



The Competencies That School-Leavers Should Possess in Order to Meet the Challenges of the 21st Century

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The current state of the planet poses challenging ethical questions that shake up our emotions and values, thus making our choices and decisions more difficult. In order to grasp the many complex issues with which we are each confronted on a daily basis, education in sustainable development (ESD) advances competencies (Unesco, 2017) that are rooted in both cognitive and socio-emotional processes. Although ESD is included in most school curricula, it is worth exploring what teachers perceive to be the real needs for these thinking tools, as well as how they value the development of these competencies in school. This research, which was carried out with pre-service and in-service teachers, answers these two questions. These initial results bring to light the interdisciplinary nature of the competencies considered necessary by the teaching profession, as well as the strengths and weaknesses of the current school system with regard to their development. This interdisciplinary approach leads us to a definition of what a competence is with regard to the specificity of the school context, and finally, to propose a typology. We have used this typology to compare the visions of the teaching staff with the competency frameworks proposed by the international bodies with the most influence in the Swiss school system, namely the World Economic Forum, the OECD, and UNESCO. Comparisons between these different elements open up perspectives on what tools could be proposed for assessing these competencies in schools in the long term.

Keywords: interdisciplinary competencies, typology of competencies, complexity, education for sustainable development, focus groups

INTRODUCTION

The current state of the planet raises ethical questions that challenge our emotions (Brosch, 2021) and values (Pellaud, 2007, Pellaud, 2011), and which are of such a level of complexity (Morin, 1977, Morin, 1990, Morin, 2000, Pellaud, 2000, Morin et al., 2003, Pellaud, 2011, Pellaud, 2013) that our choices and decisions become increasingly difficult (Pellaud and Gay, 2017). This difficulty is compounded by the explosion of scientific knowledge as well as the sheer quantity of information available, particularly via the Internet. While these should enable better understanding of current issues, it is clear that awareness of the urgent need for responsible action remains confined to those

people with certain privileged socio-cultural and economic backgrounds (according to De Cabanes, 2019, 72% of young people who took part in climate protests in France have at least one parent in the executive and higher intellectual professions), whereas it is barely apparent in the less well-off population (Tyler, 2014; Hine et al., 2016). Confused by complex and often contradictory information, the latter more easily take refuge in denial, indifference (Mathieu, 2015), or worse still, in conspiracy theories (Renard, 2015; Wagner-Egger and Gygax, 2018; Adam-Troian et al., 2020).

These findings show that in order to understand the many issues that we are confronted with on a daily basis, and the changes they bring about in our ways of thinking and living, the question of the “baggage” that pupils must have by the end of compulsory schooling (which in Switzerland comes between the ages of 15 and 16) in order to assume their role as ‘citizens and social actors’ (CIIP, 2010) appears to be of prime importance. Among the elements that make up this baggage, the competencies targeted by education for sustainable development (hereafter ESD) are clearly essential.

The aim of this article is to present the elements that the teaching community considers should be part of the citizen’s baggage. The study carried out to identify these elements, which constitutes the core of this article, was based on a sample of 89 teachers and future teachers divided into four focus groups. The results obtained make it possible to identify the competencies that these teachers consider as the most important for tackling the evolving needs of the 21st century, and also the extent to which this same population considers that the current school system does or does not promote the development of these competencies.

The analysis of the results obtained allowed a typology of competencies to emerge, and also enabled their cross-disciplinary or, on the contrary, their disciplinary aspects to be highlighted. Such a typology, which had not previously existed, will be used at a later date to facilitate teachers’ access to an evaluation of their students’ competencies, which is the final objective of our research, but which is not within the scope of the present article. A definition of “cross-disciplinary competence for compulsory schooling”, based on the current literature and compared with the notion of competence used in the professional sphere, will also be proposed. This definition, which is complementary to the definition of the typologies mentioned, is important in that it addresses the issue of assessing competencies.

The concepts as defined here will allow comparisons to be made between the expectations of teachers and the ambitions of international bodies whose influence on Swiss educational policy is recognized (i.e., the World Economic Forum (WEF), the Organisation for Economic Cooperation and Development (OECD), and UNESCO).

EMPIRICAL RESEARCH

Method

The research presented here concerns four focus groups made up of three groups of students in their second year of training at the

Haute Ecole Pédagogique in Fribourg (primary teacher training), whose average age was between 19 and 25, and one group of students on a master’s degree course in specialized teaching at the Haute Ecole Pédagogique in BEJUNE. These teachers were already in post, with an age range of between 24 and 49.

The participants were in their usual classrooms, already knew each other, and were used to working in groups. The teacher participating in the research therefore proposed a protocol based on the discussion game method, framed by a semi-directive interview.

To initiate the reflection work and the discussion game, the teacher started by carrying out an inventory, in a plenary session, of the main problems facing the world today. Climate change, the loss of biodiversity, population migration, and various forms of pollution, particularly those caused by plastic in the oceans, were spontaneously mentioned by all the groups. A slide added to these initial ideas with less publicized issues such as the rural exodus, desertification, globalization, the exploitation of resources, child labor, etc. This activity highlighted the many complex issues which form part of our daily lives, and which are reported in the media.

Following this introduction, the teacher asked the following question: “In your opinion, what are the “qualities” that students in the 21st century should be able to demonstrate when they leave compulsory schooling in order to be able to face this kind of situation?”

The participants were given ten minutes to reflect on this question individually and write down the five “qualities” that they felt to be the most important. The choice of the term “qualities” was made in order not to limit the proposals, and not to lock the participants into overly conceptual and sometimes controversial definitions of the term “competence”; and also to allow for the possibility of naming knowledge, skills, competencies, and even performances. After this initial reflection, the participants were divided into groups of five or six. Individually, each person presented his or her proposals to the whole group. The group then had ten minutes to discuss and reach a consensus on the five most essential “qualities” that they would retain and present to the plenary.

Subsequently, each group put forward its proposals. As each group listed them, the other participating groups mentioned whether a particular proposal was also on their list. Interesting discussions arose when choosing the terms to define these qualities. In a spontaneous manner, the protagonists quickly eliminated problems relating to synonyms. Thus, the terms “collaboration” and “cooperation” were grouped together under the term “cooperate” in class 2, and under “know how to collaborate” in class 1. “Curiosity” was complemented by “desire to learn” in class 2, and by “tools enabling its development” in class 4, whereas it was mentioned without addition by classes 1 and 3.

The capacity for reflection was equated with a form of self-evaluation by class 3, and with “thinking about how to do things” in class 2. Autonomy, put forward by all the classes, was presented in greater detail by some groups. Thus, it took the form of “autonomous in being/doing” for class 2, of becoming “autonomous in work to meet one’s needs” for class 3, while

TABLE 1 | Main characteristics of the focus groups.

Class	1	2	3	4	Total
Participants	26	22	21	20	89
Female	22	20	17	17	76
Male	4	2	4	3	13
Number of groups of 5–6 teachers	5	4	4	4	17
Number of potential propositions	25	20	20	20	85
Number of effective propositions (after assembling)	11	7	10	7	35
Number of final propositions retained					12

TABLE 2 | The “qualities” that teachers believe the 21st century student should have.

The 21st century student should have the following qualities at the end of compulsory schooling	Cl.1	Cl.2	Cl.3	Cl.4
Collaboration/cooperation/good social skills	0/+	+	++	+
Curiosity, desire to learn	0	+	+	–
Autonomy in work, autonomy of being/of doing	+/0	–	–	+
Critical thinking	–	–	–	0
Creativity, open-mindedness	--	--	–	–/0
Adaptability, flexibility (including cognitive), openness to change	+		+	–
Personal commitment, motivation, perseverance, sense of responsibility	–	–		+
Awareness of self, of one's limits, of one's abilities	--		–	+
Familiarity with IT, and the ability to live with technology	+	++		
Respect for oneself, for others, tolerance, benevolence	+			+
Capacity for reflection, the ability to analyze one's own processes, self-evaluation		+	+	
Self-confidence			–	
“good citizen”, “good consumer”: interest in politics, respect for rules			++	
Conformist				++
Hardworking		++		

class 4 associated autonomy with a form of responsibility that leads to mutual help. Only class 1 did not elaborate on this concept. This work of formulating and specifying these “qualities” was important, as it made it possible to group together the most similar ideas with the agreement of their authors (see **Table 1**).

In the compilation presented in **Table 2**, an identical process was used to group together elements that call for similar modes of thought or interpretations. In the end, 15 proposals were retained out of the 33 initially put forward by the 17 focus groups.

Once the “qualities” had been defined and presented on the board or flip-chart, the participants were asked to assess what they believed the school system was currently doing to develop them. The evaluation ranged from: “not at all” (–) to “very much” (++) with intermediate forms equivalent to “a little” (+) and “very little” (–). The 0 meant that the school does not do anything specific with regard to this “quality”. This assessment was carried out with the help of the “Menti” application, which each participant downloaded onto their smartphone. This application allows each participant to give an anonymous opinion on a defined scale. A “/” was used when the results showed an equivalence in the opinions given. As not all the groups proposed the same “qualities”, some boxes are not filled in the summary table below.

The constituent elements of **Table 2** are presented according to their frequency of appearance coupled with the evaluation, from the most positive to the most negative.

Data Analyses

A first important point emerged from this the data presented in this table. Apart from familiarity with information technologies (IT), all the propositions can be considered as “meta-qualities”, and as such, they are not restricted to a particular discipline. At the end of this table there are three “qualities” with a particular status. Indeed, the three classes concerned specified that they did not mention them because they considered them indispensable for the 21st century student, but rather, because they thought that these objectives were part of the hidden curriculum of the school, and that they would therefore necessarily be part of this baggage. It is also interesting to note that these elements were only identified in the classes of pre-service teachers. As the aim was to focus solely on the “qualities” deemed necessary to tackle the problems of our century, these three elements were not taken into account in the rest of this work.

This table shows that from the participants' point of view, the “qualities” most favoured at school are “collaboration/cooperation/good social skills”, to which we can add “Respect for oneself, for others, tolerance, benevolence”, since all the

classes referred to group work, which is widely encouraged both at school and in wider society (Dutr vis and Rastoldo, 2020, p. 26). These “qualities” are also included in the Plan d’Etudes Romand (CIIP, 2010). Indeed, “collaboration” is an interdisciplinary ability, in relation to which one of the descriptors refers to “taking the other into account” (i.e., requiring respect and tolerance).

On the other hand, those qualities that appear to be little encouraged are “critical thinking” and “creativity/open-mindedness”. It should also be noted that creativity was only mentioned spontaneously by group 1, which evaluated it as “not at all (--)” regarding the school’s participation in its development. The question was then proposed to the three other groups. The evaluation was also negative for group 3, barely better for group 2, and undetermined between -/0 for group 4, while at the same time being recognized as essential by all the participants.

Very different results were obtained for “critical thinking”, which was evaluated at a low level by the participants, and for “capacity for reflection”, which was favorably evaluated by the two classes that mentioned it. This difference in evaluation is explicable if we take into account the fact that it is exclusively linked to a form of self-evaluation. Thus, although “capacity for reflection” is also explicitly present in the PER (as the interdisciplinary capacity “reflective approach”), it benefits from a distorted interpretation among this population, which separates it from its critical functions decentred from the self and places it in a perspective which is more directed towards metacognition.

While general trends can thus be observed, we also noted a diversity of responses between classes, for example in relation to “curiosity/desire to learn”, and “autonomy in work, autonomy of being/of doing”. This variation can be attributed to the fact that the discourse collected from our sample is based on mixed representations of classroom practices, and therefore varies according to the personal and professional experiences of each individual.

DISCUSSION: PERSPECTIVE ON THE RESULTS AND THEIR RELATION TO THE LITERATURE

Different but Interlinked Competencies

Far removed from the notional knowledge on which pupils are usually assessed, we find in these proposals a certain unity, particularly with regard to their diversity, interdisciplinarity, and meta nature. More specifically, these qualities could be categorized either on a continuum or on a line ranging from those qualities that are closest to socio-emotional competences (e.g., the ability to collaborate/cooperate to develop good social relations, but also to respect oneself and others and thus to show tolerance and benevolence) along towards more cognitive skills (such as critical thinking, and even creativity). The latter qualities feed more strongly on notional or even academic knowledge, in contrast to the emotional qualities previously mentioned which are independent of such knowledge.

The qualities between these extremes of the continuum could include autonomy in work, which goes hand-in-hand with a certain personal commitments and responsibility for one’s own learning. To this can be added the particular vision given by some of the participants which is implicit in the concept of building a “capacity for reflection” in the sense of self-evaluation, of being able to look critically at one’s own work. But to be really effective in this learning of autonomy, and in developing harmonious social relations and managing one’s emotions, it is important to be able to adapt or to show curiosity and flexibility in the face of the different situations a person encounters, as well as to develop a good knowledge of oneself in order to be able to “use all of one’s own capacities” in the way that the participants suggest.

It should also be noted that while the comparison between feeling, moods, and emotion makes sense in some more fundamental works, in which it has been stated that emotion is more intense and less diffuse in its duration and linked to a specific object (e.g., Sander, 2013; Sander and Scherer, 2019), for the sake of brevity here we will consider these terms to be almost synonymous, to the extent that the competencies assessed in relation to feelings, moods, and emotions relate to affective mechanisms in the overall sense of the term.

Cognitive and Socio-Emotional Competencies

As was mentioned previously, this distinction between cognitive and socio-emotional skills is not so watertight. Indeed, cognition refers to the range of mechanisms (e.g., perception, attention, memory, language, decision-making, reasoning, etc.) which are responsible for processing information or, more precisely, for acquiring, developing, and transforming knowledge (e.g., Seron and Van der Linden, 2014). Long separated from emotions (which were considered as “noise” in information processing), cognition is now widely considered to be inseparable from affective processes (Billieux et al., 2010; Rebetz et al., 2015). For example, emotions can act as brakes or levers to memory (for example, all forty-year-olds remember the context in which they first learned about the events of 9/11), to maintain attention (as fear or interest draws our attention to something), or to make decisions (by relying on emotional information to make decisions appropriate to the situation). Conversely, good attention and memory skills are necessary in establishing and maintaining harmonious social relationships (e.g., concentrating during discussions, remembering certain events personally experienced with someone else, etc.).

In learning and teaching, cognitive and affective mechanisms come together in this way when, for example, dealing with boredom or having to select the most relevant information while leaving aside inappropriate thoughts or emotions; the ability to resist distractions or certain affects are essential to remaining focused or persevering with the task in hand (e.g., Houd , 2019). Research also indicates that better inhibition skills (e.g., the ability to suppress irrelevant information) are associated with greater perseverance and less urgency in responding to negative emotions (Gay et al., 2008, Gay et al., 2010).

With respect to positive-valued emotions, some research indicates that these can at the same time interfere with or promote attention and recall (e.g., Cuisinier, 2018). Interest and curiosity, as epistemic emotions, as well as joy as another

pleasurable emotion, promote creativity and information retention, and these emotions also play an important role in class dynamics (e.g., Gay and Capron Puozzo, 2016).

Is it therefore worthwhile establishing boundaries between these different competencies? This question is even more important since the most recent research (Brosch, 2021) demonstrates the undeniable links between affect, emotions, and the cognitive and motivational processes that lead to the adoption of practices favourable to an individual commitment to environmental or social causes: the ultimate objective of an ESD.

While retaining the strong links between these competencies, we believe that it is necessary to propose a differentiated approach to them so that teachers, in their daily practice, can more easily identify where the difficulties and facilities of their pupils lie, and thus intervene in a more targeted manner. This approach will also be adopted when we explore the assessment of skills and the tools available to students and teachers in a future article.

If we consult the work of psychologists (Bruner, 1991; Miller, 2003) at the origin of what has been described as the “cognitive revolution” in the late 1960’s (Delacour, 1998), cognition appears to be very strongly linked to the memorization of knowledge, to reasoning (problem solving and decision making) as well as to language, perception, and attention—all of which could be carried out by computer tools in this early period very much influenced by emerging cybernetics. Although these authors pointed out that emotions participate fully in this permanent regulation operated by the brain between perception and action, we can play on this opposition between knowledge and affectivity to create a distinction between these two types of skills.

In this way, it has been suggested that cognitive skills feed on “classic” academic knowledge and facilitate both its acquisition and its processing. In other words, without knowledge, cognitive skills cannot be exercised and acquired, and conversely, without good cognitive skills (attention and memory) knowledge, and learning cannot develop. Among our participants’ suggestions, the elements “critical thinking, adaptability, flexibility (including cognitive), openness to change, creativity and open-mindedness” can all be placed in this category.

Socio-emotional skills require a lower level of academic knowledge to appear, even if intellectual understanding of emotions facilitates their development, particularly with regard to the acquisition of new emotion regulation strategies. These strategies can be transmitted in the form of knowledge that will then favor their implementation in everyday life (e.g., Kotsou et al., 2011). The following suggestions made by our participants can also be placed in this category: “Collaboration, cooperation, good social skills, respect for oneself, for others, tolerance, benevolence”. Furthermore, “Using all one’s abilities, which requires self-awareness” and “self-confidence”, although more focused on the individual than on his or her relationship with others, fit here too. As we will specify in the following section, metacognitive skills enable us in part to bring together these two types of skills: cognitive and socio-emotional.

Metacognitive Competencies

If we keep in mind this interweaving of cognitive and socio-emotional skills, it is not surprising that metacognition, as a

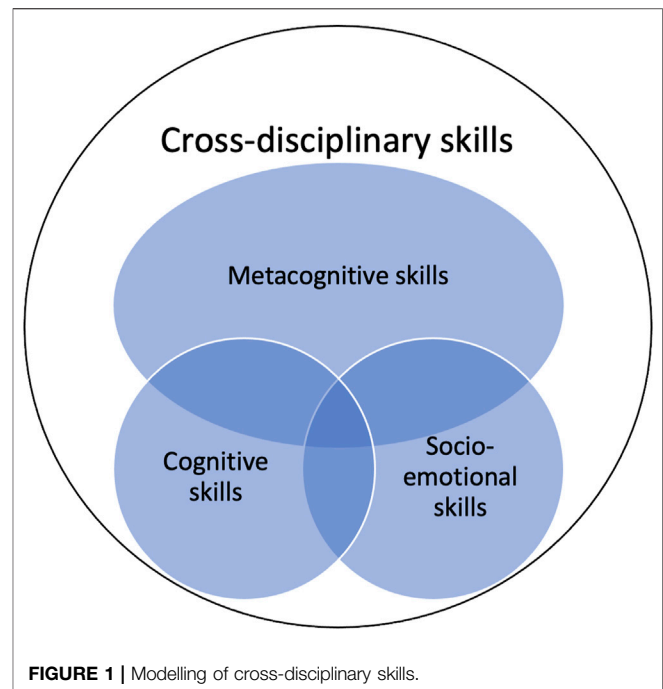


FIGURE 1 | Modelling of cross-disciplinary skills.

mental operation impacting upon these mechanisms of thought, relates to both cognition and emotions. More specifically, according to Efklides (2006, 2008, 2017), metacognition brings together different components, including knowledge about one’s own mental functioning and that of others, the ability to regulate and control one’s functioning, feelings (and also affects, judgements, and estimations) in the face of a task, as well as maintaining an awareness of these processes. In this context, we propose the following model (Figure 1) which shows the metacognitive competencies for identifying, understanding, planning, evaluating, and regulating one’s own thoughts, affects, and behavior. These metacognitive competencies make it possible to become aware of, and control, cognitive and socio-emotional skills (e.g., knowing how to memorize things, how to stay focused, and how to deal with one’s sadness/frustration and work effectively in a group).

From a more cognitive point of view, metacognition refers in particular to: 1) knowledge of one’s own mental functioning—this knowledge may be correct (e.g., I know I can concentrate better after a good night’s sleep) or incorrect (e.g., I think I learn my vocabulary better when I listen to music); and 2) using and adapting this knowledge to regulate one’s functioning (e.g., planning, controlling, and regulating one’s own behavior; see, e.g., Efklides, 2006).

These elements were perfectly reflected in the expectations of the participants in our study. Indeed, everything mentioned under “Ability to analyze one’s own processes, self-evaluation, awareness of one’s limits, of one’s abilities” is brought about by this knowledge of one’s own mental functioning. Self-awareness thus constitutes the most cross-disciplinary competence that concerns both cognitive (e.g., knowing one’s own thought mechanisms, or being aware of one’s mental functioning) and

socio-emotional dimensions (e.g., recognizing and understanding one's own and others' emotions, knowing how to manage them and use them for motivational purposes, and being aware of how one's own emotional expressions affect interactions with others). With more specific regard to the latter, different models emphasize that social-emotional competencies include self-awareness and social awareness (see, e.g., the first two competencies of the CASEL model, which is widely used in current scientific research: www.casel.org/social-and-emotional-learning/core-competencies).

Metacognitive, Cognitive, Social-Emotional Competencies: Are They Cross-Disciplinary Competencies?

In contrast to Dutrévis and Rastoldo (2020, diagram p. 11), who place cognitive competencies outside of cross-disciplinary competencies, we believe that some cognitive competencies are also cross-disciplinary because they are not directly linked to a disciplinary field, even though it is obvious, as we mentioned earlier, that knowledge is indispensable to their development. Indeed, critical thinking, reflexivity, curiosity, cognitive flexibility, the ability to adapt to situations and creativity, to mention only those “qualities” evoked by the students who will teach in our study, are not the prerogative of any disciplinary field. On the contrary, these skills are nurtured by inter-, or even trans-disciplinary approaches (Nicolescu, 1996; Darbellay et al., 2008; Pellaud, 2014), drawing from them both knowledge and modes of reasoning, regardless of whether or not they stem from their epistemology.

To summarize, emotional and cognitive competencies are closely related, and their convergence within metacognitive competencies contributes to better learning (see also MacCann et al., 2020, for a meta-analysis showing the importance of emotional skills to school success). Metacognitive skills are therefore the glue that needs to be developed in the classroom in order to foster both cognitive and emotional capacities.

Competencies That Are Rarely Coached in Education: Positive Self-Evaluation

The positive perception of one's own competencies and abilities to cope with situations, also known as having a sense of personal effectiveness (Bandura, 1977), or self-confidence, is an important driver of commitment to learning, of the effort invested, and thus of performance and success (e.g., Eccles et al., 1993; Zimmerman and Bandura, 1994). However, few pedagogical approaches or programs for the development of psychosocial skills have been able to consolidate or even to help to build this sense of competence, and more generally, self-confidence (e.g., Durlak et al., 2011). This statement certainly offers an explanation as to why only one class mentioned this quality in our study, and negatively evaluated the way the school contributes to its development.

The report of the international Pisa study (OECD, 2007), however, has already highlighted the importance of students' confidence in their competencies, and their ability to cope with situations, in the successful outcome of the actions they perform.

In a Canadian research study involving almost 7,000 students averaging 11 years of age, Tremblay et al. (2000) showed that higher levels of self-esteem were associated with better achievement in mathematics and reading. Their research also highlighted the reciprocal importance of self-esteem and 1) social relationships (for a recent meta-analysis, see e.g., Harris and Orth, 2020); and 2) depressive and anxiety symptomatology (for a meta-analysis, see e.g., Sowislo and Orth, 2013). Finally, it seems particularly interesting to concentrate on improving self-esteem during compulsory and post-compulsory schooling, as developmental data indicates that average self-esteem levels increase from 4 to 11 years of age, remain relatively stable from 11 to 15, rise sharply until a person is 30 years old, then continue to increase until they reach 60, and remain constant until 70, before declining (Orth et al., 2018). Positive self-perceptions promote mental health, learning, and the quality of relationships. As such, they should be considered as fundamentally important for the citizens of tomorrow, so that they are capable of engaging in actions in line with their values.

Which Definition for Which Competencies?

One crucial point remains to be defined: can these “qualities” proposed by the students of these different classes ultimately be considered as competencies? The term “competence” takes on different meanings depending on the authors using it and the context in which it emerges. Thus, as the HES-SO Teaching Glossary (HES-SO, 2017, p. 8) explains, “The notion of competence often overlaps with the notions of learning acquisition, knowledge, know-how (skills), educational objective, or learning outcome”, thus repeating, in other terms, the ambiguities already mentioned by Allal (2002) or (Perrenoud, 2004, p. 9), who stated that: “If knowledge is only worthwhile if one is capable of using it at the right time, in a good way, to solve problems, make decisions, guide action or accommodate new learning, we are very close to the problem of competencies”.

Moreover, while the evaluation of competencies seems to have become established in vocational training circles, it is still in its infancy as far as the evaluation of pupils in compulsory schooling is concerned. This may partly be explained by the fact that competencies seem to be integral within a complex experience, and in a professional context (Tardif, 2006). The idea of action in full-time schooling seems to us to be of little relevance in the sense that it is initiated by the teacher. In fact, even when pupils are (to some extent) autonomous, as may be the case when they carry out an independent or group project, the action has still requested, expected, and programmed in a way, and is part of the role assigned to the pupil since a mark, or at best an appreciation, will sanction it.

On reflection, therefore, we abandon the idea of action within the school, as it cannot be totally spontaneous, nor can it emanate solely from a personal choice. However, we place action as a fundamental objective, following the example of the EDD (to our knowledge, no author or body has previously mentioned this objective). Without any claim to exhaustiveness, see, for example, CIIP, 2010; Pellaud, 2011; Kyburz-Graber et al., 2013; Education21, 2016; Unesco, 2017), because, as Bourdieu (1984) reminds us, by influencing people's knowledge of the world, we

can influence society as a whole; this is a central element of complex thinking (Morin, 1977, Morin, 1990, Pellaud, 2000, Pellaud, 2011, Pellaud et al., 2012).

Following the examples of Perrenoud (1997), Allal (2002), Scallon (2004) and many others, we believe that it is necessary to move away from the paradigm of acquiring knowledge in order to be able to mobilize it in a given situation, which is equivalent to envisaging competencies of what these authors call “general culture”. Using these authors’ definitions as well as those of Gillet (1991), Roegiers (2000), Beckers (2002), Tardif (2006), and Lebrun (2013), we have developed the following definition of what a competence for compulsory schooling can be, which is as follows: a competence is demonstrated at the moment when an individual mobilizes an integrated, interdependent, interlocking and functional network of cognitive, emotional, social and sensorimotor resources in order to effectively perform a complex task for him/her, within a family of identified situations.

Our intention here is to develop tools enabling the evaluation of competence, and the form its expression takes is important to us, hence the idea of observing the moment when competence is expressed. Several terms need to be clarified in order to understand what is at stake in such a definition, which integrates complexity at different levels.

The Complexity of the Resources Mobilized

First of all, the term “mobilization” that we have chosen implies a mobility of thought. Indeed, the idea is that this approach goes beyond the simple reuse of operational knowledge in favor of creativity, allowing a perpetual readjustment in varied and constantly evolving fields. “The important thing is that the learner reinvests his knowledge by knowing how to adapt it. This requires one to be able to recognize the similar in the different, to detach oneself from reality, to take a step back and reach a form of abstraction. The latter allows a dematerialization of the object or knowledge which frees them from their particular context” (Pellaud, 2000, pp.125–126). Furthermore, “an integrated network” suggests that its constituent parts have been used and appropriated by the learner. The complementarity of the resources being mobilized is apparent in the interlocking term. Moreover, for resources to be used wisely, they must be functional and interdependent, and thus should be considered from a systemic perspective.

The Complexity of Situations

A family of situations has been identified: all the prior authors agree on this point in their respective definitions. In fact, it is a question of proposing several situations with the same goal. This point is important from a pragmatic point of view, to enable us to identify these families, but we remain aware that, in doing so, complexity will not necessarily be achieved, since it is linked to the diversity of contexts in which the competence can manifest itself. As we mentioned earlier, we remain attentive to the fact that a competence can find itself expressed to good effect outside the family of situations for which it has been developed. This creativity in mobilization appears all the more easily when the pupil finds his or herself in inter-, or even trans-disciplinary situations (Darbellay et al., 2017).

The Question of Performance

Mobilizing one’s competencies effectively is part of this definition because effectiveness and its degree are elements for which we can envisage an evaluation. By specifying that it is a complex task for the pupil, we move away from the situation-problem often identified as being part of a mathematical approach (even if it is similar to the complex task, according to Roegiers, 2000) without eliminating it, and the “for him/her” allows us to show that different levels of complexity exist, and that these must be adapted to the individual, in relation to what had previously been acquired. We take the position, even if it may seem contradictory, of considering that competencies can only be assessed in terms of the efficiency of the totality of a complex task (and therefore, that they cannot be assessed outside the real and practical context); but also that despite this, capabilities, the sum of which only represents a competence in a truncated way—“the whole is more than the sum of its parts” as (Morin 1977, p. 106) reminds us - can be identified and measured according to the normative progression expected in pupils between the ages of 8 and 15. Developmental standards for these different competencies have yet to be established on the basis of separate and rigorous methodologies (but for an example of research aimed at producing emotional competence standards to identify emotions of joy, sadness, anger, and fear [PER, PF 12], see, e.g., Lawrence et al., 2015).

Competencies or Capabilities?

In his semantic analysis, Jonnaert (2014) showed that synonymous relationships often appear between the terms “competencies” and “capabilities”. However, the author had previously demonstrated that “these two concepts, capability, and competence, are at different semantic levels. Competence encompasses capability, but the reverse is not true. Capabilities are constitutive of a competence, but the reverse is not true either” (Jonnaert, 2014, pp 674–675; cited in; Jonnaert, 2014). Further: “To confuse competence and capability by placing them in a synonymous relationship is to confuse an end, the development of a competence, and one of the means used to achieve it: the mobilization of the cognitive resources that are capabilities” (Jonnaert, 2014, p.6). We take the liberty of supplementing these quotations by adding that capabilities are not only cognitive, but also social and emotional, as are the competencies they enable us to achieve. Referring to this definition, we can therefore state that the “qualities” proposed by our participants can be considered as competencies for some of them, and for others as capabilities. “Curiosity” is the exception, as although it can be considered a facilitating element, it does not by itself enable someone to face up to a complex task.

Which Competencies Are Needed for the Challenges of the 21st Century? The Vision of International Bodies

Are these “qualities” that we can now call “competencies” shared by international bodies such as the World Economic Forum, 2018, the OECD, or Unesco, 2017, three international

TABLE 3 | Comparison of the competencies targeted by the WEF, the OECD, and UNESCO.

	Competencies and Capabilities	INTERNATIONAL BODIES			Student "qualities" desired by the teachers
		World Economic Forum	OECD - Key competencies for the PiSA assessment (2005)	Unesco Education 2030: learning objectives focused on the achievement of the SDOs	
COGNITIVE COMPETENCIES	COMPLEX THINKING - Systemic approaches - Uncertainty management	Analytical thinking, reasoning, ideation, problem-solving ability	Acting in the global context (competence 3-A). Elements of definition: ability to understand and take into account that their actions and decisions are part of a wider context (p. 16)	Acting in the global context (competence 3-A) (p. 16); Integrated problem-solving competence: the ability to solve complex problems and to develop viable, inclusive and equitable options by combining all the competences mentioned	
	- Management of paradoxes - Sense of synthesis	System analysis and assessment competence, ability to solve complex problems		Competence in systems analysis: the ability to recognize and understand relationships, to analyze complex systems, to understand how systems fit into different domains at different scales, and to take elements of uncertainty into account	
	REFLEXIVITY - Reflexive approach - Scientific/critical mind - Ethics	Critical thinking	Using technologies interactively (competency 1-C); Understanding the nature of technologies and reflecting on their potential (p. 3)	Critical Thinking Skills: the ability to question norms, practices, and opinions, to reflect on one's values, perceptions and actions, and to take a stand in sustainability discourse	Reflexivity Critical thinking
	PROSPECTIVE - Creative thinking - Anticipation, projection - Changes - Flexibility, adaptability	Creativity, originality, capacity for innovation		Anticipation skills: the ability to forge visions of the future, to assess the consequences of a given action, to take risks and changes into account	Adaptation, flexibility (including cognitive); Openness to change; Créativity, open-mindedness
	COMPETENCIES and Capabilities	World Economic Forum	OECD - Key competencies for the PiSA assessment (2005)	Unesco Education 2030: learning objectives focused on the achievement of the SDOs	Pupil "qualities" desired by the teachers
METACOGNITIVE	MOTIVATIONAL and METACOGNITIVE SKILLS - Learning strategies - Autonomy - Responsibility - Taking initiatives	Active learning strategies	Developing and implementing personal life projects and programmes (competence 3-B), p. 17	Strategic competence: the ability to collectively design and implement innovative actions that increase sustainability at the local level and beyond	Ability to analyze one's own processes;
		Taking initiative, leadership, social influence			Self-evaluation; Awareness of one's limits and abilities Autonomy at work; Autonomy of being/of doing; Personal commitment; Responsibility; Motivation; Perseverance; Curiosity, desire to learn

(Continued on following page)

TABLE 3 | (Continued) Comparison of the competencies targeted by the WEF, the OECD, and UNESCO.

Competencies and Capabilities	INTERNATIONAL BODIES			Student "qualities" desired by the teachers	
	World Economic Forum	OECD - Key competencies for the PiSA assessment (2005)	Unesco Education 2030: learning objectives focused on the achievement of the SDOs		
SOCIO-EMOTIONAL	<p>INTERPERSONAL SKILLS</p> <ul style="list-style-type: none"> - Communication, - Collaboration, cooperation - Participation - Respect - Empathy 	<p>Emotional intelligence (the courses offered by the WEF aim at fostering empathy, self-awareness, self-discipline, managing one's own emotions, welcoming the emotions of one's collaborators, collaboration, etc.)</p>	<p>Cooperation (competence 2-B). Elements of definition: presenting ideas, listening, understanding the dynamics of a debate, building alliances, negotiating, taking decisions (p. 15)</p> <p>Establishing good relations with others (competence 2-A). Elements of definition: Emotional intelligence, empathy (p. 14)</p> <p>Using language, symbols and texts interactively (competence 1-A). "Interactive" refers to the ability to take part in an active dialogue between the individual and his/her environment (p. 12)</p> <p>Defend and assert one's rights, interests, limits, and needs (competence 3-C). Elements of definition: refers to the rights and needs of the individual as a person and as a member of the community (p. 17)</p> <p>Managing and resolving conflicts (competency 2-C). Defining elements: taking each other's needs and interests into account and finding solutions that benefit all parties (p. 15)</p>	<p>Collaborative competence: the ability to learn from others, understand, respect needs and points of view (empathy), resolve conflicts and solve problems on the basis of collaboration and participation;</p> <p>Normative competence: the ability to understand and analyze the norms and values upon which one's own actions are based, and to negotiate sustainability values, principles, objectives and targets in the context of conflicts of interest and compromise, of uncertain knowledge and contradictions;</p> <p>Self-knowledge skills: the ability to reflect on one's own role in the local/global community, to evaluate one's own actions and motivations and to control one's feelings and desires</p>	<p>Collaboration, cooperation, good social skills; Respect for oneself, for others; tolerance, benevolence</p>
	<p>SELF-KNOWLEDGE</p> <ul style="list-style-type: none"> - Self-esteem - Self-confidence - Self-efficacy - Values 			<p>Use all of one's abilities (which requires) self-knowledge and self-confidence</p>	

bodies which influence educational policy, notably in Switzerland?

This article does not pretend to offer a detailed analysis of this set of visions. Our intention is, instead, limited to exploring whether it is possible to observe convergences between these different bodies, what teachers want, the aims of compulsory

schooling, and those of ESD. We do so in order to better target what could be proposed to students to respond to the challenges of the 21st century. We therefore looked at the second edition of the World Economic Forum's (WEF) Future of Jobs report (2018), which considers the competencies (soft skills) required for 2022, the "key competencies" as defined by the OECD in the framework

of the PISA assessment (2005), and the UNESCO Education 2030 program (2017), and more specifically, the learning objectives which have been set with the aim of achieving the objectives for sustainable development (ODD). We organized these different elements according to the dichotomy “cognitive competences/metacognitive competences/socio-emotional competences” in order to compare them with the wishes of the teachers who took part in our study.

From the outset, despite some differences in the formulations, several points of convergence were evident, which we highlighted through the identification of competencies, defined through abilities that can be considered as elements that must be exercised, and potentially evaluated, in order to achieve mastery of the competence.

Table 3 enables the identification of six competencies, divided between the three types identified previously. Several observations can be made in light of this table. The first is that the most complete competencies for the three bodies are relational, whereas for our teachers, these are essentially limited to collaboration and respect for others. The international bodies also propose elements related to the ability to engage in dialogue, negotiate, or resolve conflicts; these aspects were not explicitly developed by our participants.

The second is that there is a significant difference in relation to cognitive skills. Highly developed at the level of UNESCO and the WEF, they are limited from the OECD's perspective to an understanding of the impact of individual actions at the global level as far as complex thinking is concerned. It should be noted in this respect that our participants did not mention anything in connection with this aspect of cognitive skills.

The capacity for reflection, when it appears, is limited to “critical thinking”. Only UNESCO has developed this point, specifying that it refers to the capacity to question a certain number of elements (norms, practices, opinions, etc.). The OECD makes no mention of elements that can be linked to this competence.

Finally, creativity appears to be strongly linked to forward thinking both for the WEF and UNESCO, and was more focused on adaptation to change and a form of open-mindedness among our participants. Finally, for the OECD, creativity is limited to a reflection on the potential of technologies. This is reminiscent of “familiarity with IT” and the “ability to live with them” mentioned by our participants (see **Table 1**).

The third and final element revealed by this comparative table is that, despite the epistemological differences linked to the very varied contexts in which these competence frameworks have appeared, they all share certain fundamental elements. This is the case for:

- Complex thinking (which did not appear in the teachers' statements);
- Forward thinking, even if it appears only in a limited way in the OECD;
- Motivational skills, based essentially on the realization of projects, concrete implementation or taking initiatives. The metacognitive aspects only appear in the WEF's proposals, although they are very much in demand where teachers are concerned;

- Relational skills, which are highly developed in all three instances;
- Self-awareness, which is directed more towards managing one's emotions for the WEF, towards identifying values for UNESCO, and towards developing self-confidence for the OECD, with a view to defending one's rights and interests. On the teachers' side, this self-knowledge also contributes to a certain self-confidence—although this element was only mentioned by one class (see **Table 1**)—in order to be able to use all of one's own capacities.

Lastly, only the capacity for reflection, as has already been mentioned, is totally absent from the OECD's targets.

Limitations and Future Perspectives

The present study, which was qualitative and involved a limited number of focus groups, presented some general trends that deserve to be studied in greater depth. For example, it is not possible to know whether the concepts put forward by the teachers, such as tolerance, respect for others, or benevolence (see **Tables 2, 3**) in their view include the communicational aspects mentioned in the statements of the international bodies against which we have placed them into context. To do this, each item would have to have been taken up by the focus groups and developed in a more exhaustive manner.

Despite these shortcomings, it is nevertheless clear that, far from focusing on the knowledge which is taught and classically evaluated in class, the teachers took into consideration the complexity of the situations that their pupils will have to face once they leave compulsory schooling, by proposing ambitious objectives, formulated in terms of highly interdisciplinary competencies which correspond to a significant degree to the ambitions of an ESD. That said, this was not entirely the case, because this initial overview allowed us to see that certain elements were missing, particularly in terms of complex thinking, an essential aspect of an ESD (Pellaud, 2000; CIIP, 2010; Pellaud, 2011, Pellaud, 2013; Kyburz-Graber, Nagel, Gingins, 2013; Education21, 2016). A critical look at the objectives proposed by the school curricula, and additionally by the textbooks intended for students, should provide some answers as to the reasons for these shortcomings. Indeed, we are entitled to ask whether the latter chose to omit these elements in their objectives and in the exercises proposed to the students, or whether this absence of reference to complex thinking can be attributed to a misunderstanding of the objectives by the teachers themselves. We intend to continue our work in this direction.

Based upon this initial comparison with the global frameworks within which school programmes are developed, our work will continue with a comparison between these initial results and the Swiss school programmes, as well as with the national bodies involved, such as the Education21 Foundation, and the National Centre of Competence and Services for Education for sustainable development [ESD] for the whole of Switzerland. This broad perspective will provide more concrete answers about teachers' understanding of these objectives, and possible misunderstandings or misinterpretations.

CONCLUSION

Through a survey of future teachers concerning their representations of the competencies needed by tomorrow's citizens and the competencies currently being developed in schools, this article has laid the conceptual foundations for research on the most useful cross-disciplinary competencies for schools to develop for 21st century needs. It has also made it possible to see that the objectives aimed at by international bodies influencing educational policies are in line with, or at least not very far from, these expectations, although some differences can also be highlighted, particularly in cognitive skills, which are ultimately, and contrary to all expectations, not particularly well developed among teachers. In fact, since the basic subjects on which the evaluation and selection of pupils in Switzerland are based (mother tongue and mathematics, and to a lesser extent science) are essentially geared towards learning and memorizing knowledge, it is surprising that aspects such as problem-solving do not appear in the teachers' proposals, given the aims proposed by the CIIP for compulsory schooling, or those proposed by "Education 21" for ESD.

The continuation of this work will focus in the first instance on a comparison between the results highlighted in this research and the objectives of the Swiss school curricula, as well as those proposed by Education 21 which are more directly related to an ESD. Secondly, the results obtained here will allow future research to examine the role of the teacher and the student in the evaluation process so that the different types of competencies identified in this article as being part of the baggage of 21st

century students can be acquired by them. It will also focus on how the abilities identified as constitutive and assessable elements of these competencies should be presented to students in order to achieve the desired interdisciplinarity, characterized by its independence from specific disciplinary fields and by its ability to be mobilized outside of learning contexts.

ETHICS STATEMENT

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 orally informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FP wrote the first draft of the manuscript. PG and RS wrote sections of the manuscript. GB, LD, NG, and PM contributed to general conceptualisation of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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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.

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