. Most interviews were conducted

face-to-face with single teachers. One interview was conducted online *via* Skype and one through a telephone call. A trained qualitative researcher with a bachelor's degree in sociology from the American University of Central Asia held all interviews (i.e., second author). Prior to the data collection of the current study, the researcher had three years of experience in conducting qualitative data collection and analysis. Participants who were enrolled in the master's program were interviewed in English, as this was the official language of the master's program. Three teachers were interviewed in Russian and one in Kyrgyz, which were the mother tongues of the interviewer and the participants.

Research participation was confidential and on a voluntary basis. All interviews were recorded with respondents' permission asked at the beginning of each interview (see Appendix B). The study was conducted according to the *Ethical Principles of Psychologists and Code of Conduct* of the American Psychological Association, 2019. An ethics approval was not required by institutional guidelines or national regulations in line with the "*German Research Foundation*" guidelines, as the used data were anonymized, and no disclosure outside the research is possible.

Quantitative Part

Initially, 88 respondents were recruited through the researcher's network and social media platforms, such as Facebook and Instagram. Again, they were recruited based on the criteria of having teaching experience at secondary schools. Interview participants were also asked to participate in the questionnaire. Nine participants did not complete the survey and thus were excluded from the data collection process. Overall, 79 respondents participated. **Table 1** shows a description of the sample.

An online survey was created using Google forms[1]. Google forms is compliant with the European General Data Protection Regulation (Google, 2020), and participants were treated in accordance with the American Psychological Association's Ethics Code. First, they were informed about the study aims: (1) to examine how teachers and schools support students' social and emotional learning in terms of students' self-awareness, self-management, and social awareness skills and (2) to compare perceptions of teachers and students regarding opportunities that schools and teachers provide to students for learning self-awareness, self-management, and social awareness skills. In addition, they were informed that participation in this study is conducted voluntarily. All data are confidential and will be used only in the frames of this research.

Research Instruments

Qualitative Part

An interview guide with 20 questions was developed (see Appendix B). The guide had four sections. The first section consisted of introductory and background questions as well as general questions about the definition of SEL and its facets self-awareness, self-management, and social awareness. In this section, after introducing themselves, teachers were asked to explain their own understanding of the terms SEL, self-awareness, social awareness, and self-management. After that, a definition of these concepts was provided to the interviewees in order to have a common understanding when discussing the following questions. The second section aimed at exploring how schools support students' SEL. The third and fourth sections focused on how comfortable and trained teachers felt in teaching SEL and how they individually supported SEL in their classrooms. Some of the questions were adapted from the interview study by Esen-Aygun and Sahin-Taskin (2017). In addition, demographic questions were asked (see Appendix B for the full list of questions asked in the qualitative part).

During the interviews, all questions had been asked. However, the order of question emerged from the course of conversation. The interview guide was translated into Kyrgyz and Russian languages. The translation quality was tested with three researchers, who translated the interview guide from English to Russian and Kyrgyz and *vice versa*. After piloting the interview guide with four teachers, it was adjusted by reformulating some items that were initially conceptualized as "personality development" to "SEL" and its specific items.

Quantitative Part

Teachers' comfort with teaching SEL, their commitment to learn about SEL, and their perception about whether their school culture supports SEL were assessed using an adaptation of the established teachers' SEL beliefs scale (Brackett et al., 2012). As the original questionnaire does not distinguish between different SEL facets, we adapted the questionnaire by presenting a definition of the corresponding facet followed by the items of the original scale (see Appendix C for the full list of constructs that have been assessed in the quantitative part). We substituted the term "social and emotional learning" from the original items with the corresponding facet. Comfort, commitment, and perceived school culture were assessed with four items concerning teachers' self-awareness, self-management, and social awareness. Therefore, the final scale consisted of 36 items (12 per facet). Cronbach's alpha revealed good to high internal consistencies (**Table 2**). Teachers rated their agreement with each item on a 5-point Likert-type scale (from strongly disagree to strongly agree).

Analyses

Qualitative Part

The same researcher who had conducted the interviews also transcribed and analyzed the recorded interviews. The interviews were anonymized and transcribed verbatim. We used an iterative process of deductive and inductive qualitative content analysis (Cole, 1988). Qualitative content analysis aims to acquire a condensed and comprehensive explanation of the phenomenon. It results in concepts or groups representing the phenomenon (Elo and Kyngäs, 2008). Following the process described by Elo and Kyngäs (2008), there were three phases: preparation, organizing, and reporting. In the preparation phase, we selected the 13 transcribed interviews as units of analysis. We decided to focus on the manifest content only. Latent contents, for example, sighs and laughter, were not analyzed, as they were not

[1]https://www.google.com/forms/

TABLE 2 | Descriptive statistics and Cronbach's alpha for the subscales.

	Comfort					Commitment					Perceived school culture				
	M	*SD*	Min	Max	Cronbach's alpha	*M*	*SD*	Min	Max	Cronbach's alpha	*M*	*SD*	Min	Max	Cronbach's alpha
Self-awareness	3.15	0.77	1.75	5.00	0.87	4.36	0.57	2.50	5.00	0.84	2.56	0.94	1.00	5.00	0.89
Self-management	3.35	0.74	2.00	5.00	0.88	4.34	0.47	3.25	5.00	0.79	2.83	1.01	1.00	5.00	0.93
Social awareness	3.97	0.63	2.25	5.00	0.90	4.35	0.46	3.00	5.00	0.76	3.73	0.87	1.25	5.00	0.94

considered relevant for our research questions. In order to get familiar with the data, the transcribed protocols had been read through several times.

For organizing our material, we developed a structured categorization matrix according to our main research questions. We defined four categories for coding teachers' responses. The first category, "Definition of and familiarity with SEL," was developed based on prior interview studies showing that teachers were not very familiar with the general concept of SEL (Triliva and Poulou, 2006; Esen-Aygun and Sahin-Taskin, 2017). The other three coding categories, "SEL instruction comfort," "SEL experience and training," and "SEL school culture," reflect similar categories defined by Brackett et al. (2012), which was also the theoretical foundation for the questionnaire used in the quantitative part. One main difference is that instead of asking how committed teachers felt for attending a training, as it has been done in the questionnaire by Brackett et al. (2012), we explicitly included questions regarding actual training, which teachers may have received in SEL or teaching SEL. For coding, first, we chose aspects from the data that fitted our predefined categorization frame. Second, we considered (and coded) themes that occurred from multiple interviews, which had not been predefined, such as "stating the importance of SEL," "commitment for SEL training," "worries and complaints related to uncertainties," and "reasons for discomfort in teaching SEL." Our goal was to collect a detailed description of the phenomenon and not to generate generalizability of the findings, although patterns and naturalistic generalizations emerged from the data (Creswell and Plano Clark, 2018).

Quantitative Part

Quantitative results from the questionnaire were analyzed using SPSS 26. We conducted a set of ANCOVAs with repeated measurement design. According to Field (2009), "repeated measures" is a term used when the same participants participate in all conditions of a study. In our study, conditions were the three SEL facets self-awareness, self-management, and social awareness (see also Gebauer and McElvany, 2017, for a similar approach). Hence, comfort, commitment, and perceived school culture were used as dependent variables and SEL facets as independent variables with three manifestations (self-awareness, self-management, social awareness). In addition, we controlled for teachers' age, years of teaching experience, type of school, subjects taught, and country of origin. Besides, for the country of origin, the covariates were not significant. Hence, we further report only the results including the covariate when it showed a significant effect.

RESULTS

Qualitative Results

Definition of and Familiarity With Social and Emotional Learning, Self-Awareness, Self-Management, and Social Awareness

In the present study, teachers were rather unsure whether they know the concepts and terms of SEL in general or the three

facets in particular. Hence, they mostly described their own understanding of these concepts. When defining SEL, teachers mostly explained it as a concept that fosters social skills, such as building friendships and relationships, working in teams, along with emotional learning that promotes exploring your emotions and emotional states.

> I would assume that it [SEL] would have to do with students' ability to develop social skills with other students, peers, as well as adults. And then, emotional: I would assume that would be behavioral management and dealing with child's ability to self-regulate, participate in the classroom, you know without misbehaving, things like that (Teacher #12, United States).

> I think it is something with a pedagogical content, when you actually really say "OK, when you don't really only teach something, but you really try to develop students as a person and their character and everything that involves within that." So, I think it is much more about the person and their character building (Teacher #7, Germany).

While providing a general definition, teachers seemed to be intuitively aware of the three facets self-awareness, self-management, and social awareness without knowing and explicitly stating them.

Once teachers described their general understandings of SEL, they proceeded to provide definitions about the facets self-awareness, self-management, and social awareness.

Self-awareness was a concept that teachers reported to be most uncertain about how to describe it. In most cases, the term was conceptualized as "*knowing yourself*" and "*building personal identity*."

> Self-awareness is something really important. I think it is kind of being aware of what you are doing or why you are doing and being aware of yourself basically (Teacher #10, Turkey).

> Self-awareness could be broad. You could even get into building self-identity, how you identify yourself in terms of culture, background anything like that (Teacher #12, United States).

Teachers related *self-management* mostly to skills of self-regulation and discipline. They defined this concept in relation to managing learning (behavior and school tasks) and managing lifelong goals (goal setting and regulation).

> Self-management is about self-discipline, managing your own schedule, your own behavior, your learning; it must be about regulating yourself (Teacher #11, Turkey).

> Self-management is all about goal achieving, how to separate their [students'] goals into small ones and also [connect goal setting] with their [students'] time management (Teacher #14, South Korea).

Teachers explained "*social awareness*" as a term that emphasizes students' social skills such as relationship, friendship building, interacting with peers and other people, relating oneself to society, and being tolerant of people's social diversity. Teachers pointed out that, to them, social awareness is an important skill that helps students adapt to society while being at school and also afterward in their adulthood.

> Social awareness, in my understanding, is related to socialization process; it is when students learn how to interact with other people and adopt in new environments (Teacher #3, Kyrgyzstan).

> Social awareness has to do not just with yourself, but also with others around you, and being aware that your actions may affect other people (Teacher #12, Finland).

In sum, teachers in the present study described the concepts from their personal understanding rather than from professional teacher education or training. They reported that they were not much aware of the terms, which made them feel uncertain in their responses. For social awareness in particular, teachers had a more broad definition in mind that also included aspects of the SEL facet relationship skills. Nevertheless, teachers explicitly pointed out the importance of SEL and personality development for students' lifelong learning, life satisfaction, and success in school and also later in their career and relationship building.

Teachers' Comfort and Training in Teaching Social and Emotional Learning

Teachers reported that they were not very comfortable and confident when they had to interact with students concerning their social and emotional education or needs. Their uncertainties were mostly related to worries and complaints about not having enough time for delivering instruction on SEL besides the content of the subject taught as well as a lack of materials and professional training regarding SEL.

> You know we have limited time, we have certain content to cover, we have many students, all of that does not allow me to pay attention to every individual student's interests, social and emotional needs. Because I do not work on that side of teaching a lot, I will be honest I cannot say I am confident or feel comfortable when it comes to emotions of students (Teacher #11, Turkey).

According to most interviewed teachers, their bachelor's or master's programs did not offer specific courses related to teaching SEL. Some teachers had classes on educational or pedagogical psychology on the topic of classroom management or dealing with behavioral problems. However, these classes focused more on intervention rather than prevention. Nevertheless, teachers mentioned that most of their skills and knowledge come from their daily teaching experience rather than from professional training.

> Yes, we had courses on psychology or pedagogy, but I cannot say that I learned a lot from those courses. In fact, most of my experience on pedagogy comes from actual practical experience of teaching in the classroom. And definitely, there was nothing about teaching students to know about themselves, their interests, strengths and weaknesses, emotions or social skills. No, we did not study that (Teacher #11, Turkey).

> I cannot remember such courses at university; I would say no, we did not study social and emotional education. And later at work, we did not receive training on that, we had some teacher conferences on how to work with kids with behavioral problems maybe that can relate a bit, we were discussing how to manage class when someone is disturbing lessons, but other than that, I cannot remember (Teacher #4, Kyrgyzstan).

Despite the fact that teachers in the present study mentioned a lack of educational and professional training on delivering SEL competencies, they have expressed their commitment to teach SEL competencies by relating to other trainings they got, as well as by trying to incorporate some information related to SEL through the means of their teaching methods, in-class activities, discussions, and personal conversations.

> I taught in the urban setting for students coming from low economic background. She [student] was dealing with a lot at home and she was always acting up in the classroom and disrupting the classroom. And, so I think one of the things I helped her with was just again coping mechanisms—dealing with stress at home, learning to find her ways to regulate and calm down. This is something I learned in college. I was taught how to mediate between people and one of the things was, I think, self-regulating—learning to cope. I just taught her some things dealing with stress and I think it helped her a little bit. That is something you can use for everyday life, when you experience stress, you just find your own ways [of coping]. She did not want to participate, disrupt the class and yes we sat down after [class] and we spoke for 30 min and she was just telling me about everything at home (Teacher #12, United States).

In addition, interviewees highlighted that they would be interested in getting professional training about teaching SEL in general but were also interested in training about developing their own SEL skills.

> Social and emotional skills have to be taught almost like a hard skill. You know what I mean, it is a sensitive topic, there can be sensitive issues. We [teachers] are not trained for that, we might have some pedagogical knowledge, like how to manage class, but it is not enough. In order to be comfortable and confident in knowing students' emotions, something like emotional intelligence, in order to see if students know themselves well, we [teachers] need to understand ourselves how to figure that out first (Teacher #12, United States).

To summarize, teachers' reported discomfort with teaching SEL was mostly related to the lack of professional training, materials, and time during lessons. Nevertheless, they stated high interest in receiving such trainings not only for teaching SEL but also for developing these skills for themselves.

Teachers' Social and Emotional Learning Instruction and Their Perceived School Culture

Teachers, who worked in public schools, reported that they were not aware that SEL was part of their subjects' curricula or study plans. They mainly argued that they have specific plans of covering required content information and achieving their learning objectives, which rarely relate to SEL. However, although not part of curricula or study plans, some teachers pointed out that they tried to incorporate aspects of self-awareness or self-management skills into their teaching through the reflection and discussion of the content, personal initiatives of discussing these terms with the class, or in personal conversations with students individually.

> We watched so many videos and did many discussions afterward. I think my class was very different from other classes because I always bombed them with questions "Who are you?," "Why are you here?," "What do you do here?," and they would really question and leave the class with thoughts, they really criticized [school] administration. I felt a little guilty, but for me it was important because in university where I studied we were taught critical thinking and I could find my true self through this. So, I wanted my students also to think who they are and what they believe in (Teacher #1, Kyrgyzstan).

Interviewees, who had experience in working at private schools, explained that their schools particularly emphasized developing students' SEL by providing a variety of extracurricular activities such as arts, sports, or debating clubs. Teachers in Kyrgyzstan, for example, mentioned that presenting a wide range of extracurricular activities was also a "marketing strategy" of these schools in order to attract more students.

> In a private school in order to attract clients so that their children are developing not only in terms of knowledge, but also in terms of personality development [schools had extracurricular activities]. For instance, in our school we have state standards according to which we should teach content knowledge. But we also try to develop different skills. For instance, we have drawing clubs and exhibitions. This year we had an art exhibition at the state museum of fine arts with students' drawing and it makes students confident, it teaches them to express their thoughts (Teacher #2, Kyrgyzstan).

Teachers of public schools also reported extracurricular activities; for example, different types of sports, arts, or social activities, which aimed to foster different aspects of SEL.

> At the schools, where I have worked, one of them did have these kinds of, I would call it, workshops, where you were able to do different things, which also included these social and emotional skills and learning and how to acknowledge them. But it did not come clearly like that, but behind something that people were doing, so for example, one of the schools had a cooking class and I would say the teacher took self-awareness, self-management, and social awareness in consideration while teaching (Teacher #13, Finland).

However, in the present study, some teachers explained that the variety of extracurricular activities sometimes means additional workload for them, particularly when they are responsible for these activities. Others raised worries that these activities might distract students from school content.

> They have had so many choices of extracurricular activities that it was actually I think was too much for them. Well, for me it was a little too much workload on that because every teacher had to be responsible for at least two extracurricular activities (Teacher #6, China).

Most teachers reported that they share the perception that their schools do not emphasize and support SEL teaching at the school level.

> One thing I think we [as a school] do not do a good job at is promoting students to find out who they are as a person and I know it takes time, right? I do not think schools do a good job at finding out what are ways to explore yourself (Teacher #5, United States).

> I would honestly have to say no, we did not have outlets for students to learn these types of [SEL] skills or anything like that. Students come from low-income backgrounds, they deal with plenty of issues at home, at school or in the community and it [SEL] should go into the school, into classroom and there not many outlets for students to be aware of that [SEL] (Teacher #12, United States).

Moreover, from their perspective, schools' focus is more on cognitive outcomes and managing the school and classes themselves as compared to SEL.

> I cannot say that our school administrator was interested in promoting SEL. You know teachers already have many tasks, we need to deliver the knowledge, manage the class; we have only limited time and resources. The same with administration, they have many responsibilities with managing school, schedules, and different activities. I know SEL is important, but in practice, we just have too much work and SEL is, unfortunately, not very much a priority (Teacher #3, Kyrgyzstan).

> You [teacher] have administration or policy that says "OK, by the end of this year these students need to know this, this, and this and if they don't, it doesn't look good for you." What does it mean to yourself? Does it mean that scores are amazing and your teacher evaluation is great? Or is it more important for you to teach these students personal and social skills and grow them as a human being? (Teacher #5, United States).

In line with that, interviewees stated that they do not feel expected by schools to teach SEL skills unless students themselves show or address social or emotional needs.

> One of my students in my class was having a terrible temper issue—it was anger issues. He could not control himself and he wanted to jump off [the roof]. At that time he was alarming the whole school and then the principal invited an educational psychologist and everybody had a closed door—indoor meeting. Nobody knows [about the meeting] and then I was inside there as well; we had to learn from that time what crisis is and how to respond to similar needs of students (Teacher #6, China).

However, several teachers in our study mentioned that they feel obligated and expected to respond to students' social and emotional needs by students' families and society in general.

> Teachers are expected to be everything in the classroom. Especially in the States now there is a huge push [on teachers] by the society in general, teachers have to take on their role of being a mentor, helping students with emotional needs and things like that. I do not know maybe you have seen it in the news, bullying is a huge problem, we have students who are dealing with transgender roles, it is just a lot for a teacher. I think there is definitely an expectation placed on teachers to help students with those things. And it is not [assigned] by anyone in particular, it is not a requirement for schools to hire people with those skills, society is pushing that (Teacher #12, United States).

In sum, teachers have mentioned that in their school environment, cognitive and non-cognitive skills are interrelated. However, they felt that, in most cases, cognitive learning outcomes are more emphasized by schools or curricula. According to them, SEL is mostly incorporated by extracurricular activities or by teachers individually through teaching methods or student-teacher interactions. Hence, interviewees did not necessarily feel expected to teach SEL by their schools but reported a rather implicit expectation of families and society in general. In the present study, all teachers mentioned that their schools have at least one social worker or school counselor. However, they argued that this is not enough to respond to students' social and emotional needs.

Quantitative Results

The quantitative part examined the research question whether there were any differences in teachers' reported self-awareness, self-management, and social awareness regarding their comfort, commitment, and school culture. Descriptive statistics and correlations are presented in **Tables 2**, **3**. The means for the three facets for commitment are in general higher as compared to the means of comfort and school culture. In addition, teachers' commitment is rarely related to comfort or perceived school culture across the different SEL facets, whereas teachers' comfort shows mostly positive medium to high correlations with perceived school culture.

The results of the ANCOVA with repeated measurement design for teachers' comfort revealed a significant main effect for the three facets of SEL, $F(2,148) = 30.71$, $p < 0.001$, $\eta^2 = 0.29$. In addition, a significant main effect was found for the covariate country of teaching $F(4,74) = 3.03$, $p = 0.02$, $\eta^2 = 0.14$. United States teachers showed across all three facets higher levels of comfort as compared to teachers from other countries. However, the interaction between the three facets and country of teaching was not significant ($p = 0.86$). Pairwise comparisons revealed that teachers' comfort with teaching social awareness was significantly higher than their comfort in teaching self-awareness [$M_{Diff} = 0.84$, $SE = 0.13$, $p < 0.001$, 95% CI (0.53, 1.15)] and self-management [$M_{Diff} = 0.67$, $SE = 0.13$, $p < 0.001$, 95% CI (0.40, 0.93)]. No difference occurred in teachers' comfort in teaching self-awareness and self-management [$M_{Diff} = 0.17$, $SE = 0.11$, $p = 0.31$, 95% CI (−0.83, 0.43)].

For teachers' commitment to learn about SEL, no covariate was significant. When conducting an ANOVA with repeated measurement, Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2 = 14.52$, $p < 0.001$. Therefore, the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. Teachers' commitment did not significantly differ between the three facets of SEL, $F(1.71,133.12) = 0.03$, $p = 0.95$.

Teachers' perceived supportive school culture differed between the three facets of SEL, $F(2,156) = 52.62$, $p < 0.001$, $\eta^2 = 0.40$. The covariates did not reach significance. Pairwise comparisons showed that teachers' perceived school culture with regard to social awareness was significantly higher as compared to their perceived school culture in teaching self-awareness [$M_{Diff} = 1.17$, $SE = 0.13$, $p < 0.001$, 95% CI (0.85, 1.49)] and self-management [$M_{Diff} = 0.90$, $SE = 0.11$, $p < 0.001$, 95% CI (0.62, 1.17)]. Their perceived supportive school culture in self-awareness and self-management did not differ significantly [$M_{Diff} = 0.28$, $SE = 0.12$, $p = 0.06$, 95% CI (−0.01, 0.56)].

TABLE 3 | Correlations.

		Comfort									Commitment									Perceived school culture					
		Se-aw			S-man			So-aw			Se-aw			S-man			So-aw			Se-aw			S-man		
		r	CI 95%	*p*	*r*	CI 95%	*p*	*R*	CI 95%	*p*	*r*	CI 95%	*p*	*r*	CI 95%	*p*	*r*	CI 95%	*p*	*r*	CI 95%	*P*	*r*	CI 95%	*p*
Comfort	Se-aw	–																							
	S-man	**0.57**	[0.40, 0.70]	<0.001	–																				
	So-aw	**0.31**	[0.10, 0.50]	0.005	**– 0.47**	[0.28, 0.63]	<0.001	–																	
Commitment	Se-aw	−**0.31**	[−0.50, −0.10]	<0.001	−0.17	[−0.38, 0.05]	0.129	0.14	[−0.08, 0.35]	0.216	–														
	S-man	−0**.22**	[−0.42, −0.00]	0.049	−0.17	[−0.38, 0.05]	0.124	−00.13	[−0.34, 0.09]	0.265	**0.40**	[0.20, 0.57]	<0.001	–											
	So-aw	0.15	[−0.07, 0.36]	0.196	0.01	[−0.21, 0.23]	0.918	−0.03	[−0.25, 0.19]	0.825	0.15	[−0.07, 0.36]	0.183	**0.50**	[0.31, 0.65]	<0.001	–								
Culture	Se-aw	**0.80**	[0.70, 0.87]	<0.001	**0.55**	[0.37, 0.69]	<0.001	**0.33**	[0.12, 0.51]	0.003	−**0.28**	[−0.47, −0.06]	0.013	−0.15	[−0.36, 0.07]	0.183	0.17	[−0.05, 0.38]	0.125	–					
	S-man	**0.40**	[0.20, 0.57]	<0.001	**0.69**	[0.55, 0.79]	<0.001	**0.37**	[0.16, 0.55]	0.001	−0.01	[−0.23, 0.21]	0.940	−0.04	[−0.26, 0.18]	0.749	0.12	[−0.10, 0.33]	0.308	**0.44**	[0.24, 0.60]	<0.001	–		
	So-aw	0.20	[−0.02, 0.40]	0.085	**0.33**	[0.12, 0.51]	0.003	**0.61**	[0.45, 0.73]	<0.001	0.07	[−0.15, 0.29]	0.558	−0.04	[−0.26, 0.18]	0.736	−0.06	[−0.28, 0.16]	0.600	0.18	[−0.04, 0.39]	0.111	**0.45**	[0.25, 0.61]	<0.001

Se-aw, self-awareness; S-man, self-management; So-aw, social-awareness.
Coefficients significant at the p < 0.05 level are in bold type. N = 79.

Mixed Methods

After analyzing the quantitative and qualitative data separately, the results from each were compared at the point of interpretation in order to identify similarities and differences. Convergent data analysis revealed that teachers seem to feel most familiar and comfortable in teaching the facet social awareness compared to self-awareness and self-management. Furthermore, for teachers' training in SEL, the data confirmed each other. The interviewed teachers reported that they did not receive any SEL training but were highly interested in and committed to receive professional training in teaching SEL. These high levels of commitment were also reflected in the high scoring of commitment for the separate facets. Concerning school culture, the datasets partially confirmed and complemented each other. The finding that teachers reported that their schools and principals did not emphasize teaching SEL matches the low and medium ratings of school culture for the facets of self-awareness and self-management. However, for social awareness, quantitative and qualitative data diverged as teachers in the survey reported a high emphasis on fostering social awareness at the school level. Moreover, datasets were dissimilar in the level of comfort teachers reported with teaching SEL. Interviewed teachers reported low levels of comfort in teaching SEL, but the mean scores for the different facets ranged between medium levels of comfort.

DISCUSSION

The paper aimed at examining teachers' SEL familiarity, beliefs, training, and perceived school culture by applying a mixed-methods approach. The results revealed that secondary school teachers reported to feel uncertain and lack the professional skills and knowledge to deliver SEL instructions. In fact, it was hard for teachers in the present study to define or describe the meaning of SEL and its facets. However, in line with Triliva and Poulou (2006), they did find themselves easier to define certain aspects of social awareness as an orientation toward others than defining the aspects that relate more to the self. Quantitative results supported our hypothesis that teachers' comfort for teaching SEL was lower for self-awareness and self-management compared to social awareness.

In accordance with our hypotheses, we found a gap between the quantitative and qualitative part as the quantitative data showed, in general, higher levels of comfort as one would expect based on qualitative results. It seems that when secondary school teachers are asked to elaborate more closely on their familiarity and confidence and to provide their own ideas, it is more difficult for them to give clear answers. However, in our study, this may have been an effect of teachers' level of job experience, as our interviewees had less job experience (5 years) compared to teachers who participated in the survey (10 years). Hence, in the future, more mixed-methods approaches seem to be necessary and highly valuable in order to provide a broader view on and a deeper understanding of teachers' familiarity and comfort.

In both study parts, teachers expressed strong interest in receiving professional SEL training. One reason might be that our teachers had not participated in a structured SEL program yet. However, previous studies investigating teachers with or without participating in SEL programs also showed comparable high interest and commitment in SEL training (Triliva and Poulou, 2006; Buchanan et al., 2009; Collie et al., 2011, 2012, 2015; Brackett et al., 2012; Jones and Bouffard, 2012; Schonert-Reichl and Zakrzewski, 2014; Esen-Aygun and Sahin-Taskin, 2017). Hence, in future studies, it seems worthwhile to investigate more closely the differences between teachers who feel insecure and unprepared because they have not been in touch with the topic and the ones who feel uncomfortable regardless of the support they received in an SEL program. For the different SEL facets, contrary to our hypothesis, no differences in teachers' commitment in learning about SEL were found. All means were rather high, including the one for self-management. Hence, although self-management or self-regulated skills gain more and more policy, research, and practical attention, teachers in this study still expressed a high need for learning how to teach these competencies.

How teachers should be trained in delivering SEL instruction is not answered sufficiently yet (Kimber et al., 2013). However, in order to be able to guide SEL instruction effectively, teachers need to be trained not only in delivering this type of instruction, but they also need to be skillful in SEL themselves (Jennings and Greenberg, 2009; Poulou, 2017b). Developing high SEL skills themselves may be related to a higher awareness of the importance of SEL. Moreover, they may function as role models for their students (Jennings and Greenberg, 2009; Zinsser et al., 2014). In addition, teachers' social and emotional skills may be associated with the development of supportive teacher-student relationships, more effective classroom management, more effective SEL implementation in the classroom, and, at the same time, to less stress and teacher burnout (cf. Jennings and Greenberg, 2009). Hence, the development of teachers' own social and emotional skills may have beneficial effects for teachers and their students next to a training with a focus on teaching SEL.

On the environmental side, qualitative and quantitative results revealed that teachers reported to feel less supported by the school administration in their attempts to deliver SEL instructions—mainly because they experience their schools to prioritize academic learning and outcomes, which leaves little room for explicit SEL. This result is in accordance with the argumentation of Durlak et al. (2011). They stated that—even though schools are important in preparing healthy learners by promoting not only academic development but also SEL—they are not capable of covering all learning aspects due to the scarcity of resources and intense heaviness of expectations to strengthen academic performance (Durlak et al., 2011). According to our interview data, secondary schools do not provide resources (instruction materials, specific courses, or activities) or create conditions (training teachers, devoting teaching hours, increasing number of counselors at schools, receiving school administration support) that would promote SEL instruction. If so, teachers reported different extracurricular activities as learning opportunities to foster SEL. However, simply because extracurricular activities are not plain academic content, they do not necessarily allow to develop students' SEL. In addition, schools seem to focus more directly on responding to students' social and emotional

needs by offering discussions or school counseling services instead of teaching students how to develop their own social and emotional skills.

Quantitative data revealed differences in the perceived support of the school culture between the three facets. Schools seem to be more supportive of teaching and learning social awareness skills compared to self-awareness or self-management skills. This might explain why teachers also felt more comfortable in teaching social awareness compared to self-awareness and self-management. Hence, although offering teacher training for all facets seems to be important, our differential analyses showed an even higher need for providing an environment and teacher training on how to focus on the emotional, cognitive, and behavioral aspects of the self as compared to social aspects. In sum, our results show that, in future research, it is necessary and worthwhile to differentiate between SEL facets.

Overall, to support teachers in teaching SEL, a broader framework appears to be needed. At a macro level, an important step to promote SEL may be to define specific educational policies and include SEL in national standards and school laws (cf. Oberle and Schonert-Reichl, 2017). This applies to pre-, elementary, and secondary schools. As our results showed, there were hardly any differences between secondary school teachers' SEL familiarity, beliefs, training, and perceived school culture compared to studies focusing on preschool or elementary school teachers. Some countries, for instance, the United States or Turkey, have just started such initiatives (cf. Esen-Aygun and Sahin-Taskin, 2017; Collaborative for Academic Social and Emotional Learning [CASEL], 2020). However, little is known about the application of these strategies and how the intended, formally established criteria are implemented in current school policies and academic curricula. When an explicit framework would exist, curricula in teacher education training on how to develop and teach SEL could be developed. Qualified teachers seem to be a key factor for developing social and emotional competencies successfully. Thus, they need to possess the capabilities, motivation, and resources to put SEL into action. Hence, future research is asked to combine the micro- with a macro-level perspective. These efforts appear to be worthwhile, as fostering SEL may enhance countries' economic growth and contribute to higher social cohesion in the world.

LIMITATIONS AND FUTURE DIRECTIONS

Our study highlights the importance of teachers' SEL familiarity, beliefs, training, and perceived school culture for investigating opportunities and practices for SEL instruction at schools. The study's strengths are its focus on exploring teachers' own attempts, initiatives, and instructional practices to enhance students' SEL, the differential examination of SEL facets, and the mixed-methods approach.

Nevertheless, the study has certain limitations. One limitation is the composition of our sample. Our goal was to collect a detailed description of the phenomenon (cf. Creswell and Plano Clark, 2018). Therefore, we included secondary school teachers from different countries, asking about their beliefs and instructional approaches outside of structured SEL programs. Respondents were recruited based on the described criteria but not based on whether the country, where they had taught, already provided SEL policies. However, the availability of a statewide or nationwide policy and a country's cultural background may indeed influence teachers' SEL familiarity, beliefs, training, and perceived school culture (cf. Oberle and Schonert-Reichl, 2017). Hence, future studies may compare more systematically teacher familiarity, beliefs, training, and perceived school culture between countries with and without established SEL policies.

In addition, we focused on the facets self-awareness, self-management, and social awareness, as we expected these to be less often addressed in teaching in secondary schools but did not include relationship skills and responsible decision-making. However, our interview results showed that teachers already had a broader view of social awareness in mind, including many aspects that, according to the theoretical framework, would be assigned to relationship skills (Yopp et al., 2017). Hence, future research examining the effects of different SEL facets would benefit from (a) including all facets and (b) describing the facets and their differences more precisely.

One probably important belief we did not target specifically in our study is the malleability of students' social and emotional skills. Teachers need to adopt a growth mindset and believe that these skills can be taught through formal instruction at school (cf. Seaton, 2018). Only then, they will put effort into developing their qualifications and devote time to target SEL explicitly in their classrooms. Hence, future studies may additionally consider teachers' mindsets.

Finally, the perceived school culture and instructional practices were assessed by teachers only. Additional principal and student interviews would be a valuable source for getting more insights into their perspective of SEL instruction practices and school culture. Prior research on perceived teaching practices showed that students' and teachers' perceptions may differ and that sometimes rather students' perception of teaching practices influences their learning (cf. Fauth et al., 2020).

CONCLUSION

The present study adds to the literature on investigating teachers' SEL familiarity and beliefs, their current SEL teaching practices, and the school culture in relation to SEL instruction where it takes place first—before the conduction of SEL programs and interventions. Our study results indicate that teachers' familiarity with and their comfort in SEL teaching practices need to be strengthened. This could be achieved through providing support at two levels. At the micro level, pre-service and in-service teachers may benefit from professional education and training in developing their own SEL skills as well as on how to incorporate these topics in their regular teaching. At the macro level, SEL may need to be institutionalized on a policy level as it has already been done, for example, in some of the states in the United States, United Kingdom, or Turkey. By addressing both levels, teachers and schools would be better able to foster reaching multidimensional educational goals that include cognitive and non-cognitive outcomes.

DATA AVAILABILITY STATEMENT

The transcribed interviews and the dataset generated for the quantitative part of the study are available on request to the corresponding author. A full list of constructs assessed in this study can be found in the Appendices. So far, no other publications using these data are available.

ETHICS STATEMENT

The study was conducted according to the Ethical Principles of Psychologists and Code of Conduct of the American Psychological Association from 2019. An ethics approval was not required by institutional guidelines or national regulations in line with the "German Research Foundation" guidelines as the used data was anonymized and no disclosure outside the research is possible. Participants were informed about the goals of the study, that participation was voluntarily, and that all data was confidential and would be used only in the frames of this research. For the qualitative part, interviews were recorded with respondents' permission asked at the beginning of each interview.

AUTHOR CONTRIBUTIONS

AS-T introduced the articles' idea, planned the article, and wrote most parts of the manuscript with contributions from AD and LZ. AS-T analyzed the quantitative data with support by LZ. AD's master thesis built the foundation for the article and was supervised by AS-T. AD conducted the interviews and the online survey as well as analyzed and reported the qualitative part. All authors read and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.518634/full#supplementary-material

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