

Computer-supported peer-commenting: A promising instructional method to promote skill development in vocational education

In vocational education, a challenging issue is to help apprentices build integrated knowledge from workplace training and school teaching. The present research proposes a learning design in which apprentices are required to write with a reciprocal peer-tutoring approach about situations they encountered on the workplace in order to help building such articulation. Two studies were conducted in order to investigate the effect of peer-commenting learning designs that were elaborated in close collaboration with teachers, on the basis of both theoretical assumptions and field specificities. The findings showed that in both studies, apprentices were able to provide useful comments, corrections and revisions to their peer's entries and that the productions significantly improved as a result of these interventions. Furthermore, apprentices found the writing activity useful for learning and enjoyable. These studies provided insightful information regarding the implementation of computer-supported writing activities that can actually foster professional skill acquisition and development. Moreover, they illustrate a concrete learning design that could be adapted to any vocational education level and subject matter.

Keywords – Instructional design, peer-tutoring, writing-to-learn, procedural knowledge, skill development

Introduction

In the Swiss vocational education and training system, the apprenticeship model is based on the so-called “dual”¹ system – existing similarly in the German and Austrian realities – primarily organised on the alternation between the work-based segment and the school-based segment². Generally, apprentices³ spend between 3 to 4 days in a company and the rest of the week at school, where they are exposed to general subject matters (like language and civics) and to more theoretical aspects.

This model foresees also a “third learning place”⁴: the additional training segment – known as “intercompany courses” or “industry courses” – as complement to the work-based and school-based segments if such addition training meets the needs of the occupational activity and designed to enable the transfer and acquisition of basic know-how (VPETA, art.23, para.1).

¹ For some historical mentions on the origins and development of the VET we refer to Wettstein (1994). For a comparison among the European VET systems, see Bonoli e Ghisla (2008).

² It has to be noticed that some full-time VET programmes also exist (in particular the middle school for the commerce sector, the nursing schools, and some specialisations in the hand-craft schools), above all in the French and Italian speaking part of Switzerland: in these cases the school-segment assume itself the role of the host company, thus providing specialised laboratories for the acquisition of the professional competences.

³ In order to avoid unpleasant repetitions, sometimes we will use “student”, “trainee”, “learner” as synonima of the most context-oriented “apprentice”.

⁴ That is why the model is also called “triad system”.

Roughly two-thirds (65%) of the young people coming out of lower-secondary school enrol in an upper secondary level VET programme, although a last-years tendency shows a decrease of enrolments for the combined school/work based VET programmes (the so called “dual” track)⁵, for the benefit of the increasing numbers in the general education.

Compared to other European education systems, Switzerland has nevertheless the highest proportion of students enrolled in the combined school/work-based variety (58.3%).

This research focuses on improving the articulation between those three learning places. Our motivation is fourfold. First, according to previous studies, “school knowledge” and “workplace knowledge” is often perceived as unrelated in cases where it should be (Filliettaz, de Saint Georges et Duc, 2008). Knowledge and skill transfer between school and workplace should be fostered (Eraut, 2004). Second, many professions have seen an increasing complexity since the last two decades and some of the required new competences could be better taught in classroom settings. Third, learners are better motivated when classroom teaching relates to real workplace problems (Brown, Collins, & Duguid, 1989). Fourth, professional experiences at the workplace can vary widely in content and quality even within the same professional branch (Filliettaz *et al.*, 2008). School activities should provide support that help apprentices articulate their collective experience across workplaces in order to build a global representation of the profession and to allow the development of a unique professional identity (Wenger, 1998). Given this overall perspective, the new Federal Act of 13 December 2002 on Vocational and Professional Education and Training (VPETA, 2004) requires collaboration between all actors.

The research reported took place within the general framework of the XXX project, whose objective is to use technologies to help bridging the gap existing across the different training places above mentioned (Tynjälä, 2008). Within XXX, computer technologies are

⁵ Switzerland experienced – from 1990 to 2006 - a decrease in enrolment in the combined school/work-based VET programmes of 7.2% (Bonoli, Ghisla, *op.cit.*, p.16).

used with an “integrative” approach (Dillenbourg and Jermann, 2007) and designed to support learning activities that are organized in the classroom (social interactions, problem solving, and procedure learning). Technologies are thus deployed (a) at the workplace to *capture* real experiences and (b) in the classroom for *exploiting* and *expanding* professional experience. The present studies specifically investigated whether computer-supported collaborative writing activities can foster the acquisition of professional knowledge by improving the articulation across school and workplace learning spaces. More practically, our goal is to identify the conditions under which such an articulation can occur in terms of pedagogical scenario and computer support.

Writing and the acquisition of professional knowledge

Professional skill development

Professional training mostly involves the development of skills, defined as a set of knowledge that enables the individual to perform his/her professional tasks. Professional skills include several components: declarative and conceptual knowledge, implicit sensory-motor skills, and strategic or meta-knowledge that enables reflection on action and subsequent regulation (Schön, 1983). These components develop over time, not only during training but constantly through work experience.

Procedural knowledge represents the knowledge that can be directly applied to a task, to perform it correctly. Nevertheless, the development of procedural knowledge over time does not necessarily result in better task performance, but changes the way the activity is performed, organized, and conceived. After the first stages of training, it is less the actual execution that evolves, than the strategy used to diagnose the situation state and to decide which behaviour to adopt. Procedural knowledge development typically involves three steps (Weill-Fassina & Pastré, 2004). First, novices learn to apply a definite set of rules according to typical situations. In the second stage, workers learn to distinguish between classes of

situations, particularly critical situations, and to behave accordingly. They form pragmatic “concepts”, in the sense that they are oriented toward an improvement of the action performed, and not towards a better comprehension of the situation. Ochanine (1981) found that experts formed “operative images”, which are simplified and biased representations of the objective situation, but are more relevant for the practice. For example, expert air traffic controllers typically under-estimate the distance between planes, which results in taking a larger security margin than strictly necessary (Bisseret, 1995). In the third stage, with the development of expertise, several operative concepts are formed and articulated, resulting in a more abstract representation of the task, which enables workers to handle efficiently a larger number of situations.

In the eighties, cognitive psychology, under the leadership of Anderson and colleagues (Anderson, 1982; 1993, 2000; Taatgen, N.A., Huss, D. & Anderson, J.R., 2008) got interested in real-life procedural knowledge acquisition. Anderson’s model of knowledge acquisition distinguishes between declarative and procedural components. Education only could provide declarative components. Procedural knowledge should be acquired by the compilation of declarative knowledge through practice and feedback. According to Anderson’s (1993) ACT-R model, procedure acquisition starts by processing the declarative representation of a performance example. With training, productions rules, which are first memorized as “if-then” declarative representations, get ‘compiled’ in the sense that they become executed in an automatic way. Such automation reduces the level of attention necessary to perform the task, thus freeing up some cognitive resources for reflection on higher levels of the activity. On the negative side, apprentices become less able to explicit their behaviour. Moreover, they should stay sufficiently aware of critical elements of the situation (Anderson, 2008) in order to detect incidents and correct them in time.

Professional skill mastery is definitely anchored in a real context. However, we may argue that some aspects of its development - particularly conceptualisations - were better trained in a place where time is taken to reflect on the action after the fact, to compare situations and confront alternative courses of actions. By reflecting on his/her own actions, the apprentice becomes more aware of his/her activity and more capable of regulation (Schön, 1983).

How to foster procedural knowledge acquisition at school?

Several methods are used to promote the conceptual and strategic aspect of skill development. They usually include confrontation with a simulated or the real activity (videotaped for example), in tutored or collective situations (Mollo & Falzon, 2004). Though these methods are currently used in workplace or continuing education, when integrated in classroom activities they are often time consuming, designed for a small number of apprentices and rather difficult to conciliate with the set of topics pre-defined in the curriculum. In order to respond to some of these class implementation issues, we propose to use a peer-tutoring approach (Wolfe, Fantuzzo & Wolfe, 1986) in which each apprentice in turn reacts on other's propositions or actions. Reciprocal peer tutoring allows each student to reap the benefits of preparing to teach another student. It creates mutual assistance and social support among participants (Fantuzzo, Riggio, Connelly & Dimeff, 1989; Pigott et al., 1986).

Writing and knowledge acquisition

In workplace training, confrontation and reflection is usually conducted through oral verbalization. However, this would be more difficult to manage in school situations, in which a written explanation would be easier to follow and regulate for teachers. Writing activities in the classroom are often used to clarify or to elaborate new ideas, following the "writing-to-learn" approach. From a cognitive perspective, Hayes and Flower (1980) first claimed that the production of written text might foster learning since it involves the production of a message

based on domain knowledge. Domain knowledge should be "recovered", reorganized and incorporated into a linear form, a message understandable to someone else. Bereiter and Scardamalia (1987) distinguished two writing strategy levels. On the first level - "knowledge telling" strategy - the writer formulate ideas as they are recovered in long-term memory. On the second level - knowledge transforming strategy - the writer can reorganise the content retrieved in memory according to writing instruction criteria and pragmatic rhetoric. Galbraith (1999) added a third level - "knowledge constitution", - to emphasize the creative side of writing. According to his model, the emergence of an idea is linked to a pattern of activation in a body of knowledge. The same body of knowledge could lead to the emergence of different ideas, if the patterns of activation of this package are different. From an instructional perspective, Tynjälä, Mason and Lonka (2001) suggest that writing can be a useful and effective tool to facilitate domain knowledge learning under certain conditions. In the vocational training context, two conditions are particularly important. First, the writing tasks should encourage students to reflect on their own experiences, conceptualize and theorize them. Second, writing activities should be oriented toward understanding and solving practical issues.

In this research, we propose a learning design in which apprentices are asked to write about situations they encountered in the workplace, from the specific point of view of the course considered, and with a reciprocal peer-tutoring approach. Produced texts should be readable and comprehensible to the peer apprentices. According to the concept of audience design, individuals who take into consideration their potential readers get higher quality texts (Flowers, 1979). Taking into account the reader's point of view promotes elaborate writing strategies and reflexive attitude towards the content (Baudrit, 2005). Up to now, little research has investigated the effects of peer tutoring for "writing to learn" activities (Gielen, Dochy, Tops, Peeters, 2007).

Presentation of the studies, general research questions and infrastructure

This paper presents two studies investigating learning designs where apprentices from two different professional fields are asked to write collaboratively about professional procedures based on their workplace experiences, using tools such as blog and wiki in order to allow a peer assisted writing approach.

The two studies share the same theoretical and conceptual framework, thus hypothesise that collaborative writing about professional contents could foster professional competences.

Within this common background, differences between the studies are nevertheless identifiable above all for what concerns the activities conducted and the professional procedures considered. This is mainly due to the fact that the professional fields of the two studies presented are very different and the design of the activities forced us to adapt to the characteristics of the sample and of their curriculum (in terms of professional contents).

Moreover, in the spirit of DBR, we had to take into consideration the teachers' requirement, integrating them in the general framework. Additionally, as the project itself foresees different studies to generalise previous results on heterogeneous professional fields, we kept the strong basis of the design, but we also tried to exploit the subsequent experiences from a methodological point of view: that's why, for example, we used mainly the same scales, but we also sometimes inserted new elements not present in the previous tests.

Specific details with contextual and demographical information on each of the two studies will be given in the corresponding paragraphs.

The first study took place in Geneva and involved dental care apprentices attending a three-year “dual” apprenticeship program. The second study has been conducted with commercial employee⁶ apprentices in the Canton of Ticino⁷. In both cases, we designed and

⁶ A commercial employee holds an activity service-oriented in the field of management and economics processes. His/Her professional field covers internal and external customer care and consulting, as well as specific administrative procedures. See the competence profile and regulations on OPET (Swiss Federal Office for Professional Education and Training) Website at:

studied in-class computer-supported peer writing activities. In these professional profiles, there are highly differentiated working experiences and a high chance to share and compare professional experiences. Moreover, concerning commercial employees of all the six different branches, characterising the commercial working reality, seemed to be a remarkable opportunity and challenge to foster professional identity.

Instruments

To support collaborative writing-to-learn and knowledge building activities, the ELGG “social software” platform (www.elgg.org) was selected. It offers functionalities like: blog, comments, document management system, community building (sharing of relationships), RSS-feeds and profile-definition. Some initial adaptations to the platform were implemented and particularly, the interface was simplified and a wiki tool (mediawiki) was integrated. The wiki allows multi-user writing and rewriting and keeps a history of all user interventions.

Preliminary observations

As premise of the learning activities conducted in the studies and in order to evaluate the apprentices’ attitude towards writing and writing with a computer, we first administrated a questionnaire to Geneva students that is based on the “Writing Apprehension Scale” (Daly & Miler, 1975) and the “Writing with a Computer Scale” (Shaver, 1990). In order to evaluate ICT literacy, the PISA ICT familiarity scale (OECD, 2005) was administrated in Ticino.

The Daly & Miler “Writing Apprehension Scale” is a well known survey measuring participants’ attitude towards writing in general. In this study we referred to its two dimensions the apprehension towards the writing act per se and the apprehension towards the written production being evaluated. Moreover, because of our computer supported learning

http://www.bbt.admin.ch/bvz/grundbildung/index.html?lang=de&detail=1&typ=efz_all&item=566&abfragen=F_ormulare+una+richiesta (Last retrieved: July, 13th, 2010).

⁷ Switzerland is made up of 26 states known as Cantons. They are the states that originally united in 1848 to form the Confederation, to which they each relinquished part of their sovereignty. (See: <http://www.admin.ch/org/polit/index.html?lang=en>). Ticino is the Italian language speaking Canton, which forms the Italian Speaking region of Switzerland together with some valleys in the Graubünden Canton.

designs, we were not only interested in students' attitude towards writing but in their attitude towards computer writing. In order to evaluate this dimension we used the "Writing with a Computer Scale" (Shaver, 1990) and we took into consideration its two dimensions: "enjoyability of computer writing" and perceived "usefulness of computer writing".

The ICT familiarity questionnaire, an optional instrument in the 2006 Programme for International Student Assessment (PISA), consists of questions covering two main ICT-related areas: 1. use of ICT, meaning students' experience with computers at different locations and frequency of ICT use for different purposes, and 2. affective responses to ICT, meaning confidence in carrying out ICT-related tasks (OECD, 2009).

The writing apprehension scale showed that most of the tested dental apprentices do not apprehend writing activities (16 out of 25). Seven students showed a low level of apprehension and only two a high level of apprehension. The results from the apprehension scale towards writing with a computer showed mostly positive attitudes. We also found that the students appreciate the enjoyability of computer writing more than its usefulness. These results indicate good feasibility of introducing writing activities.

Concerning the PISA ICT familiarity scale, which explores the apprentices' technological competences and frequency in using different kind of technology – especially computers – the main figures show that 92.8% of our commercial employees sample use computers almost every day, and 62.3% for 5 years or more. The perceived level of computer literacy is very high. They feel very confident with several tasks, and especially with those focused on writing (to write and send e-mails - 98.6%, to chat online - 98.5%, to use a word processor - 94.1%).

To sum up, both populations have a positive relationship towards writing, writing with a computer, and with the computer itself in general.

General research questions and working hypothesis

The fundamental working hypothesis of the research project is that shared writing activities about professional experience can improve the apprentice's domain knowledge and skills, help them integrate the contents studied at school with the actual practice at the workplace contributing to professional identity building. In other words, peer commenting and revising of textual production would improve textual quality, but also foster knowledge confrontation and self-regulation and, ultimately, be beneficial to professional knowledge and procedure acquisition. This working hypothesis is re-formulated as a general research question: can computer-supported collaborative writing activities foster the acquisition of professional knowledge, and, if so, under which conditions in terms of pedagogical scenario and computer support? The following conjecture map (Figure 1) has been used to synthesise our research questions in terms of relationships among theoretical inputs, scenario design, foreseen intervening processes and desired outcomes.

(Figure 1)

Figure 1 - Conjecture map describing the theoretical conjectures, design decisions and expected outcomes for the two studies reported in this paper

Study 1: Peer-commenting on faulty x-rays

The first study took place in the dental care assistant school in Geneva, where two classes per each of the three school years of the curriculum are trained, each class containing between 10 and 15 students. The study explored the following hypotheses:

- First, peer tutoring writing activities will foster reflexive and epistemic regulation processes. Consequently, the formal and content text quality should improve over time.
- Second, a peer tutoring approach promoting peer-regulation, should decrease the teachers' tutoring load.
- Third, such activities, dealing with workplace knowledge, should be well perceived and accepted by apprentices.

Context and participants

Participants were 22 third year students of the above mentioned school, all women between 18 and 22 years old, with a heterogeneous background. They participated in the study as a regular class activity of their curriculum, in two groups.

Design

For this study we used 14 faulty digitalised x-rays that we placed in the wiki of the ELGG platform. The activity was a part of a dentistry core course on radiology. The purpose was to improve student's knowledge on dental x-rays, by making them describe the photographic and technical quality of an x-ray and provide an explanation as well as a solution for the deficiencies identified. At the beginning the students worked individually. Each of them had to comment on a different radiological image in the ELGG platform's wiki. The wiki pages were prepared in advance by the research team in collaboration with the teacher. Apprentices had to fill in a table with four columns (see Figure 2).

(Figure 2)

Figure 2 – Screenshot of an exercise wiki sheet

The first column contained the X-ray to be commented and the following three contained a scaffolding question each. Apprentices first had to describe the image (*identification*, second column), then to indicate the mistake in the radiography procedure that produced the bad cliché (*interpretation*, third column). In the second phase, the teacher projected and discussed each entry with the class and indicated the mistakes apprentices did in their descriptions and interpretations of the X-rays. In the third phase, every entry was “corrected” or completed by a peer colleague taking into account her own experience and the teacher's previous comments. In the fourth phase the peer had to write a procedural “solution” in order to solve the problem of the cliché (*pertinent use of the indices and regulation*, fourth

column). A last teacher correction took place at the end of the class and this final knowledge repository could then serve the students to prepare the exam.

At the end of the class we administered a subjective evaluation questionnaire in order to gather more information about three dimensions: the students' perceived learning (6 questions), satisfaction with the lesson (7 questions) and opinion on the wiki (4 questions). Each question was measured on a 4-point scale (1= totally agree, 4= totally disagree).

Data analysis

The effect of the instructional treatment was evaluated by counting peers' and teacher's interventions. By interventions we refer to the content *corrections*, *completions* and *lexical changes* that the texts might have suffered. By *corrections* we mean every content suppression and/or replacement with a different element of answer. We coded as *completions* every piece of added information to the entry without previous suppression. *Lexical changes* refer only to formal and lexical changes.

To measure the design acceptance, we looked at the results of our post-activity questionnaire, taking into account the scores on each of the three dimensions.

Results

In order to evaluate the interventions in the texts we looked at the previously mentioned criteria (*corrections*, *completions* and *lexical changes*) by quantifying the interventions with regard to the author (teacher or peer). We measured these criteria on a four point scale (0 = no intervention; 1 = light intervention, i.e. 1 item changed; 2 = medium intervention, i.e. 2 to 3 items; 3 = large intervention, i.e. more than three items).

Based on these criteria, the productions were analysed by 2 independent judges. The concordance between judges was significant for all of the evaluations (Pearson correlation, for the peer intervention on the first task, $r = .477$; for the peer intervention on the second task $r = .692$; for the teacher intervention on the first task, $r = .853$; for teacher intervention on the

second task $r = .747$; and finally for the teacher intervention on the third task, $r = .894$, all $p <.05$.

Using independent samples t-tests, we analysed the differences between total peer and teacher's interventions on the first two tasks. Levene's homogeneity test for the peer-teacher intervention revealed equal variances for the two tasks (0.001 , $df=30$, $p=0.9$; respectively 0.419 , $df=30$, $p=0.52$). For the first task (problem identification) peer intervention was significantly more important than teacher's intervention ($t(30)=2.13$, $p<.05$). For the second task (indices interpretation) the difference was still significant ($t(30)=4.1$, $p<.01$).

(Table 1)

Table 1 – Means and standard deviations of peers' and teacher's interventions on the first and second task (0=no intervention; 1=light intervention; 2=medium intervention; 3=large intervention).

We then compared the teacher's intervention on the third task with his previous interventions (on the first two tasks where he intervened after peer intervention). Paired samples t-test indicated a significant difference between the amount of interventions needed on the third task compared to the second task ($t(9)=-2.37$; $p<.05$) (see Table 2).

(Table 2)

Table 2 – Means and standard deviations of teacher's interventions on the second and third task

Response items of the subjective evaluation questionnaire ranged between 1 (completely agree) to 4 (completely disagree). The analysis revealed positive attitudes at all three levels (perceived learning: $M=1.76$, $SD=0.38$; satisfaction with the lesson: $M=1.57$, $SD=0.29$; opinion on the wiki; $M=1.3$, $SD=0.47$).

(Table 3)

Table 3 – Means and standard deviations for the three dimensions of the subjective evaluation questionnaire

Discussion of study 1

This study was carried out to collect information about apprentices' attitude towards writing as well as first data on the effect of peer-assisted writing designs in vocational education. The findings showed that apprentices have rather positive attitudes towards writing and that they considered computer supported collaborative writing about professional procedures useful and pleasant.

Moreover, from an instructional point of view, the results of the activity were encouraging showing that peer interventions were useful for text improvement and that teacher interventions were less important if they came after previous peer intervention.

Following this encouraging preliminary study, a second study investigated the effect of a similar instructional design with different apprentices and on a longer time frame.

Study 2: long term implementation with commercial employees

The second study has been conducted in the commercial sector, as a first transfer to a different professional field and as generalisation of the results obtained in the first study. The general working hypothesis of this study remains the same: collaborative writing about professional procedures including a peer tutoring approach should have a positive impact in terms of knowledge building and professional knowledge acquisition. In particular, we focused on (a) the effects of the commenting and revising process on the quality of the text, and (b) the apprentices' perceived effectiveness of such activities on learning.

Context and Participants

The study conducted involved 29 Commercial Employees apprentices belonging to two different groups: the first one (ARAF – Associazione della Rete di Aziende Formatici) includes a seven people group of second-year apprentices attending different schools in Canton Ticino. The second one (1CEA) is a normal first year class of commercial employees composed of 22 apprentices, attending the school in Locarno.

Design

We exploited the collaboration among the school and the professional association and then monitored a more longitudinal experience, with a longer-term structure. The whole design has been divided into different scenarios, thus providing the possibility to adopt both the commenting process (in the blog, as in the scenario 1) and the revision one (in the wiki space, as in the scenarios 2 and 3⁸).

The overall activity developed foreseen collaborative writing tasks that could foster the reflection about the apprentices' professional practices. More precisely, the activities were structured on two (repeated) different learning scenarios, both – on their turn – based on three main phases: in *a first phase* the apprentice writes her/his starting text about a specific professional practice and task (*procedure*) he/she lived at the workplace (about a job-ambit or a specific activity, e.g. the management of the phone call at the workplace); *the second phase*⁹ foresees that this text is commented or revised¹⁰ several times by a peer or by the teacher in order to obtain some hints, suggestions or to add personal professional experiences. In the last phase, the author considers the comments or revisions made by peers and teachers, integrating them in a final text (*third phase*) to be published in the blog or in the wiki space.

Data Analysis

For what specifically concerns the analysis of the text produced, we measured the effects of the revisions and comments on the quality of the text, using a modified SSQS (Six Subgroup Quality Scale; Ransdell & Levy, 1996). We evaluated the starting and the final texts collected in the platform using a 1 to 5 scale (1=very poor, 5=very good) per each of the following variable: V1 (*richness of details and opinions*), V3 (*style correctness*), V4 (*grammatical and*

⁸ The design was common for the scenarios 2 and 3, being centred on same revising activity; the only difference concerns the sample considered: ARAF group in scenario 2, while 1CEA class in scenario 3.

⁹ The process, having at our disposal nearly a full school year, was iterative, so that in some cases we had more than one phase of comments or revisions.

¹⁰ The revision process is mainly referred to the wiki space, where peers and teachers review the starting text directly; the commenting process, on the contrary, is mainly referred to the blog, where peers and teachers add separated comments related to the starting text.

syntactical correctness) and V5 (*comments impact*); these were judged by two independent evaluators, whereas the variable concerning the *professional exactness* (V2) was evaluated by the teachers involved in the project. Each starting and final textual productions were evaluated on the basis of these variables, allowing evaluations of the *results*; applying the same procedure to comments and revisions and at their integration level, we could have also an evaluation of the *process* itself.

The concordance between judges was significant for all of the ratings (Spearman correlations, ranging: for the quality of the final texts from $r_s = .479$ in scenario 2 and $r_s = .551$ in scenario 3; to $r_s = .825$ in scenario 3 for the quality of the comments and $r_s = .852$ in scenario 2 for the quality of the starting text, all $p < .05$).

Finally, to measure the perceived effectiveness of the activities and their impact on learning, we submitted a post-activity questionnaire, asking the apprentices about the pleasure, the usefulness and the possibility of learn perceived in the activities.

Results

Evaluation of the textual production. The overall quality and the quality evaluated per each variable have a positive trend in all the three scenarios analysed¹¹: the overall quality of the final text is always higher than the starting one (see Figure 3). The most evident increase is nearly always for the variable concerning the professional exactness¹².

For Scenario 3 ($N = 15$)¹³, statistical analysis (Wilcoxon Signed Ranks Test) of the ratings given to the starting and final texts showed that the quality of the final texts ($Mdn = 4.63$), resulting from the integration of revisions made by peers, is significantly higher than the quality of the starting texts ($Mdn = 4.34$, $z = -3.41$, $p < .01$, $r = -.62$). Further analysis of the data indicated that the scores for the richness of ideas/details/opinions (V1) are

¹¹ Taken into account the small size of the ARAF group, we generally speak about trend. Concerning the 1CEA, statistical analysis follows.

¹² The third variable (V3) about the pertinence of the text regarding the guidelines, has not been calculated in the overall computing, as the guidelines varied from scenario to scenario

¹³ This is the number of valid cases on the total of the 22 apprentices of the 1CEA class.

significantly higher for the final texts ($Mdn = 4.75$) than for the starting texts ($Mdn = 4.5$, $z = -3.07$, $p < .01$, $r = -.56$). The ratings regarding professional exactness (V2) are also significantly higher for the final texts ($Mdn = 4.00$) than for the starting texts ($Mdn = 3.00$, $z = -3.07$, $p < .01$, $r = -.56$). In contrast to the significant findings for the content oriented text characteristics (V1, V2), the changes concerning the formal aspects of the texts (V4 - style/tone correctness, V5 - grammatical/syntactical correctness) are not significant ($p > .05$).

(Figure 3)

Figure 3 - Evaluation flow (starting and final text), per each variable and overall average, in the three scenarios.

Evaluation of the comments and revisions. For what concerns the process, an evaluation of the quality of the comments and revisions and of the level of their integration in the final text have been calculated.

The evaluation of the comments and revisions quality has been calculated through a 1-5 scale (1=very poor, 5=very good), considering the mean of the all comments made. In order to evaluate the overall quality of the comments, we considered 4 different categories of comments: hints, corrections, ideas and personal experiences. The evaluation for the two groups is very positive, having an overall mean of 4.66 for ARAF and 4.54 for 1CEA (SD respectively of 0.46 and 0.45).

The integration level of the comments and revisions by the authors has been calculated on the same scale too, considering, per each single comment/revision, to what extent the author has considered and integrated comments or revisions provided. The average evaluation of this integration level for all the comments/revisions is positive too with a 4.57 mean for 1CEA and 4.29 for ARAF.

Perceived effectiveness on learning. Concerning the agreeableness, apprentices like nearly at the same way to write and to be read about professional experiences lived at the workplace (respectively 54.6% and 52.2% agree or strongly agree, with 27.3/ and 21.7% of

“uncertain” answers), but 78% of them agreed or strongly agreed on the statement “I like reading experiences written by peers lived at the workplace”.

Moreover, the 83% agree or strongly agree with the fact that “describing my vocational experiences and reading the peers’ ones, let me reflect”; and the 65% agree or strongly agree with the fact that it is useful to describe one own professional experiences and read the peers’ ones. More generally the perceived effect on learning and professional performances is positive: the mean of 61% of the apprentices agree or strongly agree with the items proposed.

Discussion of study 2

This preliminary study allowed us to have a more deepened knowledge of (a) the apprentices’ positive attitude towards writing and in particular writing with a computer and (b) of their positive perception of the writing and reading about professional experiences.

On the other hand, the increase in the quality of the texts cannot be related with statistical significance to the quality of the comments ($p(ARAF)=.435$, $p(1CEA)=.365$).

Synthesis and perspectives

Synthesis of the findings

Our first assumption was that learning design dealing with real workplace experience and a reciprocal peer tutoring approach would be well accepted by apprentices. In line with previous research, we found that in both studies, apprentices reported positive evaluation of writing activities and perceived subsequent learning. In the second study, a question that specifically asked apprentices to state their perception of writing activities involving workplace learning received positive rating, and very positive when the peers were involved in the writing. Therefore, from a mere motivational point of view, such activities are quite worth receiving attention to foster workplace-related skill development.

Our second assumption was that peer writing is an effective instructional method since apprentices can bring forth relevant experiences they encounter at the workplace, confront and discuss them with their peers and teachers. Findings of both studies showed that apprentices were indeed capable of reacting and commenting their peer production. In the first study, peer interventions in the text considerably increased the text quality and decreased the number of teacher's needed interventions. In the second study, peer comments were not only evaluated as relevant, but also they were very often integrated in the apprentices' final text. Consequently, the text significantly improved in quality over time, regarding richness of ideas and professional accuracy, and not regarding linguistic accuracy. These findings comforted the assumption that, as intended, such peer-writing activities involving workplace experience favoured professional oriented knowledge development, and not basic academic writing skills.

Lessons learned and open issues

From a theoretical point of view, this research reinforced the literature on the powerful effect of writing as a tool for learning subject matter (Galbraith, 1999), and not only as a tool for evaluating learners knowledge. Following Tynjälä et al. (2001) recommendations, we found that, in vocational education and training (VET), writing activities which involved the resolution of practical issues based on abstract knowledge, and that required reflexive thinking on apprentices own experiences, were of particular relevance.

In the learning design tested, collaboration was not implemented as joint text production, but rather in peer commenting or in peer assisted writing. Collaborative writing was already suggested as a mean to foster confrontation and enrichment of points of view (Scardamalia and Bereiter, 1994). In VET, confronting mutual experience is particularly important since the training received may vary widely depending on the working context (size of the company, kind of equipment, specific core-business, etc.) Rather than an obstacle to

learning, variety of workplace training becomes a powerful instructional lever (Filliettaz et al., 2008). Confrontation of points, resolution of concrete issues and complementary experiences favour the development of meta-knowledge that enable reflection on action and regulation of one's activity (Schön, 1983).

Though an improvement was observed in text quality after peer comments, this research did not find relation between the quality of comments and text improvement. Beside methodological considerations (few participants and comments), the relation between comments and text improvement involves subtle mediation effect. Comments are supposed to foster a reflective attitude towards one's experience, which doesn't necessary mean that it will be "translated" in the text in a clear and measurable way. Moreover, in the learning design tested, all apprentices produced and received comments, so that the effect of *receiving* comments could not be separated from the effect of *giving* comments. Future research should try to disentangle these possible confounding effects in controlled settings.

Limits and future studies

The studies reported here represent first implementations of a learning design based on previous research and field observations. The samples of apprentices participating in these studies, though from different vocational and linguistic contexts, were very limited in number, not allowing for advanced statistical analyses. Moreover, the interventions were integrated in real classroom activities, thus ensuring a high level of ecological validity, but did not allow for controlled manipulations. Future studies will involve a larger sample of apprentices and a control group, in order to assess that the improvement is not due to standard knowledge growth over time.

Having the VET context and the present results, two future research themes rise. Due to contextual constraints we could not compare the effect of commenting with the effect of direct revision from peers. Moreover apprentices' interventions were always scaffolded but

we did not yet take into consideration the effect of these scaffolding questions. It would be interesting to know what types of scaffolding support best for deep knowledge processing in writing activities, and subsequently learning. These two research topics would help refine the central design elements of collaborative computer supported writing activities in VET in order to promote effective learning.

Conclusion

The present studies investigated the learning effectiveness of peer assisted writing about workplace experience for reuse and elaboration in VET school setting. As the findings of the first studies were encouraging, future research will investigate the implications of commenting, correcting, and scaffolding peer intervention, using both controlled studies and long term implementations. The findings obtained in the present studies provide useful information to identify the conditions under which peer-supported writing designs are effective, and they contribute to the theoretical foundation of writing to learn.

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