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Comparative advantages of school and workplace environment in skill acquisition

Empirical evidence from a survey among professional tertiary education and training students in Switzerland

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Abstract

Purpose – The purpose of this paper is to shed light on the questions as to how important skills are; which skills can best be learned at school, and which skills can be acquired better in the workplace.
Design/methodology/approach – The authors exploit data from a survey among professional tertiary education and training business administration students and their employers in Switzerland.
Findings – The authors find that skills used in the business processes strategic management, human resource management, organizational design, and project management are most suitable to be taught in school. However, the results further suggest that soft skills can be acquired more effectively in the workplace than at school. The only exceptions are analytical thinking, joy of learning and organizational soft skills, for which school and workplace are similarly suitable.
Practical implications – The paper provides empirical evidence regarding the optimal choice of the learning place for both human resource managers as well as educational decision makers who aim to combine education and training, e.g. in an apprenticeship.
Originality/value – Little evidence regarding the optimal learning place exists.

Keywords Competences, Relevance, Soft skills, Skills, Workplace learning, School, Learning place
Paper type Research paper

1. Introduction

Soft skills become increasingly relevant in the workplace. Figure 1 illustrates this general development for Switzerland by displaying the share of all published job advertisements that mention soft skills as job requirements between 1950 and 2011 (Salvisberg, 2010)[1]. Figure 1 shows that beginning in the 1980s, an increasing share of all job advertisements contain soft skill requirements. In 2011, nearly 60 percent of job advertisements mention some type of soft skills, highlighting the relevance of soft skills in the workplace. Figure 1 further shows that the overall demand for work experience increases since the 1970s, suggesting that learning in the workplace represents an increasingly important source of skills[2].

As a result of the increasing relevance of soft skills, the education system is often blamed to put too little emphasis on soft skill development (see e.g. Boyce *et al.*, 2001; Kavanagh and Drennan, 2008; Hancock *et al.*, 2009; Jackson, 2014). However, Aarkrog (2005) points out that school and workplace differ in terms of their ability to convey particular skills and hence have a comparative advantage in teaching particular skills. Since little evidence regarding these comparative advantages exists, this paper aims to provide empirical evidence regarding the questions raised in Aarkrog (2005), who

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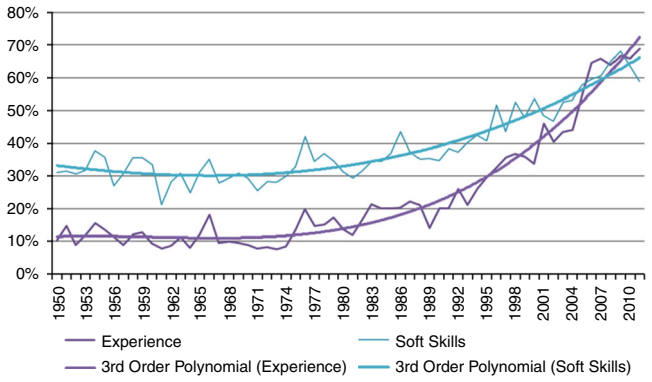


Source: Own graph based on the data given to the authors by the responsible bodies of the "job-market-monitoring", University of Zurich

Figure 1.
Development of the share of job advertisements mentioning soft skills

analyzes how to teach customer service skills and impart knowledge of goods in the shop to sales assistants:

> In order to strengthen the dual training system, continuing education and, in a broader sense, lifelong education. It is necessary to clarify the relationship between the qualifications needed to solve tasks in workplaces within specific trades and the opportunities for learning in the school and in the workplace, respectively. What qualifications are best obtained in school and in the workplace, respectively?

This citation illustrates that education system managers and human resource managers, who aim to improve the skills of their employees face three key questions for which this paper provides empirical evidence. Hence, the empirical part of this paper consists of three parts. The first and the second part assess the relative relevance of skills and where they can best be learned (Section 5.1). The third part of the empirics analyzes the relationship between the use of pedagogic instruments and the assessment of schools as a suitable learning place compared to the workplace.

First, in order to guide the decision on which skills to improve, it is necessary to know which skills are the most important. Hence, we analyze the relative importance of a broad variety of skills. Second, the education system and human resource managers need to choose the learning environment, which can be broadly separated into school-based education and work-based training. Because skills differ in the extent to which conceptualizing, experimenting, experiencing and reflecting matter in the learning process (Raelin, 1997), school- and work-based learning places differ in their skill-specific comparative advantage. Choosing the optimal learning place for each skill is particularly relevant due to restrictions of time and resources (see e.g. Woronoff, 2009; Howieson *et al.*, 2014).

Third, based on the decided skills and the corresponding learning places, education system managers and human resource managers need to choose the way in which the two learning places are linked. This can take the form of combining school and work-based education in an appropriate way (see e.g. Stern *et al.*, 1997; Leong and Kavanagh, 2013). Alternatively, the link between the learning places might be fostered by engaging employers in the education process (see e.g. Barnett *et al.*, 1987; Howieson *et al.*, 2014) or by employing pedagogic tools aiming to transmute theoretical knowledge into practical skills (see e.g. Boyce *et al.*, 2001; Shaw *et al.*, 2007; Schulz, 2008).

Analyzing the data based on a survey conducted in 2014 among business administration students of Swiss Colleges of Professional Education and Training during their last year of studies and their corresponding supervisors, this paper extends the extensive evidence

regarding the heterogeneous relevance of skills on the labor market. As a first step, we follow the existing literature and evaluate the relevance of 22 types of soft skills; Figure 1 exhibits the labor market relevance of the evaluated soft skills suggested by Salvisberg (2010). Broadly supporting the literature, the results suggest that reliability, trustworthiness, commitment, motivation and efficiency represent the most important soft skills. In contrast to the existing literature (see e.g. Gabric and McFadden, 2001; Naidoo *et al.*, 2011), we find that the assessments of students and employers resemble each other strongly. This might be due to the fact that the students, on average, have more than eight years of working experience.

While broad empirical evidence regarding the relative relevance of soft skills exists, few studies analyze the relevance of process-specific skills. Asking students and employers to evaluate the skills used in particular business processes suggests that the responses capture the skills relevant in the business process. These process-specific skills stem from a combination of hard and soft skills. Our results suggest that communication represents the most important process, followed by order processing, production and customer processes. Furthermore, we find that, on average, process-specific skills are less relevant than the average of soft skills. This suggests that the soft skill component of process-specific skills is more relevant than the hard skill component (see chapter 2.2 for a description of these concepts). Hence, these results support the literature suggesting that soft skills are more relevant than hard skills (see e.g. Maes *et al.*, 1997; Bailey, 2014).

The paper further addresses the second question, i.e. what is the optimal learning place for different skills. The results suggest that the workplace has a comparative advantage in terms of most soft skills. These findings question whether improving soft skills should be a primary aim of school-based education as the opportunity costs of doing so might be too high.

On the other hand, the findings suggest that the school has a comparative advantage over the workplace in terms of learning skills used in the business processes project management, organizational design, human resource processes, strategic management, innovation and to a lesser extent, communication. Hence, these business processes entail skills that can be learned effectively at school. The business processes leadership, customer, production, and order processing, on the other hand, display a strong comparative advantage of the workplace.

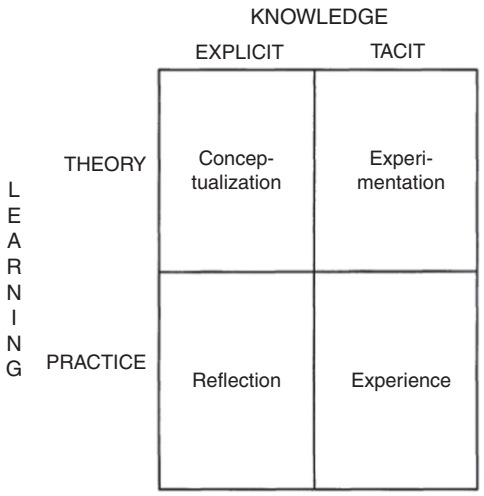
The third part of the paper analyzes to what extent these comparative advantage assessments depend on educational experience. A simple multivariate regression analysis shows that the comparative advantage of the school is positively related to a number of instruction methods (e.g. use of e-learning tools, and transfer tools, real case study presentation). However, the magnitude of the relationship is relatively small. Therefore, the comparative advantage of school and workplace depends largely on the specific skill. Hence, the optimal choice of the learning place represents the most important decision while the optimal choice of the pedagogic instruments is secondary. Thereby, the paper further adds to the literature analyzing how soft skills can be enhanced in the classroom (see e.g. Nealy, 2005; John, 2009; De Villiers, 2010; Shah, 2013; Daff, 2013; Gil *et al.*, 2013; Thomas *et al.*, 2014). However, the simple correlation analysis presented in this paper merely represents a first step in evaluating a causal relationship between pedagogy and learning outcome.

Section 2 of the paper summarizes the existing literature and develops empirical hypothesis. Section 3 describes the data and the empirical methodology. Section 4 presents the results and Section 5 concludes the paper.

2. Literature

2.1 Theoretical framework of school- and work-based learning

Figure 2 displays the four learning types in the theoretical model of work-based learning suggested by Raelin (1997). This widely cited theoretical model represents an example of models highlighting why the comparative advantage of school- and work-based learning varies across skills (see e.g. Brown, 1993, for an alternative way to model the learning process).



Source: Raelin (1997)

Figure 2.
Learning process type

The model of work-based learning proposed by Raelin (1997) distinguishes two dimensions. The first dimension distinguishes explicit knowledge from tacit knowledge. Tacit knowledge refers to knowledge that is not readily available for introspection, while explicit knowledge can be codified (Sternberg, 1999). Each skill differs in how much explicit and tacit knowledge they require[3]. The second dimension of the model differentiates two modes of learning, namely, theoretical and practical learning. Combining these two dimensions suggests four learning types in an ideal learning process that transfers explicit knowledge into the practical context and reflects the tacit knowledge from practice in the light of explicit knowledge. Hence, these four learning types represent a circular and interrelated learning process. Depending on the skill, these four learning types vary in terms of relevance for skill acquisition. Hence, in the context of this paper, it is particularly important to note that schools are more apt to convey explicit knowledge since the acquisition of tacit knowledge requires the application of explicit knowledge in the practical context (Sternberg, 1999), which is more difficult to do in school.

Building on these insights, this paragraph describes the four learning types and discusses the comparative advantage of school and learning places in each of the types. Though the four learning types are circular and interrelated, our exposition of the learning types follows Raelin (1997) and discusses them sequentially. The first step in the learning process is the conceptualization type in which explicit theoretical knowledge is acquired. This is the type in which schools have the largest comparative advantage over the workplace as a learning location. This conceptual knowledge becomes contextualized or grounded through experimentation. Thereby, the second learning process type transforms explicit knowledge into tacit knowledge. The third learning process type, the experience type, applies this tacit knowledge to idiosyncratic situations. Work-based learning has a comparative advantage over school-based learning in the experimentation and even more so regarding the experience type. This is typically the case if learners are exposed to unfamiliar and unexpected situations. However, in the fourth type, experience needs to be explicitly reflected in the reflection type, for which the school has some comparative advantage although a reflexive practice exists in workplace learning too.

This theoretical model clarifies that skills differ regarding the relevance of the conceptualization, experimentation, reflection and experience types. Therefore, the optimal

choice of the mix between school- and work-based learning depends on the particular skill. For example, successful leaders gained their overall skills during extensive experimentation and experience and not necessarily through a lot of conceptualization. Conversely, keeping the books might require substantial amounts of conceptualization, while experimentation is less relevant. Hence, the school might have a larger comparative advantage regarding accounting processes than for leadership processes.

2.2 Empirical evidence regarding the relevance of skills

Skills can be classified in many ways (see e.g. Rychen and Salganik, 2003; Le Deist and Winterton, 2005; Mulder *et al.*, 2007; Salvisberg, 2010). This paper uses two complementing approaches. Concretely, the first approach analyzes various soft skills and the second classification, discussed further below, analyzes the skills used in various business processes. Hence, skills used in a particular business process entail both hard and soft skills. For example, the production process requires both hard skills such as the ability to operate the production machines as well as soft skills such as the ability to work in a team. Hence, these two classification approaches are not exclusive but have an overlap.

The first classification follows the conventional approach of separating skills into two broad categories, namely, hard and soft skills. While the difference between hard and soft skills can be specified in various ways, we follow Robles (2012) and describe hard skills as skills that are coming from one's knowledge, and in a broader sense one's practice and aptitude. Conversely, soft skills entail skills that do not depend only on acquired knowledge. Soft skills include interpersonal skills such as communication skills and also depend on personal attributes such as personality and likeability (see e.g. James and James, 2004; Perreault, 2004; Robles, 2012).

A number of papers indicate that soft skills may be even more relevant than hard skills in the workplace (see e.g. Maes *et al.*, 1997; Gabric and McFadden, 2001; Silva and McFadden, 2005; Kesner, 2008; Wats and Wats, 2009; Klaus, 2010; Mitchell *et al.*, 2010; Bailey, 2014). However, Jackson and Chapman (2012) and Ilias *et al.* (2012) find that hard skills are more important than soft skills. Since more papers of our literature review suggest that soft skills are more relevant than hard skills and this is supported by the very high relevance of soft skills in Figure 1, we hypothesize that:

H1. Soft skills are more relevant than hard skills.

While the literature suggests that both students and employers consider soft skills more relevant than hard skills, Gabric and McFadden (2001), Klibi and Oussii (2013) and Naidoo *et al.* (2011) find that the difference is larger for employers than for students. These findings suggest that students underestimate the relevance of soft skills. Hence, we hypothesize that:

H2. Employers consider soft skills, relative to hard skills, more relevant than students.

The literature providing evidence regarding the relative relevance of various soft skills is vast. However, identifying a consensus regarding the order of relevance among soft skills in order to postulate a hypothesis is difficult. The reason is that no unified framework regarding the terminology and definition of soft skills exists. Furthermore, there is no consensus on which soft skills need to be included. In order to summarize the existing literature providing empirical evidence regarding a broad set of soft skills, Table I displays papers which deem a particular soft skill to be among the most relevant soft skills[4]. This allows to create a very crude ranking of soft skills in accordance with the number of papers which identify the soft skill as one of the most relevant soft skills. Hence, we hypothesize that:

H3. The most important soft skills are (a) communication, (b) teamwork/interpersonal skills, (c) decision making/problem solving (not tested), (d) ethics/integrity/responsibility, (e) time management/organization, (f) self-motivation, and (g) willingness to learn.

Soft skill	Literature	Sample: study field and respondents
Communication	Maes *et al.* (1997)	All fields employers
	Gabric and McFadden (2001)	Business students/Employers
	Naidoo *et al.* (2011)	Business students
	Freudenberg *et al.* (2011)	Business students
	Robles (2012)	All fields employers
	Silva and McFadden (2005)	Business graduates
	Kavanagh and Drennan (2008)	Business students
	Hancock *et al.* (2009)	Business students
	Tempone *et al.* (2012)	Business students
	Jackson and Chapman (2012)	Business students
	Ilias *et al.* (2012)	Business students
	Klibi and Oussii (2013)	Business students/Employers
	Bailey (2014)	All fields employers
Teamwork/Interpersonal soft skills	Gabric and McFadden (2001)	Business students/Employers
	Hancock *et al.* (2009)	Business students
	Freudenberg *et al.* (2011)	Business students
	Naidoo *et al.* (2011)	Business students
	Robles (2012)	All fields employers
	Jackson and Chapman (2012)	Business students
	Ilias *et al.* (2012)	Business students
	Klibi and Oussii (2013)	Business students/Employers
	Bailey (2014)	All fields employers
Decision making/Problem solving	Maes *et al.* (1997)	All fields employers
	Gabric and McFadden (2001)	Business students/Employers
	Silva and McFadden (2005)	Business graduates
	Kavanagh and Drennan (2008)	Business students
	Hancock *et al.* (2009)	Business students
	Tempone *et al.* (2012)	Business students
	Jackson and Chapman (2012)	Business students
	Bailey (2014)	All fields employers
Ethics/Integrity/Responsibility	Gabric and McFadden (2001)	Business students/Employers
	Kesner (2008)	Business students
	Naidoo *et al.* (2011)	Business students
	Robles, 2012)	All fields employers
	Ezzo (2013)	All fields graduates
	Klibi and Oussii (2013)	Business students/Employers
Time management/Organization	Silva and McFadden (2005)	Business graduates
	Jackson and Chapman (2012)	Business students
	Ezzo (2013)	All fields graduates
Self-motivation	Maes *et al.* (1997)	All fields employers
	Gabric and McFadden (2001)	Business students/Employers
	Hancock *et al.* (2009)	Business students
Willingness to learn	Kesner (2008)	Business students
	Kavanagh and Drennan (2008)	Business students
	Tempone *et al.* (2012)	Business students

Table I.
Identification of specific soft skills as the most important soft skills

The relative relevance of skills might differ across occupations and hence across fields of study. In order to assess to what extent the literature review captures the relative relevance of skills in the field of business analyzed in this paper, the third column of Table I further shows who was surveyed in the respective papers. Most of the literature surveys business students or business graduates. Similar to this paper, two of the studies complement the student survey with a survey of respective employers (Gabric and McFadden, 2001; Klibi and Oussii, 2013). However, Maes *et al.* (1997), Bailey (2014) and Robles (2012) survey employers irrespective of the study field and Ezzo (2013) surveys graduates from all study fields.

Nevertheless, this suggests that the derived hypotheses are valid for the analysis at hand, but might not be as accurate for study fields that differ substantially from business.

The literature assessing hard skills can be broadly separated into two groups. On the one hand, there are papers which assess the relevance of hard skills as a whole (see e.g. Naidoo *et al.*, 2011). On the other hand, a detailed set of specific skills are assessed (see e.g. Gabric and McFadden, 2001; Klibi and Oussii, 2013).

Following the conceptual framework of the framework curriculum of the business administration degree at Colleges of Professional Education and Training (HFW, 2008), we approach the measurement of hard skills by assessing process-specific skills. Thereby, we take an intermediate approach between assessing hard skills as a whole and assessing a detailed set of specific hard skills. This approach has the benefit that it can be applied to different occupations, allowing some comparison with the existing literature and if used in other studies enables a comparison of process-specific skills across occupations.

Process-specific skills include all prerequisites for successful action (Weinert, 1999). Hence, the evaluated skills entail both hard and soft skills relevant for a successful business process. For example, the innovation process requires hard skills such as knowledge regarding the product or production process, but also requires soft skills, such as creativity and joy of learning. Since process-specific skills contain both hard and soft skills, the process-specific skill classification approach further allows to identify the relative value of hard and soft skills.

Concretely, based on Rüegg-Stürm (2002), we distinguish 12 processes, which are associated to four process categories, namely, management processes, business processes, supporting processes, and overlapping processes. Management processes entail three processes, namely, normative management, strategic management and leadership processes. Business processes consist of customer processes, production, order processing and innovation. Supporting processes entail human resources, infrastructure, and communication. Finally, organizational design and project management make up the overlapping processes.

To our knowledge, no direct evidence regarding process-specific skill relevance exists. However, Gabric and Mcfadden (2001) provide some guidance by reporting evidence regarding the relevance of a broad set of hard and soft skills. Concretely, as mentioned above, they find that communication represents important soft skills, suggesting that communication process skills are among the most important skills. Furthermore, leadership skills, which are related to leadership processes, also have a high relevance, while project management has a moderate relevance. The moderate relevance is supported by a similar analysis of Farkas (2008). Surveying business students, Farkas (2008) further finds that entrepreneurship, which is related to innovation processes, is considered moderately relevant in the USA but highly relevant in Hungary.

On the basis of these patches of evidence, we hypothesize that:

H4. Process-specific skill relevance[5]: (a) communication process skills are highly relevant, (b) leadership process skills are highly relevant, (c) project management process skills are moderately relevant, and (d) innovation process skills are moderately relevant.

2.3 Empirical evidence regarding the comparative advantage of school- and work-based learning

While the literature provides broad evidence regarding the relevance of different skills, relatively little empirical evidence regarding the differences of the comparative advantage of schools across skills exists (see e.g. Brunello and Schlotter, 2011). The following paragraphs summarize the scant existing evidence, highlighting the skills that are related to skills analyzed in this paper to allow the distillation of empirical hypotheses[6].

Green *et al.* (2001) assess to what extent education, organizational characteristics, and other work-based indicators explain the variance in problem-solving, teamworking (related to teamwork capacity), professional communication (related to communication), social and computing skills. The results suggest that organizational characteristics represent the most important predictor of all skills. However, the relative explanatory power varies substantially across skills. For computing skills, education and organizational characteristics have a similar magnitude of effect. For skills related to professional communication and social skills, the effect of education is about half the size and for problem-solving and teamworking skills, the relative explanatory power is a third and a tenth, respectively. This crude analysis suggests that the comparative advantage of schools is higher for computing than for professional communication and social skills, followed by problem-solving and teamworking skills.

Lee (2008) compares the assessment of hospitality students regarding the learning outcomes in the classroom environment and in a work placement. Among the analyzed 29 skills, he finds nine skills where the workplace has a comparative advantage over school, namely, practical knowledge, organization functioning, realistic career expectations, networking, being initiative (related to proactive), ability to adapt to change (related to adaptability), leadership skills, self-confidence (related to assertiveness) and financial management skills. On the other hand, five skills display a comparative advantage of school-based learning, namely, oral presentation (related to communication), writing skills (related to communication), ability to design and conduct experiments, and awareness of civic responsibilities. Surprisingly, the results further suggest that schools have a comparative advantage regarding the ability to work with others (related to teamwork capacity), though school and workplace are also suggested to be similarly suitable to acquire the ability to contribute to a team effort. For the remaining skills, Lee (2008) finds no statistically significant comparative advantage. Particularly relevant in the present context are the ability to take initiative (related to proactive), the ability to creatively identify, formulate and solve problems (related to creativity), time management skills (related to organizational skills), and motivation to learn in the classroom (related to joy of learning).

Hancock *et al.* (2009) survey Australian accounting educators about the capacity of universities to develop different skills. The results suggest that capacity is largest for problem solving and communication (related to communication), followed by planning and organizing (related to organizational skills) and technology. The least capacity exists for teamwork (related to teamwork capacity), lifelong learning, initiative (related to proactive), enterprise (related to entrepreneurship and innovation process), and the ability to deal with diversity.

Woronoff (2009) discusses the comparative advantage of law schools, suggesting that universities have a comparative advantage regarding hard skills. Besides supporting this argument, Howieson *et al.* (2014) stress the relevance of universities to teach how to learn (related to joy of learning):

H5. School disadvantage: (a) schools have a comparative disadvantage regarding adaptability (Lee, 2008), (b) schools have a comparative disadvantage regarding assertiveness (Lee, 2008), (c) schools have a comparative disadvantage regarding teamwork (Green *et al.*, 2001; Hancock *et al.*, 2009), (d) schools have a comparative disadvantage regarding proactiveness (Lee, 2008; Hancock *et al.*, 2009), and (e) schools have a comparative disadvantage regarding entrepreneurship (Hancock *et al.*, 2009).

H6. Absence of comparative advantage: (a) school and workplace are similarly suitable to develop creativity (Lee, 2008) and (b) school and workplace are similar suitable to develop joy of learning (Lee, 2008; Howieson *et al.*, 2014).

H7. School Advantage: (a) schools have a comparative advantage regarding communication (Green *et al.*, 2001; Lee, 2008; Hancock *et al.*, 2009), (b) schools have a comparative advantage regarding organizational skills (Lee, 2008; Hancock *et al.*, 2009), and (c) schools have a comparative advantage regarding hard skills (Green *et al.*, 2001; Woronoff, 2009; Howieson *et al.*, 2014).

3. Data and methodology

The data stem from a survey of the KOF Swiss Economic Institute among students in their last year of business administration studies at Swiss Colleges of Professional Education in autumn and winter 2014. During this time, 769 students in the last year of their studies were enrolled at the 14 participating colleges. This roughly represents about 80 percent of the full population of students (SFO, 2014). Among these, 487 students or about 63 percent filled in the extensive questionnaire. This high response rate, particularly given that not all schools surveyed all classes, was achieved by surveying students in the classroom setting. This approach further resulted in a very low item nonresponse rate. About 40 percent of students completed the questionnaire in pen and pencil form, while about 60 percent of students answered the questionnaire online.

In order to examine the quality of student assessment, the participating students were asked to hand a prepared letter to their supervisor that contained a link to the online survey for employers. However, unlike in the student sample, the nonresponse rate of the employers was very high. In total, 62 employers filled the survey partially, suggesting a response rate of about 13 percent. Furthermore, item nonresponse was also higher. Hence, the results presented in the paper are based on about 50 employer responses, of which about 75 percent stem from direct supervisors and 25 percent stem from the CEO or the responsible human resource manager.

The low-response rate of employers raises the question of a potential nonresponse bias of employers. In this case, the responding employers would not be representative of the population of students. In order to test whether this is the case, analyzing the difference between the full population of students and the subsample of students for which we have corresponding employers in a number of dimensions suggests that the characteristics of the overall student population is similar to the characteristics of the subsample of students for which we have received feedback from employers. Hence, our nonresponse bias of the employers seems to be less a concern and therefore it is possible to compare the results from students to the responses of employers directly. Nevertheless, the low number of observations for employers needs to be kept in mind regarding the interpretation of the results of the employers.

The questionnaire entailed a number of questions regarding the student, the employer, and the studies characteristics. Most important for this paper, the main part of the questionnaire surveyed the assessment of relevance, own level and suitability of the school as a learning place for a broad set of skills. This allows us to analyze how relevant the skills are and whether the school has a comparative advantage over the workplace.

The approach to measure skills by self-evaluation rather than by a more elaborate and objective instrument has the benefit that it allows to assess a broad spectrum of skills within a relatively short time. However, it has the drawback that self-evaluation of own skill levels might entail substantial measurement error and might be even biased, e.g. if the students are overconfident. In order to address these issues of measurement error and bias, the following analysis shows the evaluations of both students and employers. The similarity of the results of the students and employers provide suggestive evidence that these measurement issues are not paramount. Nevertheless, this discussion shows that the simple measurement approach taken in this paper represents a complementary

approach to research projects that aim to measure skills objectively as, e.g. the ASCOT initiative (Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung), 2011).

The survey entails information on detailed skills based on the skills in the framework curriculum of the business administration degree in Colleges of Professional Education and Training (HFW, 2008), e.g. preparation of appraisal interviews. In order to place the empirical results in a broader context, the paper focuses on the skills in two aggregated dimensions that were also surveyed. The first skill dimension consists of 22 soft skills based on Salvisberg (2010). They are based on an empirical analysis of job advertisements in the Swiss labor market and contain data from 1950 to 2006. Thereby the choice of the soft skill dimensions represents an empirically founded set of soft skills.

The second skill dimension abstracts from the hard vs soft skill distinction and evaluates the skills used in 12 business processes, namely, normative management, strategic management, leadership processes, customer processes, production, order processing and innovation, human resources, infrastructure and communication, organizational design, and project management (Rüegg-Stürm, 2002).

Using the assessment of students to analyze the comparative advantages of school and workplace has the drawback that the student evaluations might be colored by their experiences at school. A student exposed to a school environment that fosters the exchange between the school and workplace might assess the comparative advantage of schools differently than a student in a school environment that focuses on traditional education instruments such as teacher-centered instruction.

Hence, the student evaluation of the comparative advantage of schools might reflect their experiences at school. This data feature allows to analyze the relationship between pedagogical instruments and the comparative advantage assessment. The magnitude of the relationship yields insights into how strongly experiences shape the student evaluation, i.e. to which extent the comparative advantage of schools depends on pedagogy. In addition, the relationship provides information on the effectiveness of these pedagogical instruments.

This paper analyzes two types of pedagogical instruments. The first instrument type refers to information regarding the method of instruction. Concretely, students were asked whether their studies included group work (94 percent), self-study (71 percent), e-learning (35 percent), writing a thesis (74 percent), case studies as suggested by Boyce *et al.* (2001) (77 percent), project work (79 percent) and reflection on work (57 percent), where the numbers in brackets represent the share of students indicating that this instruction method has been applied.

The second instrument type particularly aims to capture the tools developed for the transfer of knowledge from school to the workplace. The choice of the evaluated transfer tools is based on the framework curriculum of business administration in Colleges of Professional Education and Training (HFW, 2008). Concretely, the instruments analyzed refer to the presentation of real-world examples at school (example presentation) and solving real-world case studies (case studies presentation), which the median student experienced once per year. The more ambitious instruments presentation of a firm survey at school (survey) and learning contracts (learning contract), on the other hand, are relatively scarce, as less than 30 percent of students experienced them. Finally, two instruments that range in between regarding their ambitiousness are skill raster (skill grid) and learning documentation of how theory was applied in the real world (learning documentation), which was experienced by about half of the students.

In order to analyze the relationship between these pedagogical instruments and the comparative advantage of schools, we estimate simple multivariate regressions where the dependent variables reflect the mean assessment of the comparative advantage of schools relative to the workplace for process-specific skills and soft skills on a scale from

1 = work, 2 = do not know to 3 = school. Formally, we estimate:

$$y_{s,i} = \beta_{s,1}\text{Instrument}_i + \beta_{s,2}\text{Control}_i + \varepsilon_{s,i} \quad (1)$$

where $y_{s,i}$ denotes the comparative advantage evaluation of individual i regarding the sth skill dimension. Instrument refers to the pedagogical instrument and control entails a vector of control variables, i.e. gender, age, work experience, Swiss citizenship, working full time, being superior and the area of work, e.g. management, controlling[7]. ε denotes the normally distributed error term of an OLS regression, clustered at the class level. Table AI describes the variable construction and provides the summary statistics.

4. The business administration studies at colleges of professional education and training

The Swiss Colleges of Professional Education and Training provide tertiary (ISCED97 5b) degrees. Awarding about 7,600 degrees in 2013 (SFO, 2014), the Colleges of Professional Education and Training represent the important institutions in the Swiss education landscape. Accounting for about 1,600 or 21 percent of these degrees, the Colleges of Professional Education and Training in business are highly relevant.

The business administration studies at Colleges of Professional Education and Training in business aim to convey skills needed for a management position. Correspondingly, the average student is more than 28 years old and has more than eight years of work experience excluding the initial education. The degree takes three years to complete. The schools in our sample only offer the degree while working. Hence, it is not surprising that 99 percent of students are either employed or self-employed. More astonishing is though that 73 percent work more than 90 percent in addition to an average of 14 hours of studying per week. Of these, about two-thirds take place during contact hours while one-third of the time it is private studies.

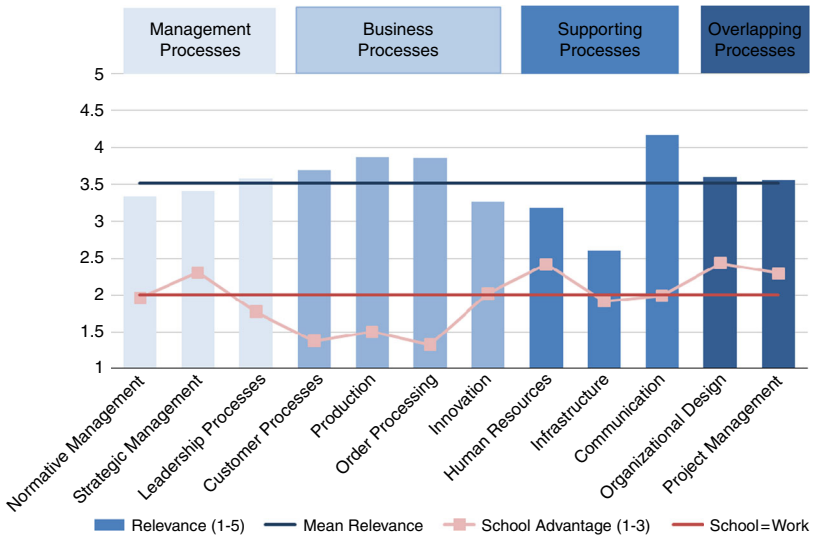
5. Results

5.1 Skill relevance and comparative advantage of schools

Figure 3 displays the student assessments of the process-specific skill relevance and comparative advantage of schools. Similarly, Figure 5 displays the student assessments of relevance and comparative advantage for various soft skills. Correspondingly, Figures 4 and 6 display the evaluations of employers. Blue bars indicate the relevance of skills on a one to five-Likert scale. The mean relevance across skills appears as blue horizontal lines. The light red line with markers shows the skill-specific comparative advantage of schools on a one to three scale. The dark red line highlights the value of 2 indicating that students are indifferent between school and work.

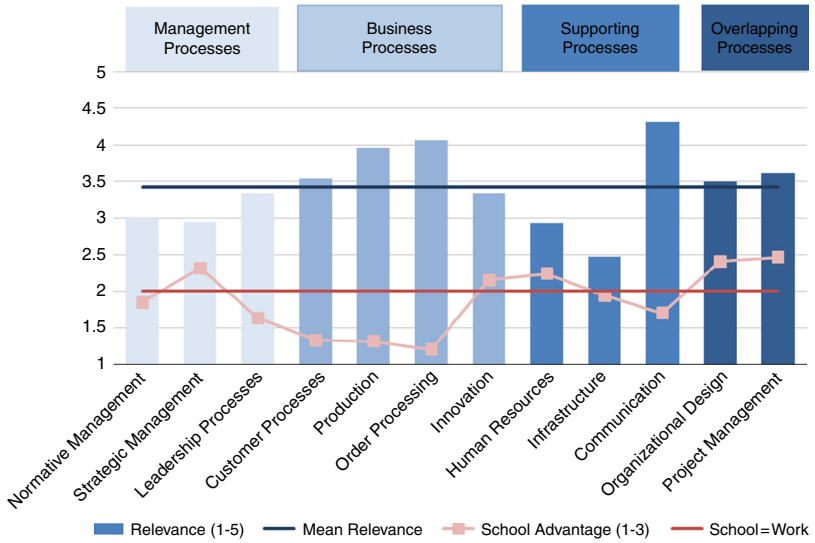
Figures 3 and 4 suggest that communication represents the most important process, thereby supporting *H4a*. Communication is followed by three of the business processes, namely, production, order processing, and customer processes. Management and overlapping processes score close to the mean relevance, supporting *H4b* and *H4c*, respectively. The least important processes are infrastructure, human resources, and innovation processes, thereby providing evidence against *H4d* suggesting that innovation skills are moderately relevant.

However, while this type of information is important regarding the choice of education and training content, the focus of this paper lies on providing guidance on the choice between education and training by assessing the comparative advantage of schools. Comparing the light red line with markers to the horizontal red line shows that schools have a comparative advantage, i.e. a value above two, regarding organizational design, human resources, project management, and strategic management.



Note: The number of observations varies between 444 for communication and 464 for normative management

Figure 3.
Relevance and comparative advantage of schools by process: students



Note: The number of observations varies between 47 for communication and 53 for normative management and innovation

Figure 4.
Relevance and comparative advantage of schools by process: employers

Furthermore, the students consider school and workplace similarly suitable to acquire the skills used in the business processes communication innovation, normative management, and infrastructure processes. On the other hand, the school has a comparative disadvantage regarding three business processes, namely, customer processes, production, and order processes.

Hence, the findings do not support *H7a* which suggests a comparative advantage of schools regarding communication. Nevertheless, compared to skills used in other business processes, schools appear to be relatively suitable to convey skills used in the communication process.

While Figures 3 and 4 show the evaluations regarding the skills used in different business processes, Figures 5 and 6 display the results for various soft skills. Rather than representing independent dimension of skills, soft skills and process-specific skills overlap as process-specific skills entail both hard and soft skills. This becomes obvious in the case of communication, which is surveyed both as a soft skill and as a business process, where the later includes both hard and soft skills.

Comparing Figure 3 to Figure 5 and Figure 4 to Figure 6 shows that the mean relevance of the soft skills is substantially higher than for the process-specific skills. Since the latter consist of both hard and soft skills, this suggests that soft skills are more relevant than hard skills, supporting *H1*. A statistical analysis confirms this visual insight. Concretely, the mean relevance of process-specific skills amounts to 3.5 and 3.4 for students and employers, respectively. The mean relevance of soft skills is 4.2 for both students and employers. Since standard deviations are below 0.1, the equality of relevance of process-specific skills and soft skills is significantly rejected at the 1 percent level.

Evaluations regarding individual soft skills show that students consider self-soft skills the most important soft skill. Particularly reliability and trustworthiness reach very high values, thereby supporting *H3d*. Furthermore, the related methodological soft skills efficiency and resilience are highly relevant too. Friendliness and teamwork capacity soft skills rank highest among the social soft skills, thereby supporting *H3b*. Furthermore, the relatively high relevance of communication supports *H3a*, though the literature would suggest that communication soft skills rank even higher. The above average relevance of motivation also supports *H3f*. However, the below average relevance of organizational skills and joy of learning provide no support for *H3e* and *H3g*.

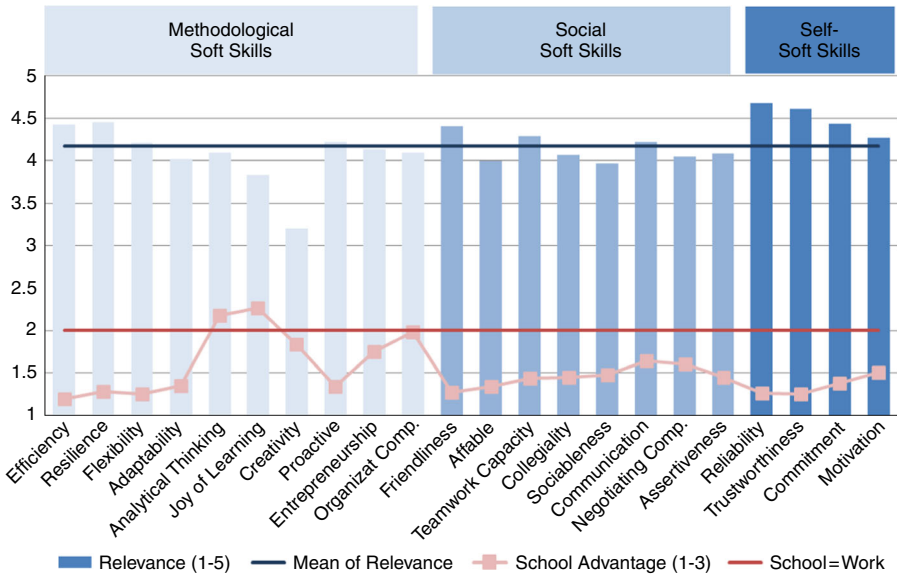
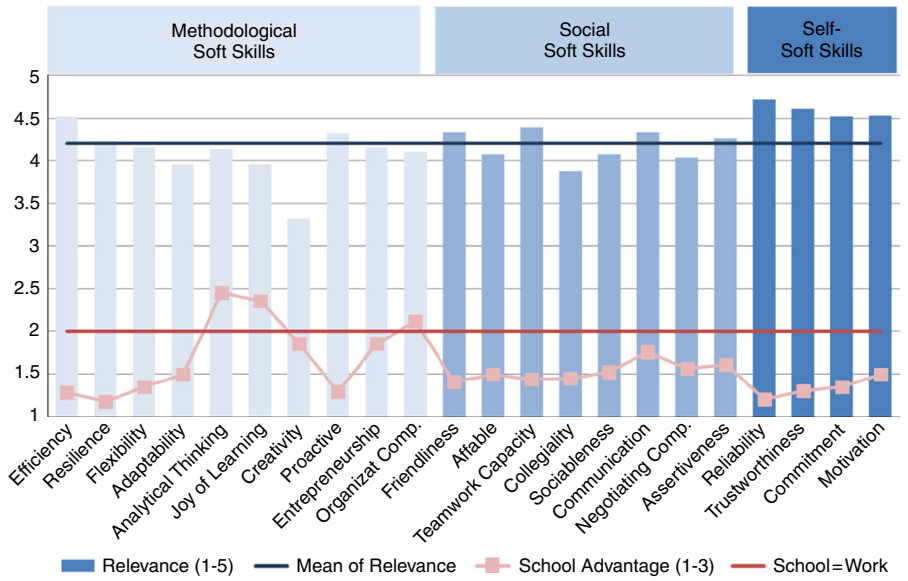


Figure 5.
Relevance and comparative advantage of schools by soft skills: students

Note: The number of observations varies between 453 for joy of learning to 471 for flexibility and trustworthiness



Note: The number of observations varies between 47 for creativity and trustworthiness to 51 for resilience, flexibility, proactive, friendliness and collegiality

Figure 6.
Relevance and comparative advantage of schools by soft skills: employers

However, while soft skills are more relevant than hard skills, Figures 5 and 6 suggest that students and employers alike consider schools to be a suboptimal learning place to acquire soft skills. The only soft skills where schools have a comparative advantage over the workplace are analytical thinking and joy of learning. Hence, the comparative advantage of schools regarding joy of learning is even higher than suggested by *H6b* arguing that school and workplace environment are similarly suited. For organizational skills, school and workplace are considered equal. Hence, *H7b* is not supported as the comparative advantage of schools regarding organizational skills is smaller than expected. However, schools have a comparative disadvantage in teaching the remaining soft skills, rejecting *H6a* and supporting *H5a* to *H5e* and *H7a*.

Hence, our findings suggest that schools have a comparative disadvantage in conveying most soft skills. It should be noted though that the comparative disadvantage of schools regarding creativity and entrepreneurship is relatively small compared to other soft skills. Hence, conditional on a decision to teach soft skills in schools, focusing on these soft skills rather than other soft skills appears to be beneficial. To a much lesser extent, this is also true for the communication soft skills. Interestingly, while schools have a comparative advantage regarding skills used in the communication process, they have a disadvantage regarding the communication soft skill. This shows that communication entails both hard and soft skills and that schools are able to convey valuable hard skills involved in the communication process.

Comparing the assessments of process-specific skills and soft skills shows that the comparative advantage of schools is higher for process-specific skills. Assuming that this reflects the hard skills contained in the process-specific skills, this finding supports *H7c*, i.e. that the comparative advantage of schools is higher for hard skills than for soft skills. A statistical analysis shows that the mean value of students' evaluation of comparative advantage of process-specific skills and soft skills amounts to 1.95 and 1.53, respectively (see Table AI). For employers, the corresponding values are 1.86 and 1.58. Equality of these means is rejected on the 1 percent level.

We further compare the responses of students and employers for two reasons. First, comparing Figure 3 to Figure 4 and Figure 5 to Figure 6 allows to assess the quality of students assessments based on whether the responses between students and employers differ[8]. This comparison shows that the results based on student and employer assessment are surprisingly similar. This is likely due to the fact that the surveyed students, on average, have more than eight years of work experience. Hence both students and employers have experienced the relevance of skills in the real workplace. The similarity of assessments by students and employers suggests that the quality of student assessments is high.

Second, *H2* suggests that the employers consider soft skills relative to hard skills more relevant than students. Since the visual inspection of this hypothesis is too complex, we test *H2* statistically. Concretely, we calculate the difference between the mean relevance of process-specific skills and soft skills for students and employers separately. Restricting the sample to students for which we have information for the matched employers suggests that the difference between the mean relevance of process-specific skills and soft skills is 0.57 and 0.78 for students and employers, respectively. Testing equality of these differences formally rejects equality at the 5 percent level with a p-value of 0.03. This suggests that the employers consider soft skills relative to hard skills more relevant than the students supporting *H2*. However, the magnitude of the disparity is fairly low, reflecting the similarity of assessments by students and employers.

It should be kept in mind though that the response rate of employers is very low, suggesting that the evidence regarding the assessments of employers is based on a small number of observations.

5.2 The influence of pedagogic instruments on comparative advantage assessment

Each column in Table II displays the regression results for the relationship between the assessment of the comparative advantage of schools and the application of a particular instruction method. The left-hand panels display the results for the comparative advantage of schools regarding process-specific skills, while the right-hand panels display the results for the comparative advantage of schools regarding soft skills. Correspondingly, each column of Table III displays the results for the application of a particular transfer tool.

Tables II and III allow to improve our understanding of skill acquisition in two directions. First, the analysis allows to assess to what extent the student evaluation of the comparative advantage of schools is related to the experience of students. The left-hand panel of Table II shows that the instruction method has no significant relationship with the comparative advantage of schools regarding process-specific skills. However, the right-hand panel of Table II suggests that using e-learning, solving case studies, and reflecting on work experience in school have a significantly positive relationship with the assessment of comparative advantage of the school regarding soft skills.

The results regarding transfer tools shown in Table III also support the notion that the comparative advantage of the school is related to the application of pedagogic instruments. All coefficient estimates are positive. In the case of process-specific skills shown in the left-hand panel of Table III, presenting examples of the workplace in school (example presentation), presenting case studies of the workplace at school (case study presentation), filling a skill grid (skill grid), and documenting the learning process in the workplace (learning documentation) have a significant positive relationship with the assessment of the comparative advantage of the school. The right-hand panel of Table III shows that presenting case studies of the workplace at school (case study presentation), presenting a survey in the workplace at school (survey), making a learning contract (learning contract), and documenting the learning process in the workplace (learning documentation) have a significantly positive relationship with the assessment of the comparative advantage of schools regarding soft skills.

Table II. Estimation results instruction method

	Process							Soft skills						
	Group work	Self-study	E-learning	Thesis	Case studies	Project work	Work reflection	Group work	Self-study	E-learning	Thesis	Case studies	Project work	Work reflection
Female	−0.127**	−0.128***	−0.130***	−0.129***	−0.127***	−0.132***	−0.131***	−0.091**	−0.087*	−0.084*	−0.088*	−0.082*	−0.086*	−0.091**
	(0.047)	(0.046)	(0.046)	(0.047)	(0.045)	(0.047)	(0.046)	(0.044)	(0.044)	(0.045)	(0.044)	(0.042)	(0.043)	(0.042)
Age	−0.015	−0.014	−0.015	−0.016	−0.016	−0.015	−0.015	−0.004	−0.003	−0.002	−0.004	−0.005	−0.004	−0.004
	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Experience	0.011	0.011	0.012	0.013	0.013	0.011	0.012	0.008	0.006	0.005	0.007	0.009	0.008	0.007
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Swiss	0.030	0.035	0.031	0.031	0.035	0.037	0.035	−0.057	−0.059	−0.078	−0.060	−0.059	−0.064	−0.056
	(0.096)	(0.094)	(0.096)	(0.095)	(0.096)	(0.095)	(0.095)	(0.088)	(0.090)	(0.086)	(0.088)	(0.093)	(0.092)	(0.093)
Full time	−0.015	−0.015	−0.015	−0.011	−0.006	−0.012	−0.014	−0.025	−0.027	−0.033	−0.026	−0.012	−0.027	−0.027
	(0.054)	(0.052)	(0.053)	(0.052)	(0.055)	(0.054)	(0.053)	(0.043)	(0.043)	(0.041)	(0.043)	(0.042)	(0.043)	(0.043)
Superior	−0.069	−0.071*	−0.071	−0.071	−0.069	−0.069	−0.070	−0.092**	−0.092**	−0.098**	−0.092**	−0.089**	−0.093**	−0.092**
	(0.042)	(0.042)	(0.043)	(0.042)	(0.042)	(0.043)	(0.042)	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.037)	(0.036)
Group work	−0.070							0.050						
	(0.055)							(0.056)						
Self-study		0.067							0.050					
		(0.041)							(0.044)					
E-learning			0.018							0.104**				
			(0.035)							(0.048)				
Thesis				−0.041							−0.000			
				(0.048)							(0.028)			
Case studies					0.052							0.100**		
					(0.043)							(0.037)		
Project work						−0.034							0.056	
						(0.037)							(0.042)	
Work reflection							0.029							0.096**
							(0.044)							(0.042)
n	364	364	364	364	364	364	364	364	364	364	364	364	364	364
R^2	0.077	0.082	0.075	0.077	0.078	0.076	0.076	0.050	0.054	0.070	0.049	0.064	0.054	0.069

Notes: The table displays OLS coefficients and robust standard errors clustered at class level in parentheses. The dependent variable reflects the comparative advantage of the school relative to the workplace on a 1=work, 2=do not know, to 3=school scale. Instruction methods represent dummy variables taking the value 1 if the instruction method was used and 0 otherwise Table AI describes variable construction and summary statistics. All estimates include field fixed effects. *,**,*** represent significance at the 1, 5 and 10 percent level, respectively

Table III. Estimation results transfer tools

	Process						Soft skills					
	Example presentation	Case studies presentation	Survey	Learning contract	Skill grid	Learning documentation	Example presentation	Case studies presentation	Survey	Learning contract	Skill grid	Learning documentation
Female	−0.132***	−0.136***	−0.128***	−0.128***	−0.130***	−0.132***	−0.089**	−0.095**	−0.072*	−0.081*	−0.087*	−0.090**
	(0.045)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)	(0.043)	(0.043)	(0.040)	(0.042)	(0.043)	(0.040)
Age	−0.018*	−0.018*	−0.016	−0.015	−0.014	−0.015	−0.005	−0.007	−0.007	−0.003	−0.002	−0.003
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Experience	0.014	0.015	0.012	0.012	0.011	0.012	0.009	0.010	0.011	0.007	0.007	0.007
	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Swiss	0.018	0.037	0.031	0.033	0.032	0.034	−0.069	−0.057	−0.083	−0.063	−0.062	−0.060
	(0.090)	(0.092)	(0.096)	(0.095)	(0.094)	(0.091)	(0.085)	(0.084)	(0.083)	(0.086)	(0.084)	(0.087)
Full time	−0.014	−0.012	−0.014	−0.013	−0.012	−0.014	−0.026	−0.024	−0.028	−0.024	−0.025	−0.027
	(0.053)	(0.054)	(0.054)	(0.054)	(0.053)	(0.054)	(0.042)	(0.043)	(0.044)	(0.042)	(0.042)	(0.043)
Superior	−0.078*	−0.074*	−0.070	−0.070	−0.072*	−0.079*	−0.096**	−0.096**	−0.091***	−0.090**	−0.094**	−0.103***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.042)	(0.037)	(0.036)	(0.033)	(0.035)	(0.037)	(0.038)
Example presentation	0.036***						0.020					
	(0.009)						(0.013)					
Case studies presentation		0.027**						0.031**				
		(0.012)						(0.012)				
Survey			0.012						0.080***			
			(0.015)						(0.019)			
Learning contract				0.023						0.060		
				(0.026)						(0.030)*		
Skill grid					0.035**						0.031	
					(0.017)						(0.020)	
Learning documentation						0.034***						0.046***
						(0.010)						(0.012)
n	364	364	364	364	364	364	364	364	364	364	364	364
R^2	0.091	0.084	0.076	0.077	0.085	0.091	0.055	0.063	0.109	0.065	0.059	0.084

Notes: The table displays OLS coefficients and robust standard errors clustered at class level in parentheses. The dependent variable reflects the comparative advantage of the school relative to the workplace on a 1=work, 2=do not know, to 3=school scale. Transfer tools take the values 1=never; 2=once; 3=annually; 4=semiannually and 5=weekly. Table AI describes variable construction and summary statistics. All estimates include field fixed effects. *,**,***Represent significance at the 1, 5 and 10 percent level, respectively

In order to evaluate the malleability of comparative advantage assessment, not only statistical significance, but also the effect magnitude matters. Tables II and III show that the magnitude of the effects are small, even in cases that display a significant relationship. For example, Table II shows that using e-learning as an instruction method increases the comparative advantage of schools by merely 0.104. Similarly, Table III suggests that increasing the frequency of presenting a survey in the workplace increases the comparative advantage of schools by merely 0.08. Hence, the estimation results suggest that the comparative advantage of schools largely depends on the skill in question and that optimizing pedagogic instruments affects the optimal learning place only marginally.

Second, while the main goal of the regression analyzes was to assert the malleability of comparative advantages, assessing the relationship between pedagogical instruments and the comparative advantage of schools represents a first attempt to analyze the causal relationship between pedagogical instruments and education outcomes thereby contributing to the literature analyzing how to teach soft skills in the classroom (see e.g. Nealy, 2005; John, 2009).

However, we caution the reader not to interpret the reported correlations as causal due to a number of problems. First, endogeneity of the estimates might arise because students select into schools, because students might select using particular transfer tools and because students might differ in the effort used for the application of transfer tools. Second, the employed measures are relatively crude, particularly for the instruction tools for which neither information on intensity nor on quality exists. Similarly, no information on the quality of transfer tools exists. Third, the power and hence the precision of the estimates might be too low to capture the effect of pedagogic instruments. Therefore, this analysis represents a first step toward a causal analysis that should be confirmed in future research that uses a more elaborate identification strategy.

The results for the control variables suggest that women tend to value school lower than men and that supervisors consider the comparative advantage of schools lower than non-supervisors. This might be due to the fact that women and supervisors place a higher weight on soft skills rather than on hard skills. The remaining control variables have no statistically significant relationship with the comparative advantage assessment.

6. Conclusion

This paper provides empirical evidence to education system managers and human resource managers regarding the relative relevance of skills and to what extent the school has a comparative advantage over the workplace to acquire the skills. Thereby the paper prepares the statistical ground to make evidence-based decisions regarding the optimal choice of the learning place for each skill. Concretely, our results suggest that schools face a comparative disadvantage in teaching soft skills. Therefore, educational programs that aim to improve soft skills should combine learning in school with workplace experience. Furthermore, the results show that the comparative disadvantage differs across soft skills. This suggests that schools should focus on teaching soft skills where the school is a more suitable learning location, notably analytical thinking, joy of learning, organizational skills and to a lesser extent creativity, entrepreneurship, and communication.

We further provide suggestive evidence that the comparative advantage of schools depends on the application of particular pedagogic instruments. The results suggest that students who experience e-learning, have solved case studies, or reflected upon their work experience consider the school more suitable as a learning place for soft skills. Furthermore, the application of transfer tools such as learning contracts and learning documentation also help to reduce the comparative disadvantage of schools. These findings suggest that schools aiming to improve soft skills need to adapt appropriate pedagogic tools to do so.

However, while this paper represents a first step to analyze skill relevance, skill-specific comparative advantage of schools and the relationship between pedagogic instruments and

the comparative advantage of schools, it faces a number of limitations that should be addressed in future research.

First, the information stems from students in professional tertiary education and training (ISCED97 5b) that aims to equip students with the skills necessary for a management position. Hence, the findings of this paper might not be valid for education and training programs that have a different goal or that address a different student body. Furthermore, the specific orientation of education and training approach requires adaptation of the evaluation tool presented in this paper to the desired context. This is particularly true for the process dimension, while the soft skill dimensions are more general.

However, the specificity of the context has the benefit that it allows to evaluate the skills as they are formulated in the framework curriculum of the business administration degree at PET colleges (HFW, 2008).

Second, the list of pedagogic instruments evaluated in this paper might be incomplete or might not coincide with the instruments used in other educational and training programs. In this sense, the list of pedagogic instruments is too narrow. However, the list of pedagogic instruments is also too broad in the sense that the specific implementation of instruments might vary substantially. Furthermore, the data provide no information regarding the existence of the quality of applied pedagogic instruments.

Third, the analysis of the relationship between pedagogic instruments and the comparative advantage of schools relies on simple conditional correlations. Future research should improve the identification strategy of causal effects by exploiting panel data or variation arising due to natural experiments.

Nevertheless, the paper provides empirical evidence regarding the important question of the relation between school and workplace learning environment, thereby improving the ability of education system managers and human resource managers to make evidence-based decisions regarding the optimal choice of the learning place.

Notes

1. The Swiss Job Market Monitor is representative of the number of open positions in the German part of Switzerland published in press, on firm homepages, or internet portals (see www.stellenmarktmonitor.uzh.ch/indices/asjmi.html for more detailed information).
2. The framework curriculum at Colleges of Professional Education and Training in Business Administration refers to the theoretical concept of action competences. Action competences include "all those cognitive, motivational and social prerequisites necessary and/or available for successful learning and action" (Weinert, 1999, p. 10). In order to simplify the discussion, we refrain from referring to this concept in the following discussion. Instead, this paper uses the term skills in a generic way, comprising hard skills, soft skills as well as competences and action competences. Section 2.2 provides a description of the distinction between hard skills and soft skills.
3. Hence, we use the term knowledge in a broad sense, referring to a subset of skills.
4. The literature search was conducted by searching for a combination of terms for relevance (relevant, important, top) and soft skills (soft skills, non-cognitive skills, generic skills) using Google scholar. Subsequently, we analyzed backward and forward citations of the emerging papers, i.e. searched the papers for relevant references as well as looking at papers that cite the identified papers. It should be noted though that the displayed literature serves to develop our hypotheses rather than providing a meta-analysis of the literature. Hence, we do not claim that the used literature represents the full universe of relevant studies.
5. Since we cannot compare the magnitude of the relevance in these papers, we restrict ourselves to formulating hypotheses for three relevance categories, distinguishing skills that are not relevant, moderately relevant and highly relevant.

6. Unfortunately, the existing evidence does not use the same skills used to derive the hypotheses regarding the relevance of skills. Hence, the hypotheses presented in this section do not match the hypotheses suggested in Section 2.2 systematically.
7. The student assessment of the learning opportunities at the workplace and hence the comparative advantage of workplace and school might also be affected by the learning opportunities of the student at the workplace. We test the relevance of this issue by estimations for the subsamples allowing to control for firm size and industry affiliation. The qualitative results in terms of effect size remain similar, though the sample reduction to 137 observations turns most coefficients insignificant.
8. Restricting the sample of students and comparing the assessment of students and their matched employers yield qualitatively the same results.

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(The Appendix follows overleaf.)

Appendix

Variable name	Variable definition	Mean	SD
Dependent variables			
Processes	Mean comparative advantage of school for skills related to normative management processes, strategic management processes, leadership processes, customer processes, production, order processing, innovation, human resources, infrastructure, communication processes, organizational design, and project management (1 = work; 2 = do not know, 3 = school)	1.95	0.36
Soft skills	Mean comparative advantage of school for the skills efficiency, resilience, flexibility, adaptability, analytical thinking, joy of learning, creativity, being proactive, entrepreneurship, organizational skills, friendliness, being affable, teamwork capacity, collegiality, sociableness, communication skills, negotiating skills, assertiveness, reliability, trustworthiness, commitment and motivation (1 = work; 2 = do not know, 3 = school)	1.53	0.33
Instruction method			
Group work	Dummy variable taking the value 1 if group work was used and 0 otherwise	0.94	
Self-study	Dummy variable taking the value 1 if self-study was used and 0 otherwise	0.71	
E-learning	Dummy variable taking the value 1 if e-learning tools were used and 0 otherwise	0.35	
Thesis	Dummy variable taking the value 1 if the student wrote a thesis and 0 otherwise	0.74	
Case studies	Dummy variable taking the value 1 if the student solved case studies and 0 otherwise	0.77	
Project work	Dummy variable taking the value 1 if the student was involved in project work and 0 otherwise	0.79	
Work reflection	Dummy variable taking the value 1 if the student reflected real world problems at school and 0 otherwise	0.57	
Transfer tools			
Example presentation	Ordinal variable indicating how often real world examples were presented at school (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	2.97	1.33
Case study presentation	Ordinal variable indicating how often real world case studies were presented at school (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	2.97	1.29
Survey	Ordinal variable indicating how often results from a survey in the firm were presented at school (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	1.59	1.05
Learning contract	Ordinal variable indicating how often learning contracts were made (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	1.30	0.73
Skill grid	Ordinal variable indicating how often skill grids were used (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	1.83	1.08
Learning documentation	Ordinal variable indicating how often the application of the theory in the real world was documented (1 = never; 2 = once; 3 = annually; 4 = semiannually; 5 = weekly)	2.39	1.36
Control variables			
Female	Dummy variable taking the value 1 if a student is female and 0 otherwise	0.37	
Age	Student age in years	28.38	4.79
Experience	Years of work experience excluding initial education	8.71	4.83
Swiss	Dummy variable taking the value 1 if a student is Swiss citizen and 0 otherwise	0.96	

Table AI.
Variable descriptions and summary statistics

(*continued*)

Variable name	Variable definition	Mean	SD
Full time	Dummy variable taking the value 1 if a student is employed 90% or more and 0 otherwise	0.73	
Superior	Dummy variable taking the value 1 if a student is employed 90% or more and 0 otherwise	0.43	
Management	Dummy variable taking the value 1 if a student spends most of his time in management tasks and 0 otherwise	0.09	
Marketing/PR	Dummy variable taking the value 1 if a student spends most of his time in marketing or public relations tasks and 0 otherwise	0.12	
Production	Dummy variable taking the value 1 if a student spends most of his time in production tasks and 0 otherwise	0.05	
Provision/Logistics	Dummy variable taking the value 1 if a student spends most of his time in provision or logistics tasks and 0 otherwise	0.12	
Quality/ Environment/ Security	Dummy variable taking the value 1 if a student spends most of his time in quality environment or security related tasks and 0 otherwise	0.02	
Human resource management	Dummy variable taking the value 1 if a student spends most of his time in human resource management tasks and 0 otherwise	0.08	
Financing/ Investment	Dummy variable taking the value 1 if a student spends most of his time in financing or investment tasks and 0 otherwise	0.19	
Controlling	Dummy variable taking the value 1 if a student spends most of his time in controlling tasks and 0 otherwise	0.14	
Informatics	Dummy variable taking the value 1 if a student spends most of his time in informatics tasks and 0 otherwise	0.01	
Organizational design	Dummy variable taking the value 1 if a student spends most of his time in organizational design tasks and 0 otherwise	0.06	
Project management	Dummy variable taking the value 1 if a student spends most of his time in project management tasks and 0 otherwise	0.12	

Note: $n = 370$

Table AI.

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