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Comparing learning opportunities of generic skills in higher education to the requirements of the labour market

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In research on higher education, the link between education and future professional success is well-documented. Little research, however, has been done about existing learning opportunities at institutions of higher education that help students acquire generic skills and on the fit between such learning opportunities and labor market demands. To address these questions, we adapted an existing scale for assessing areas of generic skills, which originated in research on job requirements, and transferred it to a survey of students (N = 4,258). We also implemented a comparable questionnaire, assessing the same set of generic skills, in a graduate survey (N = 378). The results of our study show that by using a theoretical model such as this, it is possible to connect student and graduate surveys related to generic skills. Factor analysis provides evidence for the theoretical expected areas for students. Cluster analysis of student data suggests that learning opportunities for generic skills differ according to field of study. We conclude by discussing our study's limitations and implications.

KEYWORDS

higher education, generic skills assessment, generic skills development, learning opportunities, requirements, labor market, higher education graduates, higher education students

Theory

Impact of education for employability

Higher education fosters the development of skills that contribute to the individual and society's prosperity. By examining the relationship between attendance at an institution of higher education and post-graduation working life, research on higher education also contributes to the development of individual educational and career paths. The importance of matching education and professional career is well-documented in the literature on higher education and the labor market (McGuinness, 2006; OECD, 2011; Quintini, 2011; International Labour Organization, 2014). Labor market match exists when an employee's qualification (level of education) and the skills that they acquired through their education correspond with those required for their chosen profession after graduation (Morgado et al., 2016; Li et al., 2018; Kracke and Rodrigues, 2020). Adequate employment is often linked to higher income (Bauer, 2002; McGuinness, 2006; Sattinger and Hartog, 2013; Levels et al., 2014) and greater satisfaction personally and professionally (McGuinness and Sloane, 2011; Berlingieri and Erdsiek, 2012). However, less is known about learning opportunities for a broad range of generic skills in higher education. Furthermore, there is a lack of research that connects student learning opportunities at institutions of higher education of those generic skills, which graduates report as currently required on the labor market.

A student's field of study at an institution of higher education seems to impact their employment status after graduation (Franzen, 2002; McGuinness and Sloane, 2011; Altonji et al., 2016; Verhaest et al., 2017). The current shortage of skilled workers indicates, however, that it is difficult for employers to find suitable job candidates to provide the appropriate professional qualifications for specific positions (Berlingieri and Erdsiek, 2012). Especially graduates from arts or humanities programs look longer for employment or are at a higher risk for being inadequately employed. This may result from their low level of specialization. It may also be related to the fact that these subjects do not provide training for a specific career path or occupation (Leuze and Strauß, 2008; Verhaest et al., 2017).

Most of the studies have analyzed discipline-specific knowledge and skills (McGuinness, 2006; Baert et al., 2013). Such fields as economics, science, technology, engineering, mathematics, and medicine are known to provide a highly structured curriculum along with discipline-specific knowledge (Bligh, 2000; Johnson et al., 2002). Consequently, there is a link between study programs with a highly structured curriculum and future access to the labor market. Since these fields are also known to have a strong vocational field connection (Falk et al., 2009), their greater access to the labor market could be related to the fact that employers are aware of what knowledge they can expect graduates of such programs to bring with them. In contrast to the labor market usability of those highly structured fields of study, the labor market usability of humanities and arts is discussed in the literature (Robst, 2007; Leuze and Strauß, 2008).

Institutions of higher education function both as autonomous institutions and as integral components of the societies in which they operate. As autonomous institutions, they are "organization centers of the science system" (Wissenschaftsrat, 2013) and social places, where education is linked to research, knowledge transfer, and cultural self-perception (Wissenschaftsrat, 2013). Institutions of higher education also play an essential role in preparing citizens for the current and future labor market. The current labor market appears to require employees who are equipped with a broad range of skills, like communication or problem solving skills (Suarta et al., 2017). In all likelihood, this will continue. As Handel (2020) puts it: Even policymakers and pedagogues, who believe that technological change will not take place as rapidly or as radically as some others have suggested, they nonetheless share the concern that job skill requirements are increasing so quickly, or are poised to do so, that many people are at risk of being shut out of the workforce all together. Institutions of higher education may help counter such risks. In addition to facilitating the learning of domain-specific knowledge and skills, higher education also promotes the acquisition of generic skills. Such skills include an ability: to act independently when confronted with challenging tasks; to communicate effectively; to work cooperatively; and to promote other individuals (Barrie, 2004; Braun and Brachem, 2015; Ursin et al., 2021). Moreover, in addition to improving a student's chance for future professional success, the acquisition of generic skills also appears to facilitate their participation in civic life.

So far, little research has been done on whether there is a fit between existing learning opportunities for generic skills at institutions of higher education and the generic skills required in the labor market. This gap in the literature may be due to the fact that generic skills are difficult to assess.

Job requirements approach for the assessment of generic skills

The job requirements approach is a methodological concept, which aims to assess broad generic skills, and originates in international labor market research (Felstead et al., 2007; OECD, 2011; Autor and Handel, 2013; International Labour Organization, 2014; Handel, 2020). The job requirements approach is based on a number of theoretical considerations:

1. Employees perform tasks that require certain skills. These tasks and skills vary between occupations.
2. Since a certain fit can be assumed between activities and the skills needed to carry them out, the activities can be understood as a proxy of their skills.
3. The employed individual is equipped to provide information about their profession and best able to report on activities in their everyday work life.
4. Individuals are more likely to report with more accuracy about the frequency of their performed activities than about the importance of those activities.

The job requirements approach therefore investigates the employee's activities and the frequency with which they are carried out. Employees are thus asked how often they carry out certain activities, e.g., reading long texts. This information can then be used to identify generic skills that certain occupations require (Felstead et al., 2007; Braun and Brachem, 2015). The job requirements approach is used internationally for the assessment of job related skills, for example in the Generalized Work Activities Questionnaire (GWA) (Peterson et al., 2001; Handel, 2020; O*NET, 2021), in the International Assessment of Adult Competencies (PIAAC) (Klaukien et al., 2013; OECD, 2013a,b, 2019), the UK Skills Survey (BMRB Social Research, 2006; Felstead et al., 2007), and in the German National Educational Panel Study (NEPS) (Matthes and Christoph, 2011; Matthes et al., 2014). Since the job requirements approach assumes a certain fit between work-related activities and the frequency in which they are carried out and an employee's skills, it provides insights into assessing labor market demands for generic skills (Felstead et al., 2007; OECD, 2011; Autor and Handel, 2013; International Labour Organization, 2014; Handel, 2020).

Our study builds on previous findings from Braun and Brachem (2015), in which they transferred the skills found in international labor market research to a graduate survey. Based on the theoretical foundations and the empirical results, Braun and Brachem (2015) suggest certain areas of generic skills of graduates that can be assessed with their instrument. Braun and Brachem (2017) identified nine areas of generic skills that graduates must possess for their daily work life:

1. planning and organizing of work processes
2. promoting others
3. leading and management
4. dealing autonomously with challenging tasks
5. information processing
6. number processing
7. communication and cooperation, including competence in a foreign language and intercultural communication
8. using information and communication technologies
9. physical performance

These nine areas are the starting point for this present research.

The term "generic skills" can be interpreted in a variety of ways. For the purposes of our study, we draw on the same definition employed by Braun and Brachem (2015, 2017), since our instrument is based on their previous studies. We therefore define generic competences as the ability to successfully master complex situations. Performance-based competences consist of a skillset which can be applied to different disciplines and which is needed in variety of situations (Heijke et al., 2003; Rychen and Salganik, 2003; Green, 2009; Braun and Brachem, 2017).

Other scholars have concentrated on examining skills or competences like critical thinking, interpersonal understanding, problem solving and (written) communication (Jones, 2009b; Badcock et al., 2010; Hyytinen et al., 2015). Analogous to Braun and Brachem (2017), such research has also referred to skills like "information processing"; "dealing autonomously with challenging tasks"; and "communication and cooperation." Current research has thus made inquiries into ascertaining which generic skills tend to help employees acquire and maintain a job, in general, and what is expected of graduates in the labor market, specifically.

We have used the previous findings from labor market research and adopted the instrument developed by Braun and Brachem (2017), which has already been validated for higher education graduates, to test whether there are learning opportunities for students in these, theoretically and empirically established generic skills. Another advantage of this approach is that it makes it possible to examine and compare a broad range of generic competences.

Differences between fields of study regarding generic skills

So far, little research has been done on whether these relevant generic skills are taught in the study programs and on whether there are differences between the study programs in terms of what learning opportunities they offer students as part of their curriculum. Martin et al. (2005) reported that the majority of academic engineering programs do not teach generic skills and therefore recommend that such programs improve their curriculum to provide students with better training in, for example, communication skills (Martin et al., 2005; Paviotti, 2020). Jones (2009a) examined how lecturers perceived differences in how some generic skills were taught in five fields: economics, physics, history, medicine, and law. One of their key findings was that when generic skills are an inherent part of the field of study or the subsequent profession—like problem solving and communication in medicine or writing and critical thinking in history—they tend to be taught as part of the curriculum, either intentionally or not (Jones, 2009a). In a study conducted at an Australian university, Badcock et al. (2010) found that programs in the arts, engineering, and science had significant differences in learning opportunities for certain generic skills. They found that art students, for instance, attained higher scores in critical thinking and interpersonal understanding than those in other programs. Other studies have ascertained that students in the social sciences tend to have stronger skills in written communication. Engineering students, by contrast, appear to score higher in problem solving but lower for generic skills on all other tested scales. Research has also suggested that in fields of study that are based mainly on lectures and in which students are assessed mostly by written exams, students develop fewer generic skills, since they often have merely to recall the content (Bligh, 2000; Johnson et al., 2002).

There is a significant body of research available that examines and measures specific skills, such as communication or critical thinking (Jones, 2009a; Badcock et al., 2010). Studies with a broader view base their claims either on surveys of students (Kember et al., 2007; Virtanen and Tynjälä, 2019) or on data gathered about graduates (Martin et al., 2005; Suarta et al., 2017). There are few studies that combine data from students and graduates. Furthermore, there are hardly any studies that examine a wide range of generic skills and whose selection of specific skills is conceptually and empirically based.

Comparison of students and graduates

There is abundant research supporting the claim that education plays an important role in the acquisition of generic skills (Crebert et al., 2004; Smith and Bath, 2006; Huber and Kuncel, 2016). Yet, little research has been done that establishes a connection to the labor market. We are not aware of any study that links student assessments with the demands of the labor market. Previous studies have either examined study conditions by surveying students while they are still enrolled in a program or retrospectively by graduates after they have completed them. This results in a problematic phenomenon: Graduates evaluate entry into the labor market and selected criteria for career success, the results of which are then linked retrospectively to assessments of their prior study conditions. In other words, graduates are surveyed *after* they have completed their studies; they are thus asked to evaluate events that took place between three and 6°years prior. During this period, study regulations and study conditions may have changed, making it difficult to attribute the results of the graduate survey to current study conditions. Accordingly, the results of the graduate survey generate very little concrete knowledge that could help policymakers, administrators, and instructors develop curricula and improve the management of study programs that address the current labor market.

To address these gaps in the literature on the relationship between the acquisition of generic skills in higher education and the labor market, research thus needs to be conducted that can directly compare student and graduate data. The aim of this paper therefore is to examine whether such a comparison is feasible by using the same types of assessments for generic skills for students and graduates.

Research questions

Based on previous findings and the proposed theoretical framework, we address the following research questions:

1. Can the proposed conceptual areas of generic skills, developed using the job requirements approach, be transferred to a student survey?
2. a) Can profiles for learning opportunities of generic skills be found in the student data?
3. How are the fields of study distributed among these profiles?
4. How do students rate the learning opportunities for generic skills during their studies and how do graduates perceive the requirements of the labor market for generic skills?

Materials and methods

Sample

To answer these research questions, two online surveys, one among students and one among graduates, were conducted at a large university in Germany between December 2020 and March 2021.

Student sample

For the student survey, all matriculated students were invited *via* e-mail, to participate. Overall the response rate was about 25%. The items regarding our study were filled out by 4,258 students, of which 1,007 were male, 2,931 female, and 25 non-binary. Most of the students were enrolled in programs related to the humanities (N = 761), STEM (N = 586), and educational science (N = 546).

Graduate sample

The graduates were contacted *via* mail (postal, not electronic) and invited to participate in an online survey. Graduates were surveyed about 1.5 years after they had left the university. A total of 378 graduates participated, of which 118 were male, 251 female, and two non-binary; seven did not provide an answer regarding their gender. Most of the respondents graduated in educational science (N = 58), economics (N = 51), and humanities (N = 46).

In both samples, arts (N = 89 students, N = 6 graduates) and social science (N = 114 students, N = 17 graduates) were the least represented. The programs were grouped based on the system of subject classification used by the German Federal Statistical Office (Statistisches Bundesamt, 2021). According to this system, there are ten fields of study (see **Table 1**).

Table 1 shows the distribution of the students and graduates among the fields of study.

Instruments

The surveys included over 100 questions each. The instruments discussed below were included within them. However, the following descriptions only refer to the part, which is relevant for the present study.

TABLE 1 Distribution of fields of study.

Field of study	*N* students	*N* graduates
Humanities	761	46
Sports	133	18
Economics	232	51
Social sciences	114	17
STEM	586	35
(science, technology, engineering, and math)		
Agriculture and forestry	309	25
Nutritional science	314	31
Veterinary medicine	212	36
Arts	89	6
Psychology	191	32
Educational science	546	58
Total	**3,487**	**355**

N, numbers of students and graduates.

To explore the requirements as well as the learning opportunities, we built on the work of Braun and Brachem (2017). We used the instruments that they developed to assess the generic skills on requirements that graduates encounter on the current labor market and adopted to ask students about available learning opportunities within their fields of study for acquiring generic skills. We divided one scale from Braun and Brachem's previous study into "communication and cooperation" and "foreign language and intercultural communication," resulting in ten areas of generic skills (see **Table 2**).

Instruments for measuring learning opportunities for students

The ten scales consisted of a total of 27 items, and were framed to survey learning opportunities available to students in their programs. Each item started with phrases such as "In my studies . . .," and then followed a statement of what the students did in their program. We had to reword a few items from the original instrument developed by Braun and Brachem (2017) in order to make them apply to students. The students rated each item on a five-point Likert scale, in which each point was labeled with such time clauses as: (1) "never"; (2) "less than once a month"; (3) "at least once a month, but less than once a week"; (4) "at least once a week, but not daily"; (5) "daily." Cronbach's alpha of the scales ranged between alpha = 0.64 and alpha = 0.84, which was appropriate considering the small numbers, i.e., a maximum of three items. In the area of "physical work," students were asked only one question, so that no scale value was calculated here. All scales and example items are listed in detail in **Table 2**.

Instruments for measuring generic skills requirements for graduates

The same 27 items were used in the graduate survey. They were worded in such a way that they always began with "In my main occupation . . .," and were then followed by the same statements as in the student survey, using the same response categories. Cronbach's alpha of the scales ranged between alpha = 0.66 and alpha = 0.86, which was appropriate considering the small numbers, i.e., a maximum of three items. The rationale behind this procedure was to use the same wording in order to compare student and graduate answers, and to prevent a situation in which graduates were asked to assess after graduation, the generic skills that they had acquired during their studies. All scales and example items are described in detail in **Table 2**.

Procedure

In order to answer the first research question, we examined whether the theoretically assumed factor structure of the graduate survey (Braun and Brachem, 2017) can also be confirmed in the student survey. A confirmatory factor analysis with nine factors was carried out for this purpose. The area "physical performance" was not considered as a latent factor, as it only consists of one item and therefore did not allow latent modeling. To evaluate the model fit for the learning opportunities, we used the following cut-off criteria: Considering the Root Mean Squared Error of Approximation (RMSEA) the model fit was considered as close when RMSEA $\leq$ 0.05, RMSEA $\leq$ 0.08 the model fit was considered as reasonable and RMSEA $\leq$ 0.1 was considered as acceptable. For the Standardized Root Mean Squared Residual (SRMR) the model fit was considered as reasonable when SRMR $\leq$ 0.08 and SRMR $\leq$ 0.1 showed an acceptable fit. A Comparative Fit Index (CFI) $\geq$ 0.95 show good fit and CFI $\geq$ 0.9 show acceptable fit (Browne and Cudeck, 1992; Beauducel and Wittmann, 2005; Backhaus et al., 2015). The smaller the RMSEA and SRMR, the better the estimated model fit, while a larger CFI, by contrast, indicated a better model fit.

To analyze the second research question, about possible profiles in learning opportunities in the various fields of study, we conducted a cluster analysis. To be able to conduct the final cluster analyses, we carried out several pre-tests. We first performed a single-linkage cluster analyses to identify the breakout cases. After identifying the breakout cases, we were able to perform a Ward hierarchical cluster analyses with 3,394 cases for learning opportunities for generic skills. The proposed preliminary cluster solutions were tested both graphically, with a dendrogram, and statistically. Based on the hierarchical cluster analyses, we were then able to conduct k-mean clusters, which we then used first to evaluate the different profiles for learning opportunities and second to evaluate the distribution of the fields of study among them. We tested the significance of the distribution using χ^2 and Cramér's V for effect sizes. Even though the area of "physical performance" was only measured with one item, and therefore not included in the confirmatory

TABLE 2 Dimensions for learning opportunities and labor market requirements.

		Student survey	Graduate survey	Student survey	Graduate survey
Dimension	Number of Items	Cronbach's alpha for learning opportunities	Cronbach's alpha for labor market requirements	Example item for learning opportunities ("In my studies . . .")	Example item for labor market requirements ("In my primary profession . . .")
Planning and organizing of work processes	3	0.76	0.75	I organize work processes.	I organize work processes.
Dealing autonomously with challenging tasks	3	0.66	0.80	I assess possible consequences and outcomes for other areas or people.	I assess possible consequences and outcomes for other areas or people.
Promoting others	3	0.80	0.86	I train, teach or educate other people.	I train, teach or educate other people.
Leading	3	0.84	0.81	I learn to set goals or strategies for other areas or people.	I set goals or strategies for other areas or people.
Information processing	3	0.75	0.71	I apply scientific methods, procedures or techniques to solve problems.	I apply scientific methods, procedures or techniques to solve problems.
Number processing	3	0.82	0.85	I specifically analyze information or data.	I specifically analyze information or data.
Communication and cooperation	3	0.81	0.66	I create a joint product as part of a team (reports, presentations, projects, etc.).	I create a joint product as part of a team (reports, presentations, projects, etc.).
Foreign language and intercultural communication	2	0.64	0.67	I communicate in a language other than my mother tongue.	I communicate in a language other than my mother tongue.
Using information and communication technology	3	0.71	0.83	I use internet-based applications to exchange or work out work-related issues with other people.	I use internet-based applications to exchange or work out work-related issue with other people.
Physical performance	1			I carry out tasks, which require physical competences (e.g., manual labor).	I carry out tasks, which require physical competences (e.g., manual labor).

factor analyses, we decided to include it in the evaluation of the profiles of learning opportunities, as this area has been identified as significant in research that applies the job requirement approach (Morgeson and Humphrey, 2006; Felstead et al., 2007; Autor and Handel, 2013).

To enable a comparison between students and graduates, in order to address the third research question, we turned to a visual presentation of mean values. We deliberately refrained from inferential statistical analyses: firstly, because we made no assumptions about existing differences and secondly, because we could make numerous comparisons (between the ten fields of study and ten scales), so that the procedure would be richly explorative and its possible significance random.

All empirical analyses were conducted using Stata 16.1. An overview of used samples and analysis can be seen in Table 3.

Results

Confirming the assumed theoretical structure of the constructs for students

A confirmatory factor analysis was conducted to check the structure of nine factors related to learning opportunities for students. The confirmatory factor analysis with the nine constructs showed acceptable to reasonable fits. The RMSEA showed a reasonable to close fit (0.054), the SRMR showed a reasonable fit (0.053), and the CFI showed an acceptable fit (0.925). Table 4 shows the standardized factor loadings for the areas of generic learning opportunities. In general, the results of the confirmatory factor analyses showed acceptable to high-factor loadings for all items. Only in the construct "planning and

TABLE 3 Methods of analysis and samples used according to the three research questions.

Research question	Sample	Method for analysis
1	Students (N = 3,487)	Confirmatory factor analysis
2	Students (N = 3,487)	Cluster analysis
3	Students (N = 3,487) Graduates (N = 355)	Descriptive statistics (mean values and standard deviations)

organizing of work processes" the item "In my studies I evaluate the performance or quality of people, objects, or processes" showed a barely acceptable factor loading (0.487). Since the content of the item is seen as important for the latent factor, and because the internal consistency of the scale (α = 0.76) was acceptable, we kept the item for further analyses.

Overall, the expected structure could be firmly established in the student survey.

Profiles of learning opportunities in the fields of study

In this section, we examine the student responses to the ten areas related to learning opportunities. The focus here was on the question of whether the fields of study differ in terms of which learning opportunities students reported.

To analyze profiles of learning opportunities, we conducted cluster analyses, and then tested the distribution of the fields of study among those clusters.

The dendrogram of the Ward hierarchical cluster analyses showed three reasonable clusters of profiles for learning opportunities. Therefore, we refined the results with a k-means cluster analyses on those three clusters. Figure 1 shows the mean values of the ten learning opportunities within the three different clusters. Cluster 1 is characterized by overall high number of learning opportunities for generic skills in nine areas. It is particularly noticeable that the area of physical activities was only marginally represented in this cluster. The areas "using information and communication technology"; "planning and organizing of work processes"; and "dealing autonomously with challenging tasks" were particularly high.

In cluster 2, learning opportunities in all ten areas of generic skills were also high and comparable to cluster 1. Cluster 2, in contrast to the other two clusters, showed a particularly high level for physical activity. Again, "using information and communication technology"; "planning and organizing of work processes"; and "dealing autonomously with challenging tasks" were also pronounced. The area "number processing" was the least pronounced. Nevertheless it was similarly high to how it appeared in cluster 1.

Cluster 3 showed overall the fewest learning opportunities for all areas of generic skills. As well as in the other twoclusters, the areas "using information and communication technology"; "planning and organizing of work processes"; and "dealing autonomously with challenging tasks" showed the most learning opportunities in this cluster. The areas "promoting others" and "leading" were particularly low.

In general, it was noticeable that the areas "using information and communication technology"; "planning and organizing of work processes"; and "dealing autonomously with challenging tasks" showed the greatest number of learning opportunities in all three clusters.

In the next step, we looked at the distribution of the fields of study across the three found clusters for learning opportunities. Table 5 shows the assignment of the fields of study to the three profiles of learning opportunities; it also shows absolute frequencies and relative frequencies per row. The analyses revealed that the fields of humanities, social sciences, educational sciences, and psychology could be assigned to the first cluster; sports and arts to the second cluster; and economics, STEM, agriculture and forestry, nutritional science, and veterinary medicine to the third cluster.

This distribution showed a tendency, that the fields of humanities, social sciences, educational science, psychology, sports, and arts provide good opportunities for the acquisition of generic skills, but have partially few learning opportunities in the area of "physical performance"–something they share with economics, STEM, agriculture and forestry, nutritional science, and veterinary medicine. Sports and arts seem to support more learning opportunities for the acquisition of physical skills. For economics, STEM, agriculture and forestry, nutritional science, and veterinary medicine, which could be best assigned to the third cluster, we saw overall the fewest learning opportunities for acquiring generic skills. As Table 5 shows, these are tendencies only and all field of studies show strengths in all profiles.

The relation between the field of study and the profiles formed is statistically significant, but is not high (Cramér's V = 0.25). The assignment to the clusters could be made with varying degrees of clarity. While a few fields, such as arts and psychology, could be clearly assigned to one cluster, some were distributed across several clusters (i.e., sports). Overall, however, an assignment was possible for all ten fields of study. The results confirmed our first assumptions: Cluster analysis provided some evidence that learning opportunities for generic skills differ between the fields of study.

Descriptive comparison of student and graduate assessments

In this section, we make descriptive comparisons between the responses from students on learning opportunities within their fields of study and those from graduates on labor market

TABLE 4 Factor loadings for areas of generic learning opportunities (student data).

Tasks	Item ("In my studies.")	Factor loadings
Planning and organizing of work processes	I organize work processes.	0.87
	I plan timelines.	0.83
	I evaluate the performance or quality of people, objects or processes.	0.49
Dealing autonomously with challenging tasks	I have to react to unexpected situations.	0.63
	I assess possible consequences and outcomes for other areas or people.	0.67
	I show initiative.	0.60
Promoting others	I train, teach or educate other people.	0.72
	I lead groups in a structured way.	0.79
	I support and motivate others.	0.76
Leading	I learn to set goals or strategies for other areas or people.	0.72
	I learn to persuade others.	0.88
	I learn to negotiate with others.	0.82
Information processing	I assess the quality of professional articles.	0.66
	I document complex facts.	0.75
	I apply scientific methods, procedures or techniques to solve problems.	0.70
Number processing	I create number-based diagrams or tables.	0.83
	I carry out complex calculations.	0.76
	I specifically analyze information or data.	0.73
Communication and cooperation	I create a joint product as part of a team (reports, presentations, projects, etc.)	0.72
	I stick to agreements made in a work group.	0.77
	I negotiate compromises with other people.	0.82
Foreign language and intercultural communication	I communicate in a language other than my mother tongue.	0.56
	I maintain contact with people from other cultures or social groups.	0.82
Using information and communication technology	I use internet-based applications to exchange or work out work-related issues with other people.	0.67
	I process content digitally.	0.67
	I deal with questions concerning the digitalization of work processes.	0.68

Criteria of the confirmatory factor analysis: $\chi^2(263) = 2001.65$, $p \leq 0.01$, RSMEA = 0.054, SRMR = 0.053, CFI = 0.925.

requirements. As stated above, we did not conduct any inference statistics, since we did not have a directed hypothesis. For this purpose, we have graphically contrasted the mean values and standard deviations for all students with those for all graduates in bar charts.

The graphic comparisons of the mean values for each of the ten different fields of study are also worth noting. These can be found in the **Appendix**.

Figure 2 shows student perceptions of current learning opportunities within their programs of study and graduate perceptions of current labor market requirements within the bar charts. It also shows the particular standard deviations for every dimension for learning opportunities as well as for labor market requirements. As discussed above, only descriptive analyses were conducted to avoid producing findings that were random.

Based on our study, we can draw some preliminary conclusions. There are areas in which student and graduate perceptions appear to overlap. In categories, such as "dealing autonomously with challenging tasks"; "using information and communication technology"; and "planning and organizing of work processes"; students report learning opportunities for these skills as widely available and graduates report them as greatly in demand. The absolute differences between learning opportunities and labor market requirements are quite big in the areas of "dealing autonomously with challenging tasks" and "promoting others." We also observed that there are areas, such as "number processing" or "leading," where the labor market requirements as perceived by graduates nearly coincided with the learning opportunities reported by students within their fields of study.

Regardless of the field of study, students reported slightly fewer learning opportunities than graduates reported labor market requirements. The exception was in the areas "using information and communication technology"; "information processing"; and "planning and organizing of work processes."

The high standard deviations suggest the high variance in learning opportunities, as well as in the requirements, which is not surprising due to the fact, that **Figure 2** shows mean values and standard deviations aggregated across all fields of study.

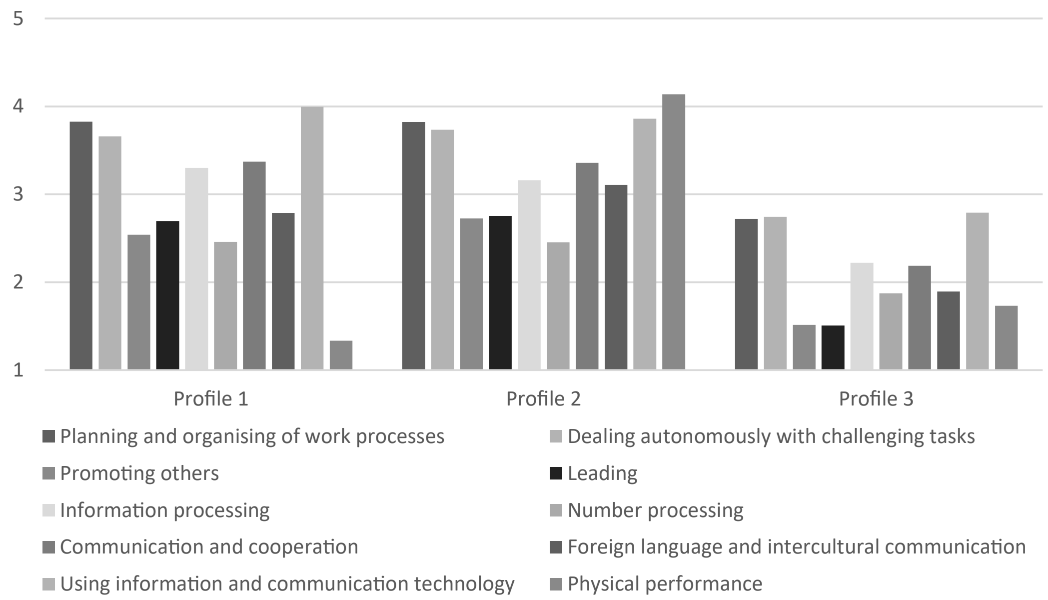

FIGURE 1
Profiles for learning opportunities.

Examining the requirements and learning opportunities at the level of fields of study (see **Appendix**), a more differentiated picture emerged. Especially for veterinary medicine or nutritional science, we observed that learning opportunities and requirements did not align very well with each other. For STEM and social sciences, however, we observed that the reported learning opportunities and labor market requirements nearly coincided.

As noted above, we refrained from inferential statistical comparisons because we did not have an explicit hypothesis directing our study and, moreover, the multiple comparisons could also have generated random findings.

Discussion

This study offers some innovative but nonetheless preliminary results. To be able to capture the acquisition of generic skills in higher education, which has been shown in prior research to be important on the labor market, we transferred ten areas of generic skills that were based on theory from the job requirements approach to a student survey. A confirmatory factor analysis verified the structure of different areas of generic skills, which were adopted from graduate surveys, and therefore also allow the appropriate use in the student survey.

We also analyzed the student data for learning opportunity profiles, structured by the ten areas of generic skills. Cluster analyses showed three different types of learning opportunity profiles, which differed mainly in the frequency of the specific areas of generic skills. While the first cluster contained frequent learning opportunities in almost all areas of generic skills except in the area of "physical performance," the second cluster showed frequent learning opportunities especially in "physical performance," as well as in the other areas. Only the third cluster stood out from the others in that it consistently contained fewer learning opportunities in all areas. If we now look at how students from different disciplines were distributed among the three clusters, some tendencies can be observed: the first cluster was made up mainly of humanities and educational sciences, while the second cluster was made up primarily of arts and sports. The third cluster was made up mostly of STEM and economics. The results are consistent with the previous feedback on perceptions of fields of study. While fields like humanities and educational science are often perceived as fields in which students tend to acquire more general skills, in fields like sports and arts, it is very common to engage in a lot of physical activities. The curriculum for students of STEM and economics, by contrast, is mostly characterized by very stringently prescribed curricula with a high level of discipline-specific skills (Bligh, 2000; Johnson et al., 2002). The results of cluster analyses suggest that the areas of "using information and communication technology," "planning and organizing of work processes," and "dealing autonomously with challenging tasks" are the dimensions in which students seem to perceive the highest learning opportunities for generic skills, regardless of their field of study.

Finally, addressing our third research question, we contrasted the data from students with that of graduates. Here we made use of graphic representations and believe,

TABLE 5 Distribution of the fields of study across the profiles for learning opportunities.

Field of study	*N* profile 1	*N* profile 2	*N* profile 3	Total
Humanities	260 42.76%	183 30.10%	165 27.14%	608
Sports	19 16.38%	50 43.10%	47 40.52%	116
Economics	65 38.69%	35 20.83%	68 40.48%	168
Social sciences	51 51%	22 22%	27 27%	100
STEM	145 31.52%	144 31.30%	171 37.17%	460
Agriculture and forestry	72 30.25%	48 20.17%	118 49.58%	238
Nutritional science	84 32.81%	25 9.77%	147 57.42%	256
Veterinary medicine	32 16.08%	50 25.13%	117 58.79%	199
Arts	10 13.33%	56 74.67%	9 12%	171
Psychology	111 64.91%	20 11.70%	40 23.39%	171
Educational science	159 38.95%	128 30.99%	126 30.51%	413
Total	**1,008** **35.95%**	**761** **27.14%**	**1,035** **36.91%**	**2,804** **100%**

$\chi^2(20) = 347.76$, $p \leq 0.01$, Cramér's $V = 0.25$. The biggest groups are shaded gray.

despite the limited nature of the empirical analysis, that such a comparison offers insights into the differences between learning opportunities in higher education and generic skill requirements in the labor market. Our findings also underscore the importance of generic skills in the areas of "planning and organizing of work processes"; "dealing autonomously with challenging tasks;" and "using information and communication technology" for both students and graduates, which aligns with previous findings (Tynjälä et al., 2006; Suarta et al., 2017).

The preliminary results regarding the relationship between different learning opportunities and the field of study fit in well with previous findings from labor market research. The labor market usability of humanities and arts are discussed in the literature, and there are some regions in the world where arts and humanities programs are being either reduced in size or dismantled all together (Cassity and Ang, 2006; Jenkins, 2015; Olmos-Peñuela et al., 2015; Preston, 2015). Especially for humanities, it is often argued that it is a field in which little discipline-specific knowledge is taught (Leuze and Strauß, 2008; Falk et al., 2009). However, our findings suggest that fields of study within the arts, humanities, and educational science in particular, offer learning opportunities for the acquisition of generic skills. Previous studies have shown that learning environments, which promote collaborative learning or where students have to deal with authentic problems foster the development of generic skills (Kember et al., 2007; Virtanen and Tynjälä, 2019). This could be linked to the fact that fields like social sciences, humanities, and psychology often deal with current developments and frequently implement collaborative methods. By bringing together student surveys and labor market research, our study was thus able to fill a gap in knowledge about the benefits of arts and humanities programs for the labor market in general. The benefits of STEM programs for an individual's economic well-being are well-documented. However, our study shows that the contribution to employability in the arts and humanities programs seems to lie in the learning opportunities for the acquisition of generic skills. In the light of the need to foster "21st-century skills" (Germaine et al., 2016; Suarta et al., 2017; Rios et al., 2020), our findings thus suggest that fields like arts, humanities, and educational science seem to offer important learning opportunities for students but are not limited to these fields of study.

Although our study enables a comparative evaluation of student and graduate data, it is also subject to limitations. So far, the scales have been applied at only one university. Therefore, we cannot yet make any statements about the broader application of the results to other contexts. Hopefully, similar studies of linked student and graduate surveys will be carried out in other countries, making it possible to compare the results of such studies with ours. Since the initial instrument (Braun and Brachem, 2015, 2017) was already tested and used in a Germany-wide graduate survey, we did not pretest our instruments. We are aware that there is a certain risk that the statements will be perceived differently by students than by graduates. Nevertheless, by using similar phrasing of the statements, cross-comparisons can be made between learning opportunities and labor market requirements for generic skills.

Another limitation is connected with the area of "physical performance," since it was captured with only one item. Despite this limitation, this area is nonetheless significant because the fields of study differ in how much physical labor is carried out by students during their studies. Future research might extend this scale by including more items. In addition, future research could use more advanced and person-centered methods to test our findings.

Even if the distribution of fields of study among the three profiles is significant, the distribution itself is not that evident. All ten fields of study show up in all three profiles, which is an indicator, that all study programs contribute to the acquisition of generic skills.

The results leave open the question of whether generic skills are embedded learning goals within higher education and whether the fields of study seek to promote the acquisition of generic skills, or if they are a mere by-product of the content of individual fields of study. To answer this question, it would be necessary to examine module manuals of the subjects in reference to their learning opportunities for generic skills.

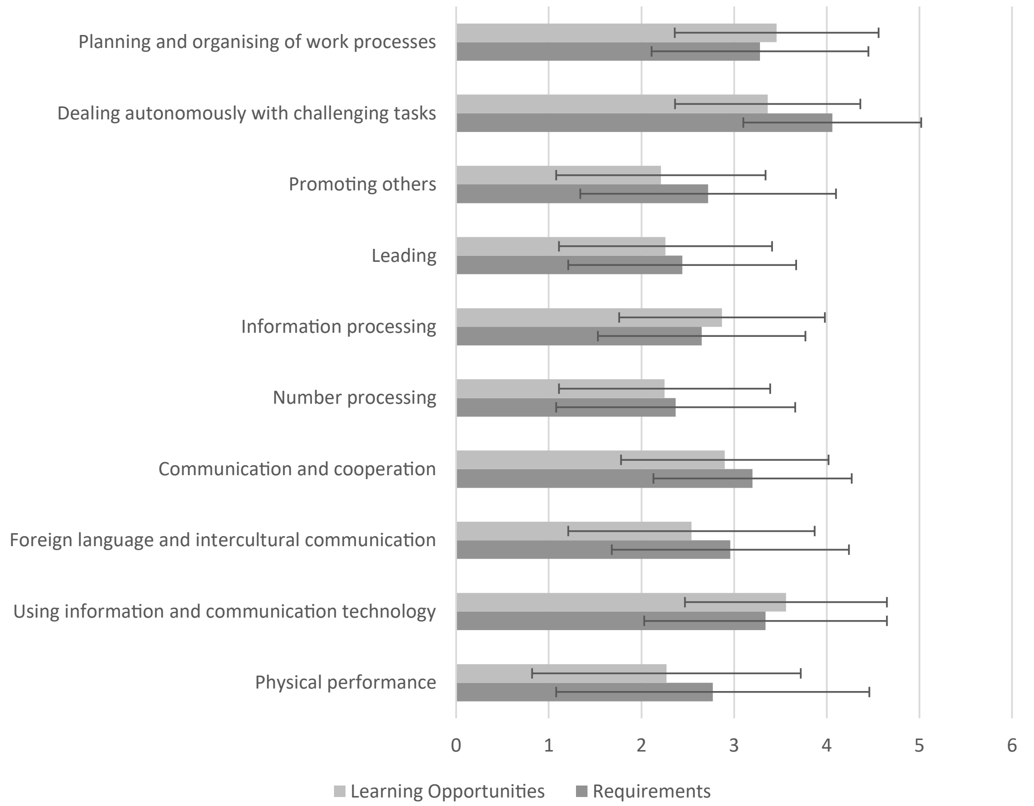

FIGURE 2
Perception of requirements in the view of graduates and learning opportunities in the view of students.

The findings regarding the descriptive comparison between the student and graduate assessments are quite restricted because of their explorative nature. Further research might build on these preliminary results to conduct more hypotheses-driven research. Nevertheless, the descriptive results provide the first indications about the fit between learning opportunities and labor market requirements for generic skills and can be used in the context of (re)accreditation for the individual subject groups.

The data were collected as part of the quality management at the university where we conducted our study. We are grateful for the permission that they granted us to use the data for our publications. Universities can draw on the gathered data and on our findings to assist in the development and administration of their programs; students and graduates can draw on them for their personal development. As part of our work, we always consider the ethical implications of our work and proceed accordingly, seeking to work to the best of our conscience.

The scales presented here are based on the job requirements approach, and therefore firmly grounded on a theoretical basis. They are nonetheless self-reported. Although this allowed an assessment of perceived learning opportunities, it did not offer a "hard" measurement of competences. Moreover, in this paper we examined only generic skills; we therefore cannot make any statements about the promotion of subject-specific knowledge, which can certainly be seen as a primary learning outcome of higher education.

Despite these limitations, the use of scales provides an empirical basis, especially for the area of quality management of study programs and teaching at universities. So far, mainly graduate data and retrospective assessments have been used to draw conclusions about the quality of the fit between study programs and the labor market. As noted above, study regulations and conditions may have changed several times in the interval between when the graduates pursued their studies and when they were surveyed about them. This time lag makes it difficult for those responsible for the organization and planning of the various study programs to draw on research to improve their programs. By using the scales presented here and applying them both to the student and the graduate surveys, a direct reference can be made between learning opportunities for generic skills that currently exist at institutions of higher education and those currently in demand on the labor market. Our experience shows that this empirical data can be used in a variety of ways, both for the accreditation of study programs and for evidence-based curriculum development. We are not suggesting that the requirements reported by graduates should be integrated one-to-one into the curriculum. We do believe, however, that the scales facilitate planning and development. They make it possible to carry out an informed discussion about which generic skills are already being promoted and those which should be given greater consideration in the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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

KL wrote the first draft of the manuscript and performed the statistical analysis. EB wrote sections of the manuscript. Both authors equally contributed to the design and the conception of this study, contributed to the article, and approved the submitted version.

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.

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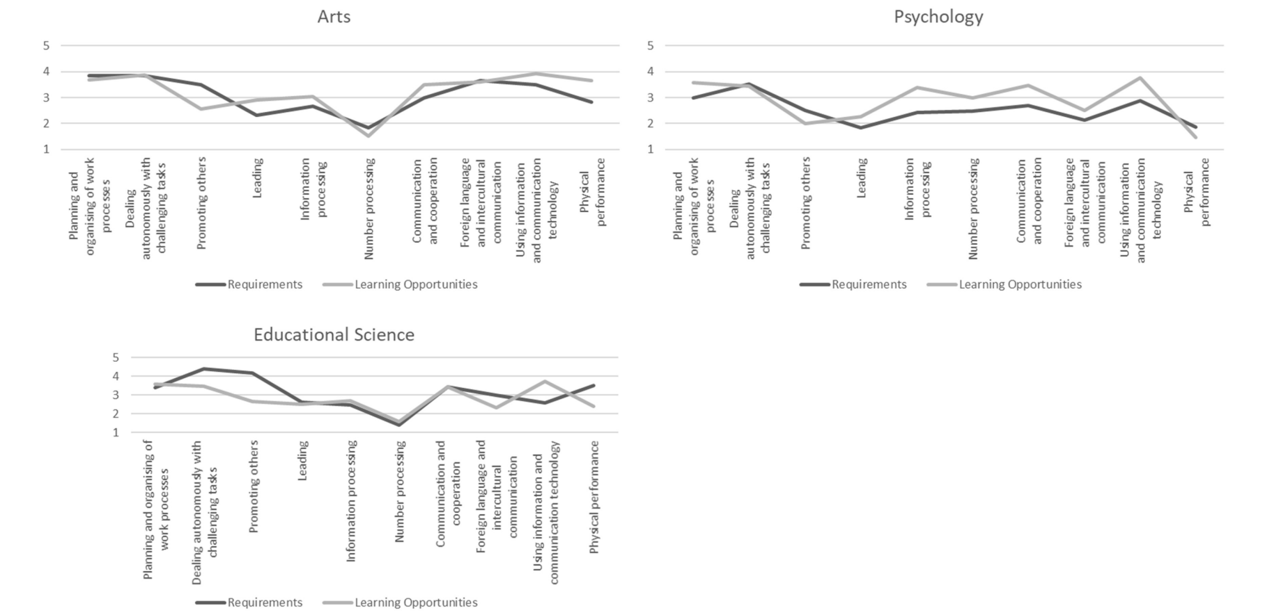
Appendix

APPENDIX FIGURE 1
(Continued)



APPENDIX FIGURE 1
Perception of requirements in the view of graduates and learning opportunities in the view of students by field of study.