Collaborative writing and discussion in vocational education: Effects on learning and self-efficacy beliefs

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Abstract: Most professional education tracks combine school learning with practical workplace training. Although in theory alternating between these two settings is a great opportunity for learning, vocational education students encounter difficulties in integrating the formal explicit knowledge imparted in school with the informal tacit knowledge acquired in the workplace. This design study explores the potential of writing and peer collaboration as mediating tools to facilitate the articulation of conceptual and experiential knowledge. In the context of a school for social and health care assistants, 40 first- and second-year students wrote about critical situations encountered in the workplace, shared them with their classmates, and engaged in written and oral discussions with colleagues and the teacher. A web-based collaborative writing tool (wiki) was used for writing and facilitating participants' interactions. The results showed significant gains in self-efficacy beliefs and performance on a case-based competence test for the first-year students, but not for those in the second-year. In addition, all students reported a high level of satisfaction with the instructional scenario and particularly its collaborative dimension. The discussion raises some issues and recommendations regarding the design of learning activities involving writing and peer feedback to support students in articulating conceptual and experiential knowledge.

Keywords: vocational education and training, written peer feedback, computer-supported collaborative learning, self-efficacy

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Most professional education tracks combine formal and organized school learning with supervised practical experience in a workplace. This combination is found across all educational levels, from high school to university, from initial vocational education and training (VET) to adult education and life-long learning. While workplace experience is included in most cases, there are different possibilities for its concrete implementation (in terms of duration, articulation with school, conditions, and supervision). The integration of the different learning environments that result represents a great opportunity for learners to acquire the full range of knowledge they will need to act as professionals. However, research has shown that this integration does not occur spontaneously and has to be formally organized during training (Filliettaz, 2010; Tynjälä, 2008).

The research presented in this article explores the potential of a learning scenario based on writing and collaboration to support vocational students in articulating conceptual and practical training. The next sections discuss the challenges of professional training to help students benefit from the combination of workplace and school learning, illustrating how writing can be used as a cognitive tool to promote abstraction and conceptualization of practical experience, while collaboration is used to foster exchange and encourage learners to move beyond personal experiences, establishing an authentic communication situation.

1. Literature review

1.1 Articulating workplace and school learning

Professional competence requires not only the acquisition of a set of conceptual, declarative and procedural knowledge (simply put, what to do, how, and why), but also the capacity to adapt one's behavior to different contexts, including a novel situation never before encountered or an unexpected event (Billet, 2006; Mann, Gordon, & Macleod, 2009). In order to face such new and critical situations, which could lead to a potentially dangerous turn of events, students have to develop both "hard skills" related to the theory of the domain and the execution of practical procedures and "soft skills" associated with the behavior, communication standards, and other interpersonal skills associated with the profession (Kumar & Hsiao, 2007). In participating in the community of practice (Lave & Wenger, 1991), learners progressively develop their professional identities with associated knowledge, values, and behavior. In order to ensure the development of these multiple skills, vocational education offers the alliance of workplace and school training to provide students with both practical situated experience and conventional conceptual knowledge, making them—in theory—effective practitioners when they terminate their studies.

However, as they are acquired in different contexts, through different mechanisms, these different types of knowledge often remain disconnected, juxtaposed rather than integrated (Billett, 2001; Filliettaz, 2010). In addition, there is great diversity among the workplaces offering internships, in particular in terms of learning affordances (Billet,

Fenwick, & Somerville, 2006) so practical training varies a lot across students. As a result, students will not necessarily practice the procedures or apply the knowledge taught in school (Ludvingsen, Lund, Rasmussen, & Säljö, 2011; Stenström & Tynjälä, 2009). Conversely, some students will perform professional tasks before being taught the conceptual rationale in school. Therefore, taking practice—which is so diverse—into account in school teaching is challenging and requires specific instructional intervention. To this effect, Tynjälä (2008) and Tynjälä & Gijbels (2012) proposed a conceptually-driven framework they called an integrative pedagogy model, which describes the different types of knowledge that professionals should develop and discusses how to foster their articulation (Figure 1).

According to this model, vocational education should not treat separately but address jointly four types of knowledge: practical, conceptual, self-regulative, and socio-cultural (knowledge that is embedded in the social practices of workplaces and is learned through participation in these practices). To this end, the instructional setting should provide mediating tools—like tutoring/mentoring, discussion, and writing activities—that support the transformation and linking from practical to conceptual knowledge, while also reinforcing self-regulative knowledge (by way of reflection) and socio-cultural knowledge (by way of discussions). The next two sections focus on two components of this design: writing and collaboration.

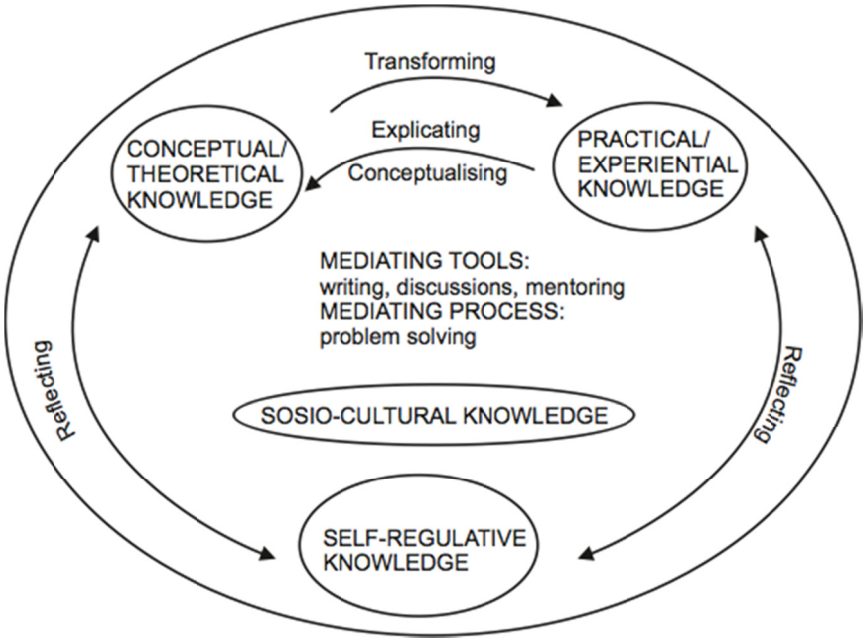

Figure 1. Integrative pedagogy model (Tynjälä & Gijbels, 2012).

1.2 Writing and learning

Writing has a long tradition in academics as a means to foster students' memorization, reflection, and conceptualization, but the cognitive mechanisms underlying the effect of writing on learning were not formally addressed before the 1970s. Hayes and Flower (1980) first described how the core cognitive processes involved in writing (i.e., planning, editing, and revising) involved a negotiation between new ideas generated in the text and knowledge in the writer's long-term memory. Later, Bereiter and Scardamalia (1989) distinguished two situations that differ in terms of their consequences for writers' knowledge elaboration. In the knowledge-telling situation, the writers only tell everything they know about a given topic. Conversely, in the knowledge-transforming situation, writers take into account the goal of the activity and adapt to the situation, which leads to a reorganization and transformation of previous knowledge. However, Galbraith (1999) criticized the vision that the explicit satisfaction of rhetorical goals was conducive to knowledge transformation and thus learning. In his latest model, Galbraith (2009) proposed a dual-process of *discovery through writing*, in which writing is the product of two complementary but somehow divergent processes—explicit planning in order to satisfy rhetorical goals and spontaneous, less controlled text production—that lead to the development of understanding through the implicit reorganization of semantic memory.

While cognitive literature converges on the idea that writing involves deep processing that leads to conceptual reorganization of knowledge, abstraction (Olson, 1994), and creation of new knowledge, attempts to collect evidence of its instructional effectiveness have been more challenging, with the literature reporting many contradictory and inconclusive results (for critical reviews, see Ackerman, 1993; Bangert-Drowns, Hurley, & Wilkinson, 2004). Tynjälä (1998), exploring the reasons underling these contradictory outcomes, pointed out one important element: typically, the learning outcomes of writing activities have been measured through quantitative testing on recall tasks without accounting for the quality of higher-order learning. According to the author, writing represents a suitable solution for learning when the objective of a learning activity is to produce conceptual and knowledge change, rather than memorization.

Tynjälä, Mason, and Lonka (2001) proposed a series of conditions to make writing an effective learning tool: (1) writing tasks should require conceptual change and knowledge transformation/construction; (2) students' previous knowledge and beliefs should be taken into account, by using free-writing exercises before studying the topic; (3) writing tasks should encourage students to reflect about their own experiences; (4) students should be encouraged to solve practical problems by applying theoretical knowledge; and (5) tasks should be integrated with the class curriculum, by organizing discussions and small-group activities around them. This last condition refers to the idea that writing should be considered as a social activity and not only as an individual one. In a previous research, Tynjälä (1998) stated that the most efficient way to exploit a writing activity for learning purposes is to combine it with oral discussion and

reading. However, designing and implementing collaborative instruction is in itself challenging, since many variables have to been taken into account in order to make it effective, as the next section reviews.

1.3 Collaborative learning, computer support, and peer feedback

Collaborative learning represents a set of various situations, which basically consist of having students work together on a set of tasks in a usually quite precise scenario, specifying how the work should be organized, distributed, and planned over time (Dillenbourg, 1999). Collaborative scenarios prompt students to engage in discussion, making their own understandings explicit and gaining from others' perspectives (Dillenbourg & Fisher, 2007). In some cases, conflicting points of view may arise, requiring the learners to reorganize their individual conceptions (Suthers, 2006). Though collaborative learning can be a powerful motor for deep learning, its actual effectiveness depends on many factors, and ultimately on whether students effectively engage in productive interactions (Stahl, Koschmann, and Suthers, 2006). In the last two decades, the research in collaborative learning has tried to identify the conditions that promote the emergence of these productive interactions among students (Scanlon, 2011; Suthers, 2006).

With the development of computers and the increased availability of Internet connections, a considerable part of the research on collaborative learning has been conducted on computers. In addition to enabling collaboration across space and time, computers allow learners to keep track of all phases of the collaboration and revise their production over time. A specific field dedicated to computer-supported collaborative learning (CSCL) focuses on how collaboration between peers can be triggered and enhanced in computer-supported environments to facilitate deep and sustainable learning (Puntambekar, Erkens, & Hmelo-Silver, 2011; Spada, Stahl, Miyake, & Law, 2011). Dillenbourg and Fischer (2007) summarized two key elements to consider when designing computer-supported collaborative activities: first, collaboration between peers does not happen spontaneously, but has to be triggered and guided through the design of the activities. In particular, well-designed activities should place students in situations in which they need to interact and provide them with all the instruction needed to guide their interactions. Second, pedagogical scenarios should not only include collaborative group-learning activities but also individual and collective tasks, some with computers and other without (Dillenbourg & Jermann, 2010).

Among the various types of collaborative writing activities that are facilitated by computer support, peer feedback represents an interesting option. Different forms of peer feedback have been implemented and studied. In peer-comment activities, learners are asked to comment on the work of their colleagues, providing constructive criticisms and suggestions (Gielen, Peeters, Dochy, Onghena, & Struyven, 2010; van der Pol, van den Berg, Admiraal, & Simons, 2008). In peer-assessment activities, participants are required to evaluate and rate each other's performance (De Wever, Van

Keer, Schellens, & Valcke, 2011; Gielen & De Wever, 2012; van Gennip, Segers, & Tillema, 2010). Learners may have reservations about peer assessment; for example, they may not appreciate having their work evaluated by a peer and may question the peer's qualifications to take this role (Kaufmann & Schunn, 2010). Interestingly, reservations regarding peer feedback may encourage students to engage in discussions and to look to textbooks or other media for confirmation of the comments made (Yang, Badger, & Yu, 2006). Teachers' feedback, on the other hand, is usually accepted as such, and learners rarely ask questions or consult other sources in an effort to better understand it. According to van Gennip et al. (2010), learners' initial hostility towards peer feedback can be caused by insufficient introduction to the process. Students' conceptions of the activity positively evolve as they gain more experience with this type of assessment (Dochy & McDowell, 1997). Regarding its impact on learning, peer exchange can have some important beneficial effects on the learning process (Davies, 2002). According to Dochy and McDowell (1997), it can support the development of important skills related to communication, self-evaluation, observation, and self-criticism.

1.4 Self-efficacy beliefs

This research investigates how writing, peer feedback, and discussions can help students in developing comprehensive understanding and articulating conceptual, practical, socio-cultural, and reflective knowledge. In this context, knowledge gain is expected not only in conceptual understanding or practical performance, but also in the development of identity and self-beliefs, and particularly self-efficacy beliefs. The concept of self-efficacy refers to the personal judgment a person has of his or her capability in performing the course of actions required to attain a designated goal (Bandura, 1997; 2006). Self-efficacy is considered the foundation of motivation and of personal accomplishment, as these beliefs provide people with a sense of agency motivating them through self-monitoring and self-evaluation activities as well as self-regulation, supporting the setting of goals and the selection of strategies (Zimmerman, 2000).

According to Bandura (1997), self-efficacy beliefs have four main sources. The first one is constituted by performance accomplishments. In this sense, self-efficacy derives directly from practice and personal experience. Successes and failures would, therefore, respectively enhance and reduce the perception of one's capabilities in attaining a certain goal. It is important to underline that single successes or failures would not impact a well-developed sense of efficacy, which means that their impact is particularly relevant when they occur early in the learning process or if they happen repeatedly (van der Bijl & Shortridge-Baggett, 2001). A second source of self-efficacy is associated with vicarious experiences. Observing others performing a task in a successful manner also impacts learners' feelings of competence, as this can provide both examples and information on the difficulty of the task. Verbal persuasion is a third, common source of self-efficacy. Van der Bijl & Shortridge-Baggett (2001), referring to

health care professionals, affirm that verbal persuasion is often used to convince them that they can succeed in difficult tasks, through the use of instructions, suggestions, and advice. Fourth and finally, physiological information is an important source of self-efficacy. In order to judge one's own capacity in performing a task, a series of emotional and physiological factors such as tension, fatigue, pain, and so forth will be examined and interpreted. When forming a judgment about his or her competence to perform specific tasks, an individual has to integrate information coming from all these different sources, assigning different weights to each one of them (Bandura, 2006). Considering the integrative character of self-efficacy beliefs, they were regarded in the present research as an interesting indicator of the development of a comprehensive understanding of professional situations.

1.5 The present study and research questions

The present study integrates the literature reviewed above in order to propose an instructional intervention based on the integrative pedagogy model developed by Tynjälä (2008) and Tynjälä and Gijbel (2012). The goal of this intervention is to help students develop comprehensive understanding of professional situations, articulating conceptual, practical, self-regulative, and socio-cultural knowledge. Following a design-based research approach (Design-Based Research collective, 2003; Herrington, 2012), the literature has been reviewed in order to formulate recommendations regarding the design of writing and collaborative learning activities—peer feedback in particular. Concurrently, thorough discussions have been conducted with teachers in the partnering vocational school in order to raise the instructional issues that occur when trying to link theory and practice. Both lines of work lead to the development of an instructional intervention (see 2.2 for details) embedded in the school curriculum. Basically, the intervention involved individual writing about one's personal experience, written peer feedback, oral class discussion, and written individual wrap-up.

In line with Tynjälä's (2008) integrative pedagogy model, we assume that writing activities, together with collaborative activities, promote articulation among theoretical, practical, self-regulative, and socio-cultural knowledge. Writing is intended to foster explication and conceptualization of practical knowledge (Galbraith, 1999). Peer commenting should encourage participants to engage in discussion (Yang et al., 2006) that exposes the students to others' perspectives and experiences, promoting the ability to reflect on their behavior and develop new knowledge (Davies, 2012; Dochy & McDowel, 1997). Finally, whole-class discussion offers the opportunity for the students to reframe their individual experiences in a collective interpretation, with conceptual support from the teacher (Tynjälä & Gijbels, 2012). Writing then functions to provide a way to collect and record for later use the collective interpretation of personal experiences (Scardamalia & Bereiter, 1994; 2006).

As a design study, we formulated a series of research questions. The first question is whether the intervention as a whole meets the objective of developing a comprehensive understanding of a professional situation. To this aim, two learning

outcomes have been explored: (1) performance in a declarative competence test that aims to capture students' capacity to understand a complex situation on a specific topic and act accordingly; and (2) self-efficacy beliefs in general and in the specific topic. We expect that the intervention will increase students' scores in the competence test and their self-efficacy beliefs related to the topic and, by transfer, to general professional expertise. As a design study involving a complete instructional intervention, it will not be possible to disentangle the effect of each component alone (writing, peer feedback, and discussion), but rather to investigate the impact of the intervention as a whole in an authentic setting. Therefore, the relation between the students' participation in the activity and their progress in terms of comprehensive understanding of the topic and self-efficacy beliefs represents the second question of this study. This aspect will be explored in consideration of previous research (Ortoleva, Schneider, & Bétrancourt, 2013), which found positive correlation between students participation in peer commentary and their post-test performance.

2. Method

The research[1] presented in this article was conducted in the School for Social and Health Care Assistants (Assistant-e-s en Soins et Santé Communautaire—ASSC) of Geneva canton. The students of this secondary vocational school have finished their compulsory schooling, which in Switzerland is until 16 years of age. Some of them acquired some professional experience before accessing this educational path and some of them engaged in other types of education before starting this VET program. The social and health care assistant training is a three-year program involving about half time in workplace internships. After finishing the program, students act as nurses' assistants in different contexts (e.g., hospitals, retirement homes, or home care).

2.1 Participants

Students of two classes were involved in the research: second-year students (20 women and 5 men; mean age = 22.48, *SD* = 3.18, min = 18, max = 31) and first-year students (12 women and 3 men; mean age = 23.3, *SD* = 6.02, min = 19, max = 40). Two teachers, both women, participated in the design and implementation of the scenario. They were nurse practitioners for more than ten years before becoming teachers.

2.2 Instructional scenario

The instructional intervention took place in a class precisely devoted to the articulation of theory and practice. This class usually entailed discussing cases presented by the teachers, who encouraged the students to make reference to their personal experiences. The teachers complained about the difficulty of engaging the students to participate fully in the discussion.

The implemented scenario entailed three phases, distributed over three learning sessions lasting one-and-a-half hours each. The sessions were two weeks apart;

therefore the whole activity was conducted over a period of six weeks (not including the pre- and post-tests which were administered in separate sessions). During this time, the students followed only general courses at the school (French, foreign languages, etc.) and were engaged in their workplace practice for four days each week. Following a design-based research approach, the third phase of the scenario was slightly modified for first-year students after its first implementation with second-year students (see details below). These modifications were conducted in consideration of students' behavior and the observations of both the researchers and the teachers at the school.

The first phase of the scenario, *writing and peer feedback*, was dedicated to the writing activity. Students recounted experiences in the workplace that were related to a specific professional competence: relationships with their patients for second-year students, and the act of washing a patient for first-year students. The teachers selected these topics as key competences participants are asked to acquire at these respective stages of the learning path. Participants were asked to write individually, on their personal page on the wiki site (see 2.3), about one critical situation they encountered in the workplace. In accordance with the critical-incidents technique (Flanagan, 1954; Schluter, Seaton, & Chaboyer, 2008), students were provided with instructions on how to describe the critical situation they encountered. More particularly, three guiding questions were proposed to the students: (1) What happened? (2) How did you react? (3) What were the consequences of this situation?

Next, every student was asked to comment on two peers' written productions. In order to avoid the potential difficulties of peer feedback for students not acquainted with the process (Kaufmann & Schunn, 2010), precise instructions and prompts were provided, guiding them in the process of producing constructive criticism and, later on, in the process of accepting and integrating the suggestions formulated by others. The instructions that were provided to them were the following: (1) formulate questions (King, 2007); (2) provide comments and suggestions; and (3) in cases in which they had a similar experience, they were asked to report that experience; otherwise, they were asked to reflect on how they would react in a similar situation (Kuhn, Shaw, & Felton, 1997).

To conclude this session, students were asked to return to their own wiki pages. They were instructed to: (1) reply to the questions formulated by their colleagues; (2) consider the comments and suggestions proposed by others and explain their perspectives on them; and (3) consider how they think they would react to a similar situation if they were to encounter it again.

In order to be able to distinguish the text written in the different moments of the activity, students were instructed to use different colors (Figure 2).

Episode reported by Diana (D), with comments from Melinda (M) and Fabio (F)

D1: "I am in charge of a schizophrenic patient living at home. I have to give her the medication she needs, but once the patient refused and threw them on the floor and she started acting in a very aggressive manner. She tries to get what she wants by threatening to jump out of the window, as she has already done. I tried to be strict, to reframe the situation, to talk to her with a firm but calm voice… nothing worked. The situation was so tense that I left the apartment. I was scared that she would hurt herself and that I would feel responsible for it."

M: What are the different approaches you tried with her?

D2: I tried to be strict, to reframe the situation, to talk to her with a firm but calm voice… I let her say what she wanted, shouting on me, hoping this would calm her, but it did not work.

M: Why does she need your assistance? To provide her with the medications? To wash her?

D2: She is schizophrenic and suffers from a cancer for which she has a very expensive treatment, which she is not able to follow on her own and she needs assistance for her personal hygiene.

F: Have you ever been scared while you were taking care of this patient?

D2: Yes, I did feel scared that she would hurt herself after my treatment and that I would feel responsible because of it.

F: Does this patient have a family?

D2: No, she does not, she is alone.

M: I think I would have reacted in the same way, trying to discuss with the patient, asking why she is so aggressive and what she feels when I come to take care of her. I think it is smart to make reference to the doctor, but why wouldn't you try to explain what the problems with her health are and therefore why she needs her medications? Always trying to avoid getting too close, in case she hits you.

F: I think I would have reacted in the same way, but also trying to get her family involved in the situation (if she has one), as well as the doctor. I would explain the effect of the treatment and try to have a closer contact with her. I would also try to find possible accommodations with the patient (e.g. she takes her medicine and you do not bother her with her toilette).

D2: We ask the doctor to help quite regularly. On the other hand, I would not like to use the accommodation system you suggest (if you do that, I don't bother you with that…) because she could take advantage of this behavior.What I will do is that I will try to explain her as much as I can her treatment and its importance for her health and that I am there for her, and if she refuses me, I will leave. When she will really need my help, she will ask me to go there.

Figure 2. Translation from French of the page of one student, including the critical incident (text in black), the two peers' comments (blue and red) and the conclusion, with answers to comments and questions (green).

The second phase of the scenario, class discussion, took place in a second session two weeks later. It was an oral discussion involving all participants, orchestrated by the teacher. Before this session, the teacher, in collaboration with the researchers, organized the episodes of the students in thematic clusters, which were discussed in class. The discussion was conducted with the objective of finding possible solutions to the critical situations reported by the learners. It was video-recorded.

The third phase of the scenario, *final text elaboration*, took place in a third session, and differed for first- and second-year students. Second-year students were asked to write and comment again on their pages and those of their colleagues, in light of what they had learned through the writing task and the oral discussion. As the students considered this activity too repetitive of what was done during the first two sessions, this phase was modified for first-year students.

In the new version of this activity, first-year students were provided with external resources (journal articles, book sections, and video excerpts) presenting interesting insights on the topics that emerged in their episodes and during the discussion. After reading and watching the material, they had to reconsider the topic discussed and draw new conclusions about how they could handle the situations described by them or their colleagues could be if encountered in their future practice.

2.3 Material

2.3.1. Pre- and post-test materials

Pre- and post-tests were administered to the learners before and after the implementation of the instructional activity. These evaluations included the following:

Competence test*:* A test to evaluate students' declarative understanding related to the professional procedure under analysis (see Appendix A for the pre-test administered to second-year students). The test included the description of one critical situation regarding the procedure under analysis: the *relationship with the patients* for second-year classes, and the *act of washing a patient* for first-year students. Each student had to select one of the seven possible reactions provided and answer two open questions (*explain why you chose this option,* and *explain what else should be done in this situation*). The pre- and post-tests presented two different cases to avoid learning effect, while they were structurally equivalent. These tests were co-designed with the teachers of the school, who ensured that the level of difficulty of the two situations were equivalent with the students' educational levels. For second-year students, the pre-test presented the case of an elderly patient with instable mood complaining of a headache, while the post-test referred to handling the relationship with a patient and her family, after the patient suffered an unanticipated problem and felt neglected.

The results of the competence test were composed of two different scores. A first score was assigned to the reaction selected by the learner in the multiple-choice question. The maximum score was 3, corresponding to the option describing a correct

reaction and all subsequent actions to be undertaken; a score of 2 was assigned for an option providing the correct reaction but missing one key element; 1 when the option was only partially correct and missed key elements; and 0 for an incorrect reaction.

Additionally, open questions were evaluated on the basis of a grid provided by the teachers, identifying eight key elements relevant to understanding the situation at hand and the actions to undertake. The researcher reviewed the texts written by the students and compared them to the grid, in order to count the number of key elements they identified in their answers (with a maximum score of 8). In order to verify the reliability of the analyses conducted on the open questions, two independent coders were asked to score the students' answers. Spearman inter-rater reliability was r = .863, (good agreement). The disagreements between the coders were resolved by consensus.

Self-efficacy beliefs questionnaire*:* This questionnaire was composed of 14 items on a 100-point continuous scale, evaluating three dimensions of self-efficacy: professional self-efficacy (covering various aspects of professional tasks), efficacy specific to the competence under analysis (*relationship with the patients* for second-year and *act of washing a patient* for the first-year students), and school related (covering various tasks associated with the school context). Appendix B presents the self-efficacy questionnaire administered to second-year students, both at the pre- and at the post-test. As the items in this questionnaire are very much specific to the profession of social and health care assistants, and to the specific procedure under analysis, the items were developed for this purpose following Bandura's guidelines (2006). The teachers co-designed these items, in order to make sure they were appropriate for the practical experience encountered by students in their workplaces. The reliability of the questionnaire, measured calculating Cronbach's alpha, was very high for all the dimensions analyzed: professional self-efficacy—5 items, pre-test α= .93, post-test α= .93; specific to professional procedure—5 items, pre-test α= .92, post-test α= .94; school-related—4 items, pre-test α= .87, post-test α= .94.

Subjective evaluation of the instructional scenario: Nineteen questions organized into 6 categories were designed to evaluate the students' perception of learning through the activity (4 items), perception of learning though the collaboration (3 items), appreciation of the activity (3 items), appreciation of the collaboration (4 items), appreciation of the wiki platform (3 items), and willingness to reuse it in the future (2 items). All these items were developed for the purpose of this research, as they asked very specific questions about the implementation of our activity in all its different aspects. Learners had to provide answers to the questionnaire using a 4-point Likert scale: (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree.

2.3.2. The computer-supported environment

The activity was conducted on *Wikispaces* (www.wikispaces.com), a wiki Web service targeted for educational purposes. Wikis are specifically designed to support collaborative writing, providing accessibility across space and time, capacity to create

hyperlinks and new pages, and capability to track all modifications and their authors (Parker & Chao, 2007). During the first session, each student received an individual account to access the platform. On the site, each learner had an individual page, named after him or her, which provided the space to write about his or her critical incident and receive peer comments and questions.

2.4 Procedure

A few weeks before the intervention started, the teachers who collaborated in the design and implementation of the activity, introduced the three sessions of the scenario, explaining the activities foreseen in the context of each section and their implementation. They introduced the researcher implementing the study (the first author of this paper), explaining that this activity was part of a university research project. Students' consent in participating in this study was obtained in this context.

During the session preceding the intervention, a forty-five minute pre-test session was conducted. The students were asked to complete the competence test and the self-efficacy questionnaire. Subsequently, the three sessions of the scenario were conducted, two weeks apart. Once the scenario had been fully implemented, one post-test session was conducted in which students were asked to fill out the second version of the competence test and the self-efficacy questionnaire, and their questions and impressions on the activity were collected.

3. Results

As second- and first-year students followed different instructional scenarios, results are presented separately for each class.

3.1 Competence test performance

As the data did not meet the condition regarding homogeneity of variance or normality of distribution, a non-parametric test for related samples (Wilcoxon-Signed Rank test Z) was used to compare students' scores at pre- and post-test.

3.1.1. Performance of second-year students

The performances of second-year students to the multiple-choice and open questions are reported in Table 1; the *n* does not correspond to the total number of participants, as only the students who participated in all the sessions where included in the analysis. The results showed no significant difference in the multiple-choice test scores between the pre- and the post-test ($Z = .612$, $p > .05$). As far as the open questions were concerned, there was a marginally significant difference between the pre- and the post-test ($Z = 1.854$, $p = .0684$), with higher scores in the post-test.

Table 1. Competence test results of second-year students (N=16)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Multiple-choice question (max =3)	2.31	1.25	2.56	0.52
Identification of key elements (max = 8)	3.13	0.96	3.75	1.34

3.1.2. Performance of first-year students

The results of first-year students are reported in Table 2. Regarding the multiple-choice question, there was a significant difference in the selection of the most appropriate reaction between the pre- and post-tests ($Z = 2.743$, $p < .05$). On the other hand, no significant difference was observed in the open questions between the pre and the post-test ($Z = 1.581$, $p > .05$).

Table 2. Competence test results of first-year students (n=12)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Multiple-choice question (max = 3)	0.25	0.87	1.50	0.67
Identification of key elements (max = 8)	3.67	1.16	4.42	1.17

3.2 Self-efficacy beliefs

The self-efficacy beliefs questionnaire evaluated three dimensions of students' perceptions of their abilities in performing a series of tasks: professional, specific to the procedure under analysis, and related to school. Results are displayed in Table 3 for second-year and Table 4 for first-year students. As the data did not meet the condition regarding homogeneity of variance or normality of distribution, a non-parametric test for related samples (*Wilcoxon-Signed Rank test*) was used to compare the scores at pre- and post-test.

3.2.1. Results of second-year students

There was no significant difference between the pre- and post-tests for any of the dimensions observed (*$Z = .450$, $p > .05$ across all dimensions*).

Table 3. Self-efficacy beliefs of second-year students (n = 18)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Professional	58.93	18.14	61.31	17.71
Specific to the procedure	70.57	22.97	71.34	20.30
School-related	67.49	16.96	68.99	21.08
Mean of all dimensions	64.72	17.40	66.56	18.27

3.2.2. Results of first-year students

The statistical analysis conducted on first-year students responses revealed a significant improvement in students' self-efficacy beliefs on every dimension measured through the questionnaire, in line with our expectation (professional self-efficacy: $Z = 2.934$, $p < .01$; specific to the procedure: $Z = 1.961$, $p < .05$; school related: $Z = 2.668$, $p < .01$).

Table 4. Self-efficacy beliefs of first-year students (n=11)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Professional	67.64	17.64	84.62	9.51
Specific to the procedure	82.48	16.70	92.83	7.00
School-related	76.82	20.11	92.11	9.15
Mean of all dimensions	76.19	17.28	90.21	7.64

3.3 Participation

Students' participation in the written tasks was evaluated through the mean number of words written by the students for each task in the first phase of the scenario (for both second- and first-year classes). Though the number of words does not take into account the meaning or the quality of the text, it can be used to estimate students' engagement in a task (Jermann & Dillenbourg, 2008). Student's participation in the oral discussion was estimated by counting the number of times each learner intervened in the discussion from the video captures of the class discussions. The data are presented in Table 5.

From an instructional point of view, the overall participation in the writing tasks (M = 545.15 for second-year students; M = 389.22 for first-year students), was considered highly satisfying by the researchers and the practitioners, considering the previous experiences of writing activities with students in this educational path. As

there was substantial difference in the scores of second- and first-year students, a between-subject ANOVA was conducted on participation in the three stages of the writing task. The ANOVA indicated that second-year students wrote significantly more to report their critical situation than first-year students, $F(1,32) = 11.123$, $p < .01$, partial eta-square = .258. In contrast, there was no difference for the peer comments, $F(1,32) = 2.561$, $p > .05$, or for the conclusion, $F(1,32) = .438$, $p > .05$.

Table 5. Participation in the writing tasks (mean number of words produced) and in the class discussion (mean number of interventions)

	Second-Year (N = 21)		First-Year (N = 13)	
	M	*SD*	*M*	*SD*
Critical incident	247.10	97.52	147.15	58.12
Peer comments	185.43	73.41	146.15	62.55
Conclusion	112.62	78.47	95.92	58.00
Intervention in the class discussion	6.59	5.87	11.40	5.77

Correlation analyses (Pearson Correlation) were conducted between participation data for the whole sample and competence test scores on the multiple-choice question at pre-test and post-test. First, there was a significant correlation between the number of words written in the critical incidents and the pre- and post-test scores (with pre-test score, $r = .584$, $p < .001$; with post-test score, $r = .459$, $p < .05$). However, there was no significant relation between the participation in the comments and the competence test scores, either at pre-test, $r = .255$; $p > .05$, or at post-test, $r = .124$, $p > .05$. Interestingly, there was a significant negative correlation between the length of the description of the critical incident in the first session and participation in the oral discussion in the classroom, $r = -.435$; $p < .05$.

3.4 Subjective evaluation of the activity

Table 6 reports the scores of first- and second-year students for the six dimensions evaluated (four-point Likert items). Even if the participants were only moderately convinced that they had learned much through the activity (mean scores below 3), all the other scores were above 3, showing participants appreciated the activity, particularly its collaborative dimension, and the wiki platform.

Table 6. Subjective evaluation of the activity by first-year and second-year students

	Year I (n = 23)		Year II (n = 11)	
	M	*SD*	*M*	*SD*
Learning through activity	2.77	0.70	2.71	0.52
Learning though collaboration	3.31	0.50	3.20	0.36
Appreciation activity	3.43	0.52	3.00	0.54
Appreciation collaboration	3.79	0.32	3.45	0.38
Appreciation wiki	3.53	0.46	3.17	0.58
Willingness to reuse wiki environment	3.40	0.43	3.10	0.49

4. Discussion and future directions

Writing can be a powerful instructional method to foster knowledge construction from an individual point of view (Galbraith, 1999), but is rarely used to foster discussion and collaborative knowledge construction (Scardamalia & Bereiter, 1994, 2006; Tynjälä, Häkkinen, & Hämäläinen, 2014). This study investigated the effectiveness of an instructional intervention involving writing about a critical workplace experience, peer commenting and class discussion in fostering the articulation of conceptual and practical knowledge, following Tynjälä's (2008) integrative pedagogy model.

4.1 Did the students learn from this intervention?

The first research question aimed at exploring whether this intervention would foster students' comprehensive understanding of the topic at hand, which should be reflected both in their capacity to solve a case-based competence test and in the self-efficacy beliefs of students regarding this topic. The results of the competence test at pre- and post-test partially met our expectations; while first-year students improved their ability to select the correct response to the multiple-choice question, second-year students had better results in their identification of the key elements of the situation (a marginally significant improvement). The differences between the two groups may be explained by the fact that first-year students still need to learn how to react in difficult circumstances, while their more experienced colleagues are already more capable of selecting the appropriate reaction, but may still need to refine their abilities to detail the reasons for their choices and anticipate future actions. The fact that second-year students wrote much more than first-year students to describe their critical situations may also be an indicator of higher expertise. In addition to the low sensitivity of the competence test score used in this study, the lack of substantial changes in performance could also be due to the relatively short intervention, particularly when conceptual understanding is involved (Bangert-Drowns et al., 2004).

Regarding self-efficacy beliefs, the results only partially confirmed our expectations. Self-efficacy beliefs improved over the sessions for first-year students on all dimensions, while there was no observable change for second-year students. As self-efficacy beliefs of students are normally developing as their expertise increases (Bandura, 2006; Renninger, Hidi & Krapp, 1992), it may be that second-year students had a more stable (and accurate) image of themselves, less subject to modifications and adjustments in similar settings. However, as there was a modification of the instructional scenario from its first implementation with second-year students to first-year students, the hypothesis that this modification had an impact on the results cannot be ruled out. Moreover, the fact that all dimensions of self-efficacy were improved for first-year students may simply be due to their normal professional development during the course of the intervention distributed over eight weeks.

4.2 Participation and subjective evaluation

While the outcomes measures were not fully conclusive, students' participation in the written tasks was quite substantial for all phases of the activity. Following the recommendations of Tynjälä et al. (2001) for the design of the writing activities resulted in an instructional scenario that was engaging for students, as evidenced by both the level of participation and the students' subjective evaluations. In addition, in accordance with Tynjälä's integrative pedagogy model (Tynjälä, 2008; Tynjälä & Gijbels, 2012), the collaborative phase was particularly appreciated. This reinforces the assumption that getting their peers' perspectives on a practical situation would broaden the students' understanding and help them to develop a more abstract view for further practice. Furthermore, there was a significant negative correlation between participation in the oral discussion and in the written description of the critical incident. Though this correlation across the whole sample should be considered with caution, it suggests that students who were at ease with the written communication format were not always as willing to discuss their professional practice during an oral session in the classroom, and vice versa. This finding provides support for the claim that a blend of oral and written exchanges and discussions represents the best option for the implementation of writing activities, in which all learners get involved and participate in the learning scenario (Tynjälä, 1998). However, contrary to what was found in a previous study (Authors, 2013), there was no correlation between the competence test score and the number of words produced in the peer commenting phase, while there was a significant correlation with the number of words written in the critical incident, both at pre- and post-test. One plausible interpretation is that the more able students wrote more detailed accounts of their critical situation. However, in addition to the fact that learning gains were minimal, another limitation is that simply counting the words learners wrote was too rough an estimation of their engagement. Taking into account the quality of the critical incident and the comments they wrote would provide a better picture of the students' engagement in the activity (Hämäläinen & De Wever, 2013).

4.3 Limitations

Conceived following a design-based research approach, this study presented some limitations. First, though it involved all students in the first and second years of study of the school, the sample remained limited (40 students, 2 teachers) for quantitative data analysis and generalization. Furthermore, the absence of a reasonably valid control group for this design study does not allow for the assertion that the changes observed in learning gains and self-efficacy beliefs were due to the intervention itself and not the other concurrent elements of their training. Even if they had no professional classes during the intervention, they were engaged in workplace internships. The second major limitation is that taking the intervention as a whole, it is not possible to disentangle the effects of writing and peer commenting from the effects of class discussion and teachers' interventions with new material and explanation. Though the study was conceived primarily to evaluate the effectiveness of the whole intervention, it was not possible to identify the critical instructional elements. Further analyses are currently being carried out on the written productions in order to characterize students' written productions and identify the conditions under which productive interactions occurred (Dillenbourg & Fisher, 2007; Hämäläinen & De Wever, 2013; Scanlon, 2011). A third limitation is related to the instruments used, and particularly the competence test. This case-based test was conceived ad hoc, with teachers, which ensures its authenticity and its validity within the school context but not its validity as a scientific instrument. The lack of an instrument to measure complex learning developed through meaningful writing activity, like the articulation between conceptual understanding and the capacity to behaviorally adapt to a practical situation, has been pointed out has one of the major bottlenecks of writing intervention studies by Tynjälä et al. (2001). Further research should address this issue in developing a set of different assessment tools, with quantitative and qualitative indicators, the reliability of which could be evaluated before the intervention.

4.4 Instructional recommendations

This design study provides encouraging results to recommend the use of instructional intervention combining individual writing with peer feedback, embedded in an authentic class situation, also involving discussions and teacher's feedback, when the objective is to help learners connect workplace and school settings in initial vocational education—and probably in any education track involving articulating conceptual and situated knowledge. Three recommendations can be raised from this study. First, as already evidenced in the collaborative learning literature, having students first work individually before exchanging is very engaging for students and probably more effective, too, since learners first organize their ideas through writing (Galbraith, 1999; 2009) before gaining from others' perspective (Scardamalia and Bereiter, 1994). Second, students engage in peer feedback in the form of written comments if the interaction is scaffolded using prompts that promote productive interactions, like asking questions, making suggestions, and encouraging connections to their own experiences

(King, 2007; Kuhn, Shaw, & Felton, 1997). Third, using simple web-based wiki environments provides benefits of computer affordances such as history tracking and revision and collaboration functionalities without overwhelming students and teachers with technical difficulties.

Future research will further investigate the type of interactions that emerge when using a combination of individual and collaborative writing activities, in order to design instructional methods grounded in a solid understanding of the mechanisms underlying the observed learning effects.

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Appendix A – Competence test

Situation

You are an apprentice health and social care assistant in your second year and are performing an internship in a retirement home. This morning, as every morning, you assist the distribution of breakfast to the patients and help those who need assistance. You awaken a ninety-year-old patient, who complains of a headache and says she feels very tired. You know this person, and you know that she has an instable mood and tends to complain very much.

1. Considering the situation described, **choose** the reaction you consider the most appropriate.
If needed, you can complete the missing parts of the responses.

1. You try and motivate the patient, encouraging her to react, explaining that everything will be fine, and that she should have a positive attitude in order to feel better. As she has stayed in bed all day, she should have the energy to wake up and eat. (0 pts)
2. You tell her that you will call a nurse or a doctor as soon as possible. (2 pts)
3. You tell her that you will come back after breakfast and will take the time to discuss the issue with her. (1 pt)
4. You explain to the patient that she should not worry about her headache, as many people are suffering from this problem due to the weather. You encourage her to have her breakfast, explaining that this will help in feeling better. (0 pts)
5. You don't pay attention to this episode, as you know that this patient complains very often. You tell her, in order to reassure her, that you will communicate her problem to a nurse. (0 pts)
6. You get worried because of this headache and you ask various questions to the patient to obtain additional information. You talk to her and formulate a hypothesis about the reason for her condition. (3 pts)
7. You decide to give this patient an analgesic, and afterwards you discuss with her in order to understand what is wrong. (0 pts)

2. Explain why you consider the chosen reaction the most appropriate in the given situation.

3. Explain what else you would do after this interaction with the patient.

List of key elements for the open-ended questions:

- Serious consideration of the symptom (regardless the tendency of the patient to complain);
- Questions to the patient in order to obtain all the information regarding her symptom;
- Declared Intention to verify the situation later in the day;
- Consideration of the feelings of the patient (reassure, etc.);
- Transmission of the information to the rest of the team taking care of the patient;
- Description of the health procedures adopted to take charge of the situation (measurement of blood pressure, temperature...);
- Consideration of providing an analgesic only after approval by another member of the health team (nurse, doctor, etc.);
- Consultation of the patient's history to identify similar symptom and treatments.

Appendix B - Self-efficacy questionnaire (year II)

Indicate your ability to perform the actions listed below on a scale from 0 to 100. 100 corresponds to the expertise of a professional with several years of experience, e.g., a person with whom you work with in your internship and who has several years of professional experience in the field of health and social care:

I can correctly perform all the tasks I am required to do in the workplace.	0	100
I can effectively handle all types of situations I encounter while performing my job.	0	100
I can effectively handle unforeseen situations while performing my job.	0	100
I master all the knowledge needed to perform the tasks I am required to do in the workplace.	0	100
I can efficiently perform my professional tasks with all types of patients.	0	100
I feel comfortable with all patients.	0	100
I manage to remain calm, even when patients are unpleasant to me.	0	100
I effectively handle my embarrassment due to the nudity of patients while I perform my professional duties.	0	100
I am able to listen to my patients, and I always try to understand their problems when I have the feeling that something is wrong.	0	100
I am able to talk to patients, make them comfortable, and reassure them when I have the feeling that something is wrong.	0	100

For the following items, use a scale from 0 to 100, in which 100 corresponds to teachers' requirements, therefore a note of 6 out of 6.

0 _____ 100

I am not able at all

I always meet teachers' requirements

I manage to concentrate during classes.	0 _____	100
I understand the concepts discussed in school and in the texts we read.	0 _____	100
I can effectively organize my work during classes and at home, even when I have several things to do.	0 _____	100
I can take notes effectively during classes	0 _____	100