Acceptance of an Augmented Reality system as a visualization tool for Computer-Aided Design classes

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Summary

This paper presents a study conducted with nineteen students from the Technical University of Catalonia. The study examines user experience and acceptance of an Augmented Reality (AR) system as a visualization tool for Computer-Aided Design (CAD) classes. Although results showed that AR does not improve the learning of CAD techniques, students mentioned that they would find it useful and interesting to continue using AR in CAD lectures. They said that AR helps them to easily understand the forms and volumes of objects and better comprehend the location of objects in the space and its relations with others.

Keywords

Augmented Reality; CAD; Design

Introduction

We present in this paper the results of an experiment with students where we’ve tested whether Augmented Reality can enhance the teaching of Computer-Aided Design (CAD) techniques by letting the students visualize and interact with their designs in a more intuitive way. In our experiment, nine students on the CAD course used an Augmented Reality (AR) system to visualize and interact with their designs, whilst the other ten students used traditional forms of visualization. They then all answered a questionnaire.
Augmented Reality refers to a system in which the physical surroundings of a person are mixed with interactive real-time computer generated information, which results in an enhanced perception of the surrounding environment (Azuma, 1997; Azuma, 2001; Bonsor, 2001).

Traditionally, Computer-Aided Design is limited to 3D visualization in virtual environments. Until now it was necessary to use a virtual representation of the real world if we wanted to analyze how the CAD objects would fit in the place they are being designed for. The main advantage of the proposed AR system is that students can actually see how the three dimensional objects they are designing will fit in its appropriate real space.

**Experiment**

The participants of our experiment were 19 students from a CAD subject in the Technical University of Catalonia. During the course semester the students learned some CAD techniques with the SolidWorks software. The students were given the option to develop their final projects using the traditional form of visualization (rendering on the computer screen) or using the Augmented Reality system. Nine students showed interest for the AR approach and ten chose to work with the traditional method.

The AR system used in our experiment was a Monitor based video see-through system (Azuma, 1997) with a Firewire DV camera to capture the images. We prefer monitor based visualization instead of traditional AR Head Mounted Displays. Our previous tests with Head Mounted Displays showed that they are too cumbersome and uncomfortable to use and they don’t deliver good image quality.

Video see-through AR systems are based on accurate tracking of real objects. We used the ARToolKit (ARToolKit) library which can calculate the position and orientation of a camera relative to square fiducial markers. Some modifications were made to the ARToolKit in order to allow users to change position and orientation of virtual objects relative to the markers at run time.

Our goal was to test the impact of Augmented Reality as a visualization tool. Thus, different from other approaches, our system didn’t allow immersive modeling. The students created their designs with the SolidWorks, exported them to the VRML (VRML) format and then imported them to the AR system. If they found that their designs needed modifications they would edit them with the SolidWorks and export again to the AR system. The students were allowed to visit the AR Lab and use the AR system as much as they wanted during a period of one week.

In the proposed exercise the students were asked to design add-ons (e.g. keyboards, speakers, screens, etc) to a multimedia kiosk, see Figure 1. At the end of the semester all students handed their projects and answered a questionnaire. The questionnaire consisted of 25 questions grouped in 5 topics (Figure 2). The questions were the same for all students and they should answer them based on the visualization method used.
**Figure 1**: Students testing their virtual add-ons to a multimedia kiosk.

<table>
<thead>
<tr>
<th>PROCESS</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
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<tbody>
<tr>
<td>1. The time to complete the design was enough</td>
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<td>2. It was easy to detect errors in the design</td>
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<td>3. The process to obtain a realistic image of the design was simple</td>
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<td>4. The technique makes team work easier</td>
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<td>5. The technique improves the design process</td>
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<th>RESULT</th>
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<td>6. The result represents with effectiveness the colors and textures of the object</td>
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<td>7. The result represents with effectiveness the proportions of the object</td>
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<td>8. The result represents with effectiveness the volume of the object</td>
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<td>9. The result represents with effectiveness the form of the object</td>
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<td>10. The technique improves the design result</td>
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</table>
### PRESENTATION AND/OR COMMUNICATION
11. The technique allows to communicate with effectiveness the characteristics of the designed object
12. The technique makes the explanation of the object of work easier
13. The technique improves the communication between the client and the designer
14. The technique improves the communication in the work team
15. The technique makes the presentation of the result easier

### LEARNING
16. The technique is easy to use
17. The technique makes the understanding of forms and volumes easier
18. The technique makes easier the location of objects in the space and its relation with others
19. Makes easier the understanding of CAD techniques (SolidWorks)
20. Improves the learning of design techniques

### ABOUT THE EXPERIMENT
21. The method facilitates the understanding of the experiment
22. The technology (software and hardware) is adequate
23. The experiment was well explained
24. The experiment had the desired result
25. It is convenient to use this technique in the teaching of the subject

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree.

**Figure 2**: Questionnaire.

### Results and Discussion

Although results showed that the use of AR itself does not improve the learning of CAD techniques (see Figure 3), students indicated that it is convenient and interesting to continue using AR in the teaching of the CAD subject because AR does help in the overall process of creating their designs. They said that AR allows them to better understand and locate their objects in space and facilitates the detection of errors in the design.
General results of the experiment clearly show the acceptance of the AR approach. AR was better rated in all categories except one: Process. This is understandable since the students were already used to visualizing their designs on the screen and, on the other hand, they were experimenting AR for the first time. The Process category had questions related to the time needed to finish the design and the simplicity of the visualization process.

Below, we can see a summary of the aspects in which each method performed better:

**Traditional Method**
- Simplicity of the process to obtain a realistic image
- Colors and textures well represented
- Improves design result
• Less time to finish the design
• Communicates with effectiveness the characteristics of the designed object
• Makes easier the understanding of CAD techniques (SolidWorks)
• Improves the learning of design techniques

Augmented Reality

• Easier to detect errors
• Makes the explanation of the object of work easier
• Makes the presentation of the result easier
• Improves the communication between client and designer
• Improves the communication in the work team
• Improves design process
• Forms well represented
• Volumes well represented
• Proportions well represented
• Easy to use
• Makes the understanding of forms and volumes easier
• Makes easier the location of objects in the space and its relation with others

When the Design perspective was considered, Augmented Reality really performed better than the traditional method showing its great potential in this area. Among other things, students believe that AR can improve the communication in the work team and between client and designer.

We believe that two of the aspects where AR was outperformed (time to finish the design and simplicity of the process to obtain a realistic image) are related to the fact that students lost time exporting their designs from the SolidWorks and then importing them into the AR system. If the system allowed immersive modeling they wouldn’t lose time, but besides the efforts being done today, it is still not possible for an AR system to allow the same level of modeling sophistication as a CAD system does. Augmented Reality was also outperformed in the aspect of colors and textures representation, this is also related to the relative loss of quality in the process of exporting the design into a VRML file.

It is interesting that students pointed that AR improves design process but not design result when compared to the traditional method. We think this is due to the fact that students believe they can reach the same design result without AR, but with AR the process to get there can be better.

Conclusion

We’ve presented in this paper an experiment made with 19 CAD students about the acceptance of an Augmented Reality system as a visualization tool in CAD classes.
We used a Monitor based video see-through system with a Firewire DV camera. Different from other approaches, our system did not allow immersive modeling. Although many efforts have been made in this direction by the scientific community, AR immersive modeling systems still do not match the sophistication of today’s CAD software. In our experiment, we tried to take advantage of both CAD sophisticated modeling and AR visualization aptitude. Nevertheless, this approach has the inconvenience of some loss of time and quality in the export/import process.

We believe that the use of AR in CAD teaching is really a step forward. Even though we found that AR does not improve the learning of the CAD subjects the results made clear that AR can improve the CAD classes. Students pointed that among other things AR helps to detect errors in design, improves the communication in the work team and makes easier the presentation of the results. As we expected, some problems were also pointed and this tells us where improvements should be made to the AR system.

On the other hand, the results showed that AR has great potential for improving the design process. Technologies such as Computer-Aided Design (CAD) and Virtual Reality (VR) have already made their way into design and development procedures, we believe that Augmented Reality will be the next technology arriving to assist designers.

The evaluation of a product design usually involves a demonstration of the designer’s work. The visualization should convincingly demonstrate that the design fits both spatially and aesthetically into its environment. Design visualization is very important to the communication and shared perception of designs and is essential for meaningful design development and collaborations. To convey this information one normally builds physical scale models or mock-ups. We believe that by using AR, users could interact with the design objects in a more natural way, perceive and comprehend the design features easily, and better judge the visual impact of the finished design. In this context we are planning a new experiment, this time with professional designers, to evaluate this theory.

References


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Strategic Teaching in a Virtual Context: A Study on Tutor Training in Continuing Education

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Summary

Adult students who start a distance-studying program need to develop a strategic learning that allows them to adapt themselves to the demands of distance education and achieve their learning goals successfully. The tutor becomes a fundamental factor when it comes to facilitating these students’ adaptation process to distance studying as well as the development of their strategic learning. In this article it is present a qualitative study on the training process of a group of tutors in strategic distance teaching and learning; it is also presented the analysis of the changes generated in them regarding conceptual and strategic knowledge, both in an academic (as students in the course) and a professional (as tutors) level. Results point out that those tutors who managed to develop higher levels as strategic learners during the training course, accordingly developed a bigger conceptual knowledge and a better performance as strategic tutors.

Keywords

Distance education; Tutorship; Teacher training; Strategic Learning; Distance studying skills; Strategic teaching

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INTRODUCTION

Nowadays, the modality of distance education is recognized as a valid option for permanent development since it offers an evident number of advantages for adult people’s learning, such as the flexibility in organizing one’s study time and space, or the possibility of combining other working or personal activities. However, these same adults, as students, are not always prepared to successfully face the modality of distance study. Regarding this problem, we consider that educational psychology should provide theoretical and empirical answers about the process of distance learning, which should be based on a psychopedagogical model that goes beyond the technological aspect.

This research is set on a socio-constructivist approach over the processes of distance teaching and learning (Ally, 2004; Barberá et al., 2001). This approach is centered on the student and his/her processes of personal and collaborative learning through communication and interaction mediated by the materials, the tutor and the classmates (Duart y Sangrà, 2000; Hirumi, 2002; y Perez i Garcias, 2002, Onrubia, 2005). Likewise, this study includes the strategic learning approach in distance education, which is understood as a conscious and intentional decision taking process. Moreover, the students are supposed to perform this decision taking process over what knowledge and procedure to select and execute in order to reach the learning goals, taking into consideration the personal conditions of the tasks and the circumstances in which the process of teaching-learning is developed, in particular those related to distance education.

The main focus of our research is the tutor and his/her formation. The importance of the tutor’s role in distance education cannot be refuted since he/she is the real architect of the successful learner’s adaptation to this learning modality. In this respect, it is crucial the need of forming these tutors in strategic distance learning and teaching areas.

This study consisted of the design and development of a training course for university tutors about “Strategic distance education and learning” in a virtual context, and the analysis of the changes experienced by each tutor academically (as learners) and professionally (as tutors).

This research tried to respond to the following three needs present in the process of distance education and learning: the convenience of having a student with specific learning strategies for distance learning; the existing methods to teach these learning strategies and the tutor’s formation so that he/she could acquire those methods and employ them adequately. Now we’ll briefly analyze each one of these aspects:

a) The first need emerges once when facing the difficulties that adult students experience in this modality since it implies a new learning experience not only because of its own peculiar features, but also because it implies a return to the student’s role for the active professional, in parallel with his/her daily activities (Östlund, B, 2005).

Studies such as those developed by Karsenti, Larose & Núñez (2002) and Brown & Voltz (2005) approached the study of the difficulties experienced by students when entering into a virtual formative
process, identifying the student’s own lack of autonomy and self-direction as the major problems; that is, their difficulty in managing their own learning.

In this line of research, we acknowledge the need for the development of various skills in distance learners. Among these we highlight metacognitive skills, whose main dimensions are: self-knowledge and knowledge of strategies, together with the knowledge of the tasks, and learning programs and goals (White, 1999, Land, 2000; Shrum, 2002; Garrison, 2005; Richardson, & Newby, T., 2005; Coll, 2005).

Several studies focused on the definition of the characteristics or skills that students should have in order to succeed in distance education have stressed that self-regulated learning is a desirable function not only for students, but also for teachers and staff members (Ardí & Boaz, 1997; Eastmond, 1995 in Paulsen, 2003).

Therefore, in order to succeed in this modality the adult student must become a strategic learner capable of self-regulating his/her own learning process, developing favorable attitudes, as well as organizational and study planning skills; understanding, analyzing and interpreting the information; managing of new information and communication technologies; communicating and interacting for a collaborative learning, all these with responsibility and autonomy.

b) From the socio-cultural constructivism, the need for “someone” to teach learning strategies is identified because we understand distance learning as an interactive process, not a solitary one. Therefore, it is necessary that tutors provide a set of rules that allow students to develop the skills and strategies they need for distance study.

The interaction with the tutor is a significant factor (Valenta et al., 2001) in helping distance students to be able to plan, supervise and assess their own studying activities due to “a set of guidelines, indications and criteria that were once taught by their teachers and now accompany and help them in their learning processes” (Monereo, 2001, p. 2).

Studies on the tutoring in distance education are addressed to identify its general roles and functions as well as those focused on moderating collaborative learning environments (García Aretio, 1999, Charlier, 2000, Adell & Sales, 2002, Anderson, 2004; Silva Qiroz, 2004; Salmon, 2000; Collison, 2000; Xiaojing et al, 2005). Nevertheless, studies about the tutor’s role at providing pedagogical assistance for strategic distance learning are still very few.

With the conviction that the tutor’s role is genuinely relevant, a diagnostic research was performed (Del Mastro, 2001) about pedagogical assistance given via tutorship in order to develop the strategic learning of students of two Second Specialty Diploma courses, which were offered by the department of Education of the Pontificia Universidad Católica del Perú. These courses were addressed to in-service teachers.

This research revealed that tutors acknowledged the students’ adaptation to this specific modality as part of their job, but in practical terms, they did not completely develop the procedural and strategic
aspects needed for this adaptation. Besides, the spaces of presential tutoring were given priority and the technological tools for interaction between tutor and students were not employed as expected.

c) The third and last necessity is tutors’ training conceptually and methodologically in the field of strategic e-learning and e-education. This training must be based on a continuing teacher training approach of reflection and action (Shön, 1994). This approach should be oriented toward the development of significant mutual relationships between academic and professional knowledge. That is, between theoretical concepts (academic, conceptual, declarative knowledge), their practical application (professional knowledge), and the reflection upon one’s own action both as an apprentice and a teacher (strategic academic and professional knowledge, respectively) (Pérez Cabani, 2000).

Most research about distance education and e-learning related teacher training are more focused on the technological aspect of this issue than on how students could build up their learning in situations mediated by tutors and technological devices (Blanton, Moorman & Trathen, 1998; Moore, 2001 in Sigalés, 2001). Nevertheless, some teachers’ training experiences (Monereo & Badía, 2004) and online constructivist training programs for teachers (Gold, 2001) are valuable precedents of training processes with a solid theoretical foundation for the teachers’ formation in learning and education strategies.

RESEARCH DESIGN

Objectives

The training course about strategic distance learning and teaching was aimed to have teacher-tutors experience, as learners, the formation process of virtual distance modality (e-learning, e-teaching), by means of reflection and being aware of their role in the disposition and provision of pedagogical help, so their students may benefit from more strategic teaching and learning.

Concerning the aims of this research, the following objectives and analytical units were formulated:

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>ANALYTICAL UNITS</th>
<th>ANALYTICAL LEVELS</th>
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<tbody>
<tr>
<td>Characterizing the tutors’ and students’ previous conceptions as a starting point of the formation process in a virtual environment.</td>
<td>1. Previous conceptions.</td>
<td>• Students’ previous experiences • Tutors’ previous experiences</td>
</tr>
<tr>
<td>Identifying and characterizing the interaction formats: demands and assistance during the teaching-learning of the formation course.</td>
<td>2. Interaction formats during the formation process.</td>
<td>• Virtual interactions • Presential interactions • Feedback</td>
</tr>
<tr>
<td>Identifying the main changes that have taken place in every tutor’s speech and practice in their own course (academic context).</td>
<td>3. Changes in every tutor regarding the academic context (speech and practice).</td>
<td>• Conceptual knowledge • Procedural knowledge • Strategic knowledge</td>
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<td>OBJECTIVES</td>
<td>ANALYTICAL UNITS</td>
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<tr>
<td>Identifying the main changes that have taken place in every tutor's speech and practice in his performance as a teacher and a tutor (professional context).</td>
<td>4. Changes in every tutor regarding the academic context (speech and practice).</td>
<td>• Planned assistance • Applied assistance</td>
</tr>
<tr>
<td>Identifying the methodological devices present during the formation, which have influenced in the production of the tutors' changes</td>
<td>5. Methodological devices that have influenced in the production of changes during the formation.</td>
<td>• Tutor – trainer tutor interaction • Communication from the tutor trainer • Interaction between tutors • Interaction contents/activities-tutor</td>
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**Method**

The methodology employed was the case study through recorded sources (audio, electronic documents, and video) and the consecutive qualitative analysis of the interactions that occurred before, during and after the tutors’ formation process. The computing program used for data processing and analysis of the qualitative data was Atlas-ti 4.2.

Based on a careful reading of the data in each unit and analytical levels, some representative statements were identified, selected and registered in “descriptive” specific categories. Later, these specific categories were grouped in families of “interpretative” general categories. In order to establish the validity and reliability of the categories, an agreement among judges technique was employed. A sample of categories and documents were randomly delivered to be categorized, using a blind technique. After this, all the revised categories were compared for the judges to observe similarities and differences. All the categories that obtained a good score in the Kappa’s index were maintained. The fuzzy categories were eliminated and those evasive categories were recategorized by consensus.

a) Participants

The sample of participating tutors in the formation course was selective. There were 6 female tutors from three Second Specialty Diploma Programs of the Department of Education at the Pontifica Universidad Católica del Perú: all of them were active tutors in the first semester of the career. All of them had studied education and had graduated in various specialties; furthermore, they had experience as teachers or assistant teachers in an expositive format, as well as some hours of tutorial duties.

b) Training course and Visual support

The procedure used was the course of virtual formation, which was developed through a web page specifically designed under the constructivist principles of learning. Access to the course was done
through the Virtual Campus – PUCP; e-mail and a forum were also used as communication and interaction tools.

The course was organized in three didactic sequences. Each unit included a group of 3-4 texts and an individual reading guideline, as well as a collaborative or individual activity, as shown in Table 2.

<table>
<thead>
<tr>
<th>DIDACTIC SEQUENCE</th>
<th>READINGS</th>
<th>TASKS</th>
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</table>
| THEMATIC UNIT 1: CONCEPTIONS AND ROLES IN DISTANCE TEACHING AND LEARNING. | 1. Distance Teaching and Learning  
2. The Student’s Role  
3. The Teacher-Tutor’s Role | Reading Guideline 1  
Activity 1:  
• Forum “The Tutor’s Role” |
| THEMATIC UNIT 2: STRATEGIC LEARNING IN DISTANCE EDUCATION | 4. Study process and distance learning  
5. What are learning strategies  
6. Strategic learning in distance education | Reading Guideline 2  
Activity 2:  
• Analysis of strategic learning cases: individually and by pairs  
• Forum 2 on case analysis |
| THEMATIC UNIT 3: STRATEGIC TEACHING IN DISTANCE EDUCATION | 7. Conceptions about the teaching of strategies  
8. Objectives and instances of Strategic Teaching  
9. Methodology for the teaching of strategies  
10. Planning and provision of pedagogical assistance | Reading guideline 3  
Activity 3:  
• Design of strategic teaching and learning activities |

From a didactic point of view, the sequence of the three thematic units was based on the fundamental principles of strategic teaching, the constructivist virtual environments, and the formation of teachers and distance tutors (Pozo & Monereo, 1999, Jonassen, 1999; Monereo & Barberá, 2000; Putnam & Borko, 2000; Prendergast, G., 2003).

- Moving from implicit theories about distance tutoring and learning toward explicit, conscious and verbalized concepts. Tutors’ previous conceptions were registered in an initial interview (before) and these were compared to the expressed conceptions in the learning activities of each unit (during) and the final conceptions expressed in an interview and a final questionnaire (after).
- Experience vividly the course as a strategic learner in order to transfer strategic learning to strategic teaching. During the course, strategic reading activities and metacognitive analysis performed by tutors, as learners, were registered. Later, their (planned and executed) actions as strategic tutors were also recorded.
- Progressively giving up the control and regulation of strategies from external control and regulation toward self-control and self-regulation of the learning process. The progressive session of control was mainly conducted by the reading guidelines of each thematic unit.
During the first one, very directive indications about reading strategies were offered. In the second one, a lined support was presented, and in the third one was self-directed.

- Moving from social mediation in collaborative learning spaces toward the internalization of knowledge. The learning activities of the first unit promoted the social interaction among the whole group, in the second unit, there were paired-work activities, and in the third one, an individual activity was proposed.

c) Procedure

In order to achieve the research objectives, the procedure carried out was organized across the following phases:

**PHASE 1**

- Previous selection of the sample
  - Initial contacts with institutional authorities
  - Program design
  - Simple selection
  - Beginning of the Course

**PHASE 2**

- Design of the training course
  - Definition of units and levels of análisis
  - Design of inicial interviews
  - Preparation of recording of tutorial actions
  - Inicial interviews with tutors and participants
  - Design of the training course and web page of the course

**PHASE 3**

- Development of the course
  - Recording of training actions in audio and electronic documents
  - Recording of Teacher tutor - Tutor interactions
  - Recording of tutoring activities (tutor-participants)
  - Interview and final questionnaire
RESULTS AND DISCUSSION

1. FIRST UNIT OF ANALYSIS: STUDENTS AND TUTORS' PREVIOUS EXPERIENCES AND CONCEPTIONS

The information about the first unit was obtained through the focal interview with a group of 12 former students about their experiences as students in the modality (graph 1), a focal interview of the tutors and individual interviews with each tutor about his/her previous conceptions.
As you can see in the graphic, the main difficulties found in the distance students during their initial study process were: time management, organization and planning when and how to study. Moreover, they were confused about the conditions and demands of the learning tasks since they admitted that they did not know how to react to a new learning experience. A mismatch between their initial expectations of commitment and effort and the real demands of the distance study was observed. Besides, students do not recognize that they received explicit help from their tutor so they could adapt themselves to the modality and face the experienced difficulties.

These results confirm the students’ need to develop developing learning strategies so they can learn to identify the learning goals and become aware of their personal, learning task-related, distance-education-related conditions. Otherwise, they experience this process in isolation and as a “discovery”, adapting to this modality by means of a “trial and error” method. This way, they expose themselves to have more failed than successful experiences.

Regarding the female tutors’ previous conceptions, they admit fundamental features of distance modality, such as non-presentiality, flexibility and a greater accessibility. There is lack of clarity and depth in their conceptions about the studying process and learning strategies in the modality. Nevertheless, as shown in graph 2, a very precise practical knowledge about the students’ needs and difficulties is observed, but they do not point out experiences or proposals to improve this situation via tutorship.

**Graph 2**

**FEMALE TUTORS’ PREVIOUS CONCEPTIONS: STUDYING PROCESS**
LEARNING STRATEGIES IN DISTANCE EDUCATION

Students and female tutors’ previous conceptions and experiences show a distance education approach as an “independent” studying process in which the tutor’s role is either passive or reactive to the students’ eventual inquiries. A small degree of tutor’s proactivity restricted to spaces where the student is present has been observed, as well as a lack of conceptual management and practical experience in the field of strategic distance teaching and the tutor’s role. All this corroborates the need of a formation of female tutors in both conceptual and methodological levels in the field of strategic learning and teaching in a virtual context, and from a more constructive, interactive and communicative learning approach.

2. SECOND UNIT OF ANALYSIS: FORMATS OF INTERACTION DURING THE FORMATION PROCESS

Virtual interactions:

The tutor trainer’s general messages (planned and sent to all female tutors) were oriented toward the development of the group’s strategic knowledge: guiding time organization, orienting the forum participation, guiding the learning activities and promoting metacognitive analysis. The tutor trainer sent guidelines to develop these activities (to promote strategic learning and awareness about the goals and sequence of the activities). These messages were basically unidirectional because they responded to the female tutors’ difficulties to assume progressively the management of their own cooperative learning spaces. Nevertheless, the tutor trainer did not promote a more bi-directional, interactive dialog to benefit a collective search for the sense and meaning of the activities.

Also, the tutor trainer performed a more personalized monitoring and interaction, through individual messages that were adjusted to the three interaction styles identified in the female tutors: independent, communicative and strategic.

a) The independent interactions belong to female tutors 2 and 3 who employed the e-mail to send activities and information about the difficulties found to be sent on time. In these cases, the tutors did not ask for help to the tutor trainer and showed a low level of metacognitive analysis to detect and communicate their difficulties during the learning process. At this level, the tutor trainer used the e-mail space solely for the distribution of learning activities and her respective feedback.

b) The communicative interactions belong to the female tutors 4 and 5 that reported advances or limitations of their studying process, as well as the difficulties that they found along the way. Nevertheless, and despite the constant communication (either after their own initiative or to reply the tutor trainer’s messages), they did not request specific help in due time, showing limitations at the level of awareness and decision-making to solve problems. In such cases, the tutor trainer performed a personal monitoring in order to obtain information about the female tutors’ advances and studying process. Although the tutor trainer did not solve specific doubts or difficulties, she possibly facilitated the female tutors’ time organization.
c) The strategic interactions were assumed by the female tutors 1 and 5, and they were focused on requesting help from the tutor trainer in order to solve specific problems that emerged during the learning process, as well as to report the respective advances. These actions show the awareness of their own difficulties or doubts and their capacity to make decisions and seek solutions or aids via e-mail. Meanwhile, the tutor trainer sent more strategic messages whenever there was a bi-directional communication concerning the doubts addressed by the female tutors, so they could be helped in their studying process.

In general, e-mail was not employed to clarify, broaden or deepen the knowledge but to inform about specific issues, communicate difficulties or solve doubts. However, given the fact that e-mail was used during the course, this influenced its later incorporation in planned and applied tutorial actions.

On the other hand, the use of the forum as a space for virtual interaction was not enough exploited during the formation course. The female tutors showed difficulties regarding its use and the access frequency was low. The forum space was employed as another task to be made by giving an answer as participation. However, the forum did not work as an interactive space to share and build meanings in a collaborative way. As shown in Table 5, most of the interventions were unidirectional, and in some cases interactive, but very few were genuinely collaborative.

**Table 6**

**LEVELS OF INTERACTION AT THE FORUM AND COLLABORATIVE ACTIVITIES**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Female tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unidirectional: They communicate their contribution but do not take others’ ideas into account</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Interactive communication: they take others’ ideas into account during their interventions</td>
<td>1, 3 and 4</td>
</tr>
<tr>
<td>3</td>
<td>Collaborative work: they integrate ideas with others</td>
<td>5 and 6</td>
</tr>
</tbody>
</table>

The tutor trainer’s moderating role was oriented to picking up each she-tutor’s main efforts and encourages their participation. A more active communication was achieved when the questions got more open-ended, motivating and related to practical experience. Knowledge and experimentation of the forum’s tool allowed she-tutors to use them more extensively in their courses.

**Presential interactions:**

Besides, the tutor trainer convened some presential meetings in which she tracked the group’s progresses and scheduled dates and deadlines for the course’s delivery. Also, she clarified conceptual and procedural contents, using examples for that.

These sessions helped she-tutors become aware of and assess their main achievements and difficulties during the distance study process and concerning their own tutorial work. There was also a comparison between the contents exposed in the course and their tutorial practice, in which they discussed the changes that were just getting incorporated into their work.
Feedback:

The tutor trainer, through the feedback on the activities and the e-sending of additional notes, carried out a unidirectional, unsynchronic communication. She not only did perceive or point out mistakes in the she-tutors’ performances, but also she sought to promote new learning, by specifying concepts and by relating the learned income to their practical application at the tutorial work or their individual study process. There were two levels of feedback (Table 7).

Table 7
EXAMPLES OF INTERACTIONS IN THE FORUM ABOUT THE TUTOR TRAINER’S ROLE

| T01 | I think the tutor trainer should fulfill a function, as T07 mentioned in the case analysis 1 “proactive”, that is, a person that could anticipate her participants’ difficulties during the learning process and not to wait the participants to realize about them in order to solve them. Sometimes, the tutor trainer only answered doubts and inquiries. Otherwise, the tutor trainer should be a dynamic agent of the little learning community in which she is a part of. She should orient, facilitate, and emotionally support but also generate interaction and communication spaces among all the participants. As a mainly motivating agent, the tutor trainer should promote awareness processes about their own participants’ abilities and design strategies and resources to be applied (…). |
| T06 | When we talked about an interactive approach in distance education, I think we are in a specific position to define the tutor’s role since it is not only an observer of the student’s learning process, waiting for questions, doubts or inquiries made by the students who study in an autonomous way. The tutor trainer is continuously participating in the process mentioned before, its main role is to mediate between the contents and the student, the tutor facilitates the students’ reflection, new questions about the contents and everything that helps the participants’ learning process (that it was only made with the materials). There is a special stress in relation to this function: the possibility of creating interaction among students in order to promote debates and group actions toward a collaborative learning, in parallel with the self-learning. |
| T07 | What is shown in the materials (…) and commented by T06 and T01, the tutor’s role from an interactive approach in distance education requires interaction, communication, bidirectional dialog as Holmberg stated but with a series of additional resources needed in the student’s learning process and the means he/she uses. Somewhere I read about the interactive nature of the multimedia means and they make more demands to take advantage of the technology as a way to promote educational processes of more quality. The quality as a concept has changed in the history of distance education (…) Well, we will see you. |

The moderator role was oriented to rescue the main contributions of each female tutor and encourage participation. A more interactive communication in the group was achieved when the questions of the Forum were more open and related to practical experience. The knowledge and experimentation of the forum were employed by the tutors in later courses.

Presence interactions

The tutor trainer organized some meetings in which she monitored the advances of the group and developed dates and deadlines for the course advance. Likewise, she clarified conceptual and procedural contents and oriented with examples.

These sessions favored the tutors’ awareness and assessment of their own main achievements and difficulties during the study distance process and their tutorial work. Similarly, they contrasted the contents developed in the course with their tutorial practice and shared the changes they included in their labor.
Feedback:

The tutor trainer developed a unidirectional and asynchronous communication through the feedback of activities and sending notes in the margin. Not only the achievements were confirmed or mistakes in the tutors’ performance pointed out, but also new ways of learning were promoted by specifying concepts or relating what was learned with its practical application in their tutorial work or personal study process. Two levels were identified in feedback (Table 8).

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Congratulates and points out the achievements in the first unit as well as clarifies the sense of the activity of question.</td>
<td>2 y 3</td>
</tr>
<tr>
<td>2</td>
<td>Congratulates and points out the achievements during the three units / promotes the relationship with the practice.</td>
<td>1, 4, 5 y 6</td>
</tr>
</tbody>
</table>

These guidelines and comments were received by each tutor via e-mail, but they failed to generate a subsequent interaction that might guarantee an improvement in learning and the assimilation of the tutor trainer’s suggestions into each tutor’s work; the exceptions were tutors 1 and 6, who formulated questions (either via e-mail or in a context where tutors were present) in order to seek further clarification.

3. THIRD UNIT OF ANALYSIS: CHANGES IN THE ACADEMIC CONTEXT (as learners)

Changes in conceptual knowledge

The change in the conceptual knowledge was based on the comparison between tutors’ previous implicit theories and conceptions, identified in an earlier interview before the course development and the concepts, more explicit, conscious and verbalizable, observed in the forum participation were the development of reading guidelines and a final questionnaire. Three levels of conceptual change in the three main notions of the course were observed: tutor’s role, strategic learning and strategic teaching.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>States information about the topic</td>
<td>2 and 3</td>
</tr>
<tr>
<td>2</td>
<td>Explains and establishes concepts</td>
<td>4 and 5</td>
</tr>
<tr>
<td>3</td>
<td>Explicitly acknowledges a conceptual change</td>
<td>1 and 6</td>
</tr>
</tbody>
</table>

The social interaction (specially through forums) and the execution of all the activities proposed in the strategic reading guides, all of them contributed to the change in the conceptual knowledge.

In the forum that turned out to be the most interactive (Unit 1) (see table 7), a major change in the conceptual knowledge about the tutor’s role in the distance education was observed. Therefore, the social interaction and the exchange of meanings with their classmates favored the change.
Furthermore, the tutors improved their conceptual understanding when they discussed their conceptual doubts with their classmates or tutor trainer and received explanations.

Finally, the tutors who followed the complete sequence of control transfer proposed in the Reading Guides achieved conceptual changes, more conscious and verbalizable, in the three main notions. This fact could be explained because of a major level of internalization.

Table 10
EXAMPLE OF CONCEPTUAL CHANGE ABOUT STRATEGIC LEARNING (UNIT 2)

<table>
<thead>
<tr>
<th>BEFORE (Initial Interview)</th>
<th>DURING (Guide 2)</th>
<th>AFTER (Final Questionnaire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategies depend on the students, they should have them before. The strategies do not depend on the tutor.</td>
<td>Conceptual clarity about learning strategies, characteristics, and metacognition.</td>
<td>Identifies changes in her conception about learning strategies. Recognizes the importance and necessity of the development of a strategic learning in the students.</td>
</tr>
</tbody>
</table>

• They are mechanisms, procedures, and techniques that participants employ to understand specific contents to process them so as to collect the relevant information and create knowledge. The participants are not usually conscious about them or they have a low level of development of strategies. Along the process, they discover their own potentials and foster them.

• I would wish the students to have the strategies developed or master them and not to have difficulties but when this does not occur, they become despaired.

• Particularly, I think it is important to identify the differences between autonomous and independent learning, as mentioned in text 1, any learning is conditioned somehow by external factors and agents, and this is not isolated but personal and embedded into interactive processes and relationships (…)

• A second relevant aspect was the opportunity to deepen in the concept of metacognition and its importance in the development of strategic learning.

• Being conscious and valuing their own capacities, the procedures we usually employ are indispensable to clarify what, when, and why of learning

• Before I had the idea that learning strategies were individual, now I mean each person uses a certain amount of them and tutorship functions are not to develop or rediscover them.

• The idea of strategic learning as a process of decision-making in order to build new knowledge where to want, to be able and to know how to learn interact.

• I perceive the users of distance courses with more possibilities of developing complex cognitive processes, who are able to recognize their own learning abilities and conditions. Thus, they will generate new knowledge (…). But, above all, they are able to learn strategically, that is, to incorporate kinds of knowledge they have built themselves; moreover, they apply specific learning strategies in concordance with the nature and purpose of the study process.

Some tutors experienced difficulties to understand the concept of strategic learning and strategic teaching. The units related to these concepts did not include social interaction activities. Besides, activities and reading guides of these units demanded more autonomy for their production. These data
showed that some tutors needed more social interaction and external control in guides 2 and 3 since
they presented difficulties in the tutors’ autonomous development.

**Changes in strategic knowledge:**

These changes were recorded mainly in the strategic learning and metacognitive analysis.

- To identify the changes in the strategic reading, the development of reading strategies “before,
during and after” in guides of each unit was analyzed. Regarding strategic reading, four levels
were identified:

<table>
<thead>
<tr>
<th>Table 11</th>
<th>LEVELS OF STRATEGIC READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Description</td>
</tr>
<tr>
<td>0</td>
<td>Answers questions only “after” (female tutors 5 and 6)</td>
</tr>
<tr>
<td>1</td>
<td>External control: develops questions proposed before, during and after the session (female tutor 2)</td>
</tr>
<tr>
<td>2</td>
<td>Intermediate control: takes into account guidelines during and after the session</td>
</tr>
<tr>
<td>3</td>
<td>Self-control: develops their own reading guide before, during and after the session</td>
</tr>
</tbody>
</table>

At the highest level, a transition from an externally guided reading (reading guide 1) to a more
strategic self-controlled and self-regulated reading (reading guide 3) was noticed. This was feasible
when all proposed activities in the reading guides 1, 2 and 3 were developed, following a sequence of
progressive concession of control on the strategies before and after the reading session.

- The changes in the metacognitive analysis were observed in the answers to the questions of
the reading guides, the final questionnaire and the final interview. The changes were the
awareness and communication of the main achievements and difficulties during the study and
learning process, as well as the search and application of solutions. These changes were
noticed in three levels:

<table>
<thead>
<tr>
<th>Table 12</th>
<th>LEVELS OF METACOGNITIVE ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Description</td>
</tr>
<tr>
<td>1</td>
<td>Analysis only at the end: answers questions from the final questionnaire and interview</td>
</tr>
<tr>
<td>2</td>
<td>Analysis in one unit and at the end</td>
</tr>
<tr>
<td>3</td>
<td>Analysis in more than one unit and at the end</td>
</tr>
</tbody>
</table>

In the table 13, an example of level 3 of metacognitive analysis can be observed. In this case, the
tutor analyzes her difficulties along the course and during the study process, and proposes solutions to
improve it.
Table 13
EXAMPLE OF DEVELOPMENT OF METACOGNITIVE ANALYSIS DURING THE COURSE

<table>
<thead>
<tr>
<th>MOMENT</th>
<th>IN READING GUIDE 1</th>
<th>IN READING GUIDES 2 AND 3</th>
<th>IN THE QUESTIONNAIRE AND THE FINAL INTERVIEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing difficulties</td>
<td>Detected difficulties in time management for activity production.</td>
<td>Detecting difficulties in time management</td>
<td>Assessing technological difficulties, time and application problems, etc. Analyzing the reasons, pointing out as achievements the overcoming of the problems.</td>
</tr>
<tr>
<td>Guide 1-</td>
<td>During the study of Unit, none but the short time to be devoted to make simultaneous products, whose dates to be delivered coinciding with the datelines of the Unit.</td>
<td>Guide 3 Checking my notes on previous reading (from the same or different unit) to facilitate the articulation among the diverse contents. I overcame this by taking more time to check my notes, having in mind that this checking will finally reinforce my knowledge.</td>
<td>Final Questionnaire Difficulty 1: Initial exploration of the web page. Reason 1: Scarce ability developed in this field before the course started. Difficulty 2: Prejudices about function and scope of the tutorial action. Reason 2: Notion that learning strategies are individually determined, each person has a certain amount of them and the tutorship is not for developing and/or rediscovering them. Difficulty 5: Obstacles related to every distance learner (website material management, assessment system, virtual communication, etc.). Reason 5: Having not previous experience as a participant distance IT</td>
</tr>
<tr>
<td>Guide 1</td>
<td>However, when checking the compliance of the activities required by the unit, implicit goal in my study process, the results have not been satisfactory to me, though this is not because of disorganization, but I was not able to detect them on time.</td>
<td>Guide3 - T01 Another difficulty was the compliance of my study schedule since some activities did interfere with the normal compliance of my schedule.</td>
<td></td>
</tr>
<tr>
<td>Solving problem</td>
<td>Searching solutions to difficulties and applying them</td>
<td>Searching solutions to difficulties and applying them</td>
<td>Indicating achievements obtained when overcoming the identified difficulties during the course.</td>
</tr>
<tr>
<td>Guide-T01.</td>
<td>I overcame difficulties by having a strict schedule I prepared myself, Though I was quite tired because of the other activities.</td>
<td>Guide3 I overcame it by taking the required time in order to review and this would reinforce my knowledge.</td>
<td>Final questionnaire 1. Progressive good management and familiarity of the resources offered by the web site and the IT. 2. Acknowledgement of the possibilities offered by the tutor ship as a space to enhance the development of learning strategies in the participants. 3. Development of a more empathic and understanding attitude toward my participants, since they have fulfilled their role as a student experiencing worries, needs and distress.</td>
</tr>
<tr>
<td>Guide1-</td>
<td>I would be more careful in the phase of getting know the website so as to know all the features and activities included in the unit.</td>
<td>Guide 3 I overcame the difficulty by recovering the lost minutes in some other moments of the next day.</td>
<td></td>
</tr>
</tbody>
</table>

It can be observed that tutors developed all the activities proposed in the three guides, above all, the strategies before and during the reading, they reached higher levels of strategic knowledge due to a more autonomous and conscious practice of the reading comprehension strategies and their distance learning process. This strategic knowledge is directly related to higher levels of conceptual knowledge.
FOURTH UNIT OF ANALYSIS: CHANGES IN EACH TUTOR IN THE PROFESSIONAL CONTEXT

Assistance planning:

The making of the final work was the planning of tutorial actions for the development of students’ strategic learning. In this planning, three levels were identified, as it is shown on Table 14:

Table 14
LEVELS OF ASSISTANCE PLANNING

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>She-tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Organizing and planning tutorial actions</td>
<td>2 and 3</td>
</tr>
<tr>
<td>2</td>
<td>Selecting learning strategies to be taught and proposes general actions</td>
<td>4, 5 and 6</td>
</tr>
<tr>
<td>3</td>
<td>Selecting learning strategies to be taught and specifies concrete actions and recourses necessary to develop them</td>
<td>1</td>
</tr>
</tbody>
</table>

During the course, most of the tutors selected the learning strategies to be developed in their students with clarity and efficiency. These strategies were usually: the analysis of the course or the conditions of the distance study, the time organizations, and the reading comprehension. The tutors also proposed learning and teaching activities of these strategies and incorporated the use of media such as e-mail and the forum in their tutorial actions. In table 15, some examples of planning tutorial assistance for strategic learning are observed.

Table 15
Examples of planning tutorial assistance for strategic learning

<table>
<thead>
<tr>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>To develop time management in group through actions such as “Thinking about the availability of personal time for study and the ways for optimizing this resource. Making plans for the individual study, using a readjustable matrix during the study process”. Consequently, some aids are proposed from the tutorship, for example, “providing a matrix to facilitate the time organization. Planning future actions in function of the demands and requirements of the group expressed in the session.”</td>
</tr>
<tr>
<td>To analyze in a metacognitive way, helping them “to reflect in group over the real learning conditions of each of them: previous knowledge personal goals, study spaces, expectations, strategies to be applied because of the nature of the course and final activity that is required. Answering individually orienting questions about some of the aspects previously mentioned.</td>
</tr>
<tr>
<td>At the end of the course, the students should “review their initial goals, motivations, and expectations, identifying to which extent they were fulfilled, which difficulties they had for not doing it and how much the final product matches with the expected results. Assessing the final product, identifying good choices, omissions and mistakes. Socializing experiences with their classmates.” Hence, this activity will cause “the value of their good choices and the acknowledgement of their omissions and deficiencies.</td>
</tr>
</tbody>
</table>

Assistance application:

The information on application of assistance for strategic learning was obtained through e-mails sent and received by the tutors and their students, from filming the group tutorships and the self-report of the telephone and face-to-face tutorships. Each tutor developed a different style of strategic learning in the practice, identifying the following levels
Table 16
LEVELS IN THE APPLICATION OF ASSISTANCE

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Conceptual learning</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>Technical recommendations</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>General guidelines &quot;unidirectional&quot;</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Specific guidelines &quot;directive&quot;</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Strategic aids: guiding, inquiring, engaging in a dialog, explaining, giving examples</td>
<td>1 and 6</td>
</tr>
</tbody>
</table>

The levels of change in the professional knowledge showed that tutors who acted as strategic students (unit of analysis 3) incorporated more and better strategic teaching actions in their work with their student group (unit of analysis 4), which allowed identifying three types of tutors

a) **Tutors who plan** (2 and 3), as students, they were not able to overcome their conceptual confusion among learning and teaching strategies, they did not act as strategic learners and did not develop a metacognitive analysis about their study process. They were also unable to put themselves as students. However, they included a vocabulary related to the role of the tutor and distance learning. In a professional level, they experienced changes in basic aspects such as planning and organization of their tutorial actions, but without identifying the learning strategies they were supposed to develop in their students. In practice, they were unable to incorporate strategic teaching actions.

b) **Procedural tutors** (4 and 5) achieved remarkable changes with respect to their initial conceptions but they did not explicit these conceptual changes in a conscious way. Likewise, they developed a strategic knowledge in the reading, the metacognitive analysis or the analysis of their practice, but they did not ask an external support or control and did not internalize their decision-making, control and assessment process.

In their professional knowledge, they achieved to design and select learning strategies to be developed in their students and general actions to be carried out in their tutorial working. Nevertheless, they did not give control to the student in application of these actions since they only offered general orientations about the study process (tutor 4) or very specific and directive guidelines (tutor 5), without giving students the chance of making explicit decisions. They incorporated the teaching of procedures for the study and learning into their work but they were not able to develop a strategic approach completely.

c) **Strategic tutors** (1 and 6) presented positive interdependence between the level of academic and professional knowledge. During the formation course, the tutors obtained an elevated change in the academic conceptual knowledge, verbalizing the changes experienced (discourse). They also developed a high level of strategic knowledge (practical), achieving to self-control and regulate their reading process. They were also able to exercise their metacognitive ability by means of both analysis of their achievements and difficulties and search and application of actions to overcome the previous situation. They developed a more interactive teaching, creating in their students the awareness about their own study process as well as the decision-making guided or autonomous of the possible solutions.
The tutors who showed a better performance as strategic students incorporated more and better strategic learning actions in their teaching work with their students. That is to say, conceptual comprehension and strategic knowledge as learner contributed to a better planning and application of distance strategic learning.

4. FIFTH UNIT OF ANALYSIS: METHODOLOGICAL DEVICES THAT DURING THE FORMATION HAVE CONTRIBUTED TO THE PRODUCTION OF CHANGES IN THE TUTORS

During the formation process, the devices that influenced favorably the production of changes in the tutors were identified. We define device as a methodological, intentional or not, option that allow the tutor to have control over the building of strategic knowledge and the development of tutors’ autonomy. In these devices, there is an interaction between tutor and contents (through the learning activities proposed), between tutor and trainer or between tutors.

The analysis of the levels achieved by each tutor in their use of the methodological devices and in their academic and professional changes allowed identifying the following relationships:

• Interaction with the tutor trainer via e-mail facilitated the change in the strategic knowledge related to metacognitive analysis.
• Tutors’ interaction with their classmates in the collaborative activities and forums was an aid for the negotiation of the meanings of the content and the development of the proposed activities, which in turn mainly contributed to the change in conceptual knowledge.
• Interaction with the reading guides and development of all the activities proposed with the progressive cession of control in each unit favored a change in strategic and conceptual knowledge.
• Tutors’ conceptual comprehension and strategic knowledge as learners was an aid for the design and application of changes in strategic distance teaching, from tutorial work.

CONCLUSIONS

From the analyzed results, we can state the following:

1. The female tutors who followed the whole process of control cession developed a more strategic and self-regulated knowledge at both academic and professional level because they achieved a larger degree of assimilation and autonomous practice. Consequently, taking into account the future tutors’ formation, it is essential to design reading guides with precise guidelines that allow going from a very detailed level of control to more autonomous levels. It is necessary to be explicit about the need to ask the questions before the reading in order to clarify the objectives, the expectations about the topic to be studied, the previous knowledge as well as the time planning and the reading strategies to be used.

2. Some female tutors did not achieve an autonomous practice of strategic learning, possibly due to time limitations and the social interactions that took place; these factors determined that they could only reach an externally controlled stage of guided practice. Hence, it is necessary to balance the duration of each unit and the time planning for the development of the activities suggested in the
future tutors’ formation. Furthermore, interaction social activities should also be included, by the means of forums, in all the units.

3. Guided reading and participation in collaborative e-spaces have contributed to a larger elaboration and conceptual change.

4. Metacognitive analysis has contributed to larger strategic knowledge and conceptual elaboration due to the development of a major awareness of the experienced change. Consequently, it is essential to include questions that facilitate both the metacognitive analysis and allow identifying achievements, difficulties and improvements in their own learning and reading process.

5. All the female tutors improved the planning of their teaching actions due to a major awareness of their role. Hence, it is convenient to reinforce both the development of planning activities and its application (and later self-assessment) in the tutors’ formation process.

6. Some tutors developed a strategic teaching in the planning and application of tutorial actions oriented toward their students’ strategic learning because of the development of a more self-regulated and autonomous strategic learning. Consequently, distance tutors’ formation should start considering their role as distance learners who are able to be aware of their own process of distance study student. Furthermore, it will be important to offer guidelines to analyze the achievements and difficulties they experience as tutors as well to provide advice about their tutorial practice.

7. All the tutors incorporated the use of virtual media in their tutorial work with their students, due to a satisfactory practice with them. Therefore, it is necessary to develop tutors’ formation process through virtual contexts so that tutors can experience these different technological tools as users.
References


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Scripting computer-supported collaboration by university students

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Summary

The present work studies the virtual collaborative elaboration of written documents in three groups of university students, and the influence of the assistance provided by the teacher on this elaboration. For the analysis a model of phases of collaborative construction of knowledge, adapted to the features of the studied tasks, is used. The results show that, although the students follow the instructions proposed by the teacher, they usually do not manage to reach the more advanced phases of collaborative construction of the model.

Keywords

Computer-supported collaborative learning; higher education; phases of collaborative construction of knowledge; collaborative scripts.

Introduction

The combination of the rapid development of the information and communication technologies (ICT) since the 1990s and the renewed interest for the social dimension of learning have, in a relatively short time, converted CSCL - Computer-Supported Collaborative Learning- in to a popular instructional

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3 This article presents some of the results of a doctoral thesis in progress, titled “Construction of knowledge in virtual environments of teaching and learning. The interrelation between the processes of collaboration between students and the processes of help and guidance from the teacher.” The thesis is carried out by the first author of this article, under the guidance of the second author at the Department of Developmental and Educational Psychology at the University of Barcelona.
approximation in several educational levels, especially in higher education. The shared interest of most research within the field of CSCL is how ICT facilitate the emergence and development of collaborative processes in teaching and learning situations, and how computer-supported collaborative learning environments can improve the interaction and group work and ultimately the results of the process of the participants’ learning.

The most recent research that analyzes the collaboration between students in CSCL environments show a tendency to focus on the processes of joint construction of meaning, rather than on the individual contributions of the participants (the interpsychological processes rather than intrapsychological), elaborating descriptive models of these interpsychological processes. Some of these models worth highlighting are those of Garrison, Anderson & Archer (2001), Gunawardena, Lowe & Anderson, (1997), Harasim (2002) and Xin (2002), which have been revised and adapted by several authors in different research projects (Kanuka & Anderson, 1998; McLoughlin & Luca, 2000; de Laat & Lally, 2002, 2003, 2005; Schellens & Valcke, 2005; Schrire, 2006). Although these authors differ in their theoretical approach to these processes of joint construction of knowledge, and define a varying number of stages or phases in their production, essentially they all describe it as a socio-cognitive process characterized by “a logically sequenced developmental process” (Kanuka & Anderson, 1998): a process that moves from the divergence between the participants’ ideas and contributions to the convergence of the meanings and the shared comprehension, and in which each stage or phase represents a higher level of cognitive complexity than the previous. The defined phases of the process represent an ideal logical sequence of development, although with a more complex nature in practice, (not linear and discontinuous), in which the group can demonstrate advances and declines between the phases. According to these works, this sequential process requires high levels of ongoing interaction and reciprocal communication between the participants in order to drive the processes of argumentation, negotiation, discussion and the joint construction of meanings.

The results of these studies prove the complexity and the difficulty of progress for the students from the initial levels to the more advanced phases of construction of knowledge. Usually the students share ideas and compare information – typical interventions for the earliest phases in the process of shared construction of knowledge-, but hardly debate ideas, concepts or statements, or negotiate meanings, and very rarely construct new ideas collaboratively – typical interventions for the more advanced phases of the process-. On the whole these works point out that, regardless of how sophisticated the electronic resources and devices are and how the environment technologically enables a certain expected social interaction in groups that work together in CSCL environments, there are no guaranties that this will occur (Wallace, 2003).

In studies of CSCL, establishing these difficulties have increased the interest in the role of the teacher as a guide and support in the students’ process of collaborative construction of knowledge. In light of this, and in opposition to more traditional CSCL research, which mainly focuses on the interaction between students essentially isolated from the teacher’s presence and impact on the processes of collaborative construction of knowledge in the analyzed activities, some of the more recent studies have begun to pay attention to the role of the teacher as a facilitator of the discourse, as the organizer and designer of the interactive processes, and as the expert that provides adjusted assistance to the students in their process of learning and promotes those types of interaction between students that
have higher constructive potential (De Laat & Lally; 2005; Garrison & Anderson, 2003; Lockhorst, 2004; Veldhuis-Diermanse, 2002).

The proposals of various authors to establish scripts for the process of collaborative construction also point out the importance of step-by-step description and direction of these processes for the facilitation of the development of optimal interaction from the point of view of collaborative construction of knowledge (Dillenbourg, 2002; Kollar & Fischer, 2004; Weinberger Fischer & Mandl, 2001). The scripts are defined as didactic scenarios that stipulate a certain number of activities of collaborative learning in a sequence of phases. Each phase of a script is concretized based on various attributes: the task that the students need to develop in the phase, the composition of the group – the size of the group, the criteria for the formation...–, the way in which the task is distributed in and between groups – subtasks, roles –, the mode of interaction – face to face, synchronous, asynchronous...– and the timing of the phase. The design of a script is based on the hypothesis that the promotion of certain interactive and communicative dynamics between students will activate specific interpsychological mechanisms that will facilitate the processes of negotiation and construction of meanings involved in learning and intellectual progress.

Following the description above, our study aims at an in depth comprehension of the processes of collaborative construction in CSCL environments and the role of the teacher in these processes. Therefore, adopting a constructivist and sociocultural conception of the processes of teaching and learning based on the CIT (Coll, 2001; Onrubia, 2005), we study the relations between students’ collaborative construction of knowledge and the teacher’s assistance to this construction in situations where the task of elaborating a written product is undertaken collaboratively. Earlier studies, which typically have focused on the analysis of the discussion forums, have paid little attention to the study of these situations. While acknowledging the relevance of this type of forums and their regular presence in CSCL environments, we assume that expanding the study to include other types of activities would be beneficial for theoretical as well practical reasons. Theoretical, because it can not be taken for granted that the investigative instruments and the obtained results, based on the analysis of one kind of activity, can be used or obtained in an identical manner in other activities, and practical, because the joint elaboration of written products also is a common type of task in CSCL environments. Consequently, and concretely, our work has two objectives. The first is to analyze the processes of collaborative construction of knowledge in three groups of students who have to resolve diverse tasks that require the joint elaboration of different written products. We are particularly interested in investigating if these processes can be described in terms of a sequence of phases similar to those established in earlier works, centred on the analysis of discussion forums. If this is the case, we would like to delimit the concrete indicators through which it is possible to identify these phases in tasks of collaborative elaboration of written products. Our second objective is to study some of the features of the assistance provided by the teacher to the students’ collaborative construction of these tasks, with the intent of establishing some of the relations between those features and the phases of the attained collaborative construction. Methodologically, our work follows these objectives by way of an observational approach, without the intervention of the researchers in the studied phenomena, based on case studies.
Participants and situations of observation

Two didactic sequences have been registered and analyzed. Each of the registered sequences corresponds to one module of the course "Psychology of education", included in the plan of study of the degree of BA in psychopedagogy at the Open University of Catalonia (UOC). The UOC is a rather new university offering distance higher education through a virtual campus of their own design, which is based on tools for asynchronous written communication. The BA en Psychopedagogy has been part of their offer from the start of the university. The course “Psychology of education”, with a duration of half a year and corresponds to 4,5 academic credits, is mandatory for some of the students who are aiming for the BA depending on their previous studies.

The data was gathered in one of the groups of the course, consisting of the teacher and 35 students. The students were organized in small heterogeneous groups with regard to four components. The analysis was centred on the data from three of these small groups. The selection was made in light of the objective to study groups with diverse levels of achievement and work dynamics, and was carried out based on the teacher's information with regard to these criteria.

The course was divided into three modules. In each module the students were requested to carry out a set of different activities and tasks. The studied didactic sequences correspond to the modules 2 and 3 of the course. The duration of the didactic sequences was of, respectively, six and seven weeks. In each sequence, the students had to resolve one individual task and two tasks in the small groups. These tasks were subject to the teacher's evaluation. In the first didactic sequence the group tasks consisted of the analysis of diverse educational situations based on the theories presented in the module and the elaboration of a conceptual map of the main concepts of one of these theories. Both group tasks of the second didactic sequence revolved around the differences between the educational contexts (family, school, television and learning from adults). In the first task the small groups were requested to present a detailed description of these contexts based on a series of dimensions that characterize the educational practices developed in them, and in the second, a comparative reflection of the impact of the diverse contexts in the socialization of the individuals and the possible contradictions between them in relation to the promoted values and behaviours.

The virtual classroom of the course included several diverse spaces of communication: the board, a notice board where only the teacher could post notes; one general forum where both the teacher and the students could participate; the group work space, a private work space for the members of each group - the teacher could read the contributions and intervene if so desired – constituting of a board, a forum, a zone for storage and interchange of files; and the space for continuous evaluation, where the students send their written works to the teacher. The students could also use the electronic mailing system of the Virtual Campus, called personal mailbox for their communication concerning the course.

Procedures of data collection

The main body of gathered data corresponds to the register of the contributions and documents added by the teacher and the students from the three analyzed groups in the different available communication spaces throughout the duration of the two sequences. More specifically, registered
were all the messages to the board, the forum, the small group work spaces, the teacher’s mail box, and all the interchanged documents between the students. The documents could contain individual proposals – preliminary or definitive, total or partial – in relation to the assigned tasks, comments or individual revisions of a document previously produced by any member of the group, or the final products presented as the result of the group work.

Additionally, information was collected from diverse sources with the purpose of providing contextual elements and facilitating the comprehension and interpretation of the messages in the registered messages and documents: initial and final interviews were carried out with the teacher, students filled out questionnaires at the beginning, during and at the end, and we also gathered the grades of each product in the different tasks given to each group by the teacher.

* Procedures of data analysis*

For the analysis of the process of collaborative construction of knowledge in small groups, in the first place, we selected messages and documents, of each member of each group, centred entirely or partially on the elaboration and resolution of the assigned tasks, separating them from those exclusively related to other questions, such as the individual study of the content, the organisation and management of the work in small groups or off-task questions. In the selected messages and documents corresponding to each task of the small groups, we identified the diverse ways in which the students discussed the contents, resolved the tasks and produced their final products; these diverse ways were categorized in terms of the phases of the process of the collaborative construction of knowledge in the group. The typology of phases that finally was used was the result of a repeated process of back and forth between theory and data. The starting point for the typology was the phases of collaborative construction proposed by Gunawardena et al. (1997) and Garrison, Anderson y Archer (2001). The final adapted typology distinguishes between four phases, which we call respectively, *phase of initiation, phase of exploration, phase of negotiation and phase of co-construction*, respectively. Ideally, these phases correspond to successive levels of shared elaboration of knowledge by the members of the small group, identifiable by four criteria: the continuity or discontinuity of the participation of each member of the group in the discussion; the level of reciprocity and contingency of the contribution; the level of critical acceptance of the ideas and the previous declarations of the participants; and the level of consensus regarding the delivered document as the final product of the task. Ideally, each phase provides the platform that allows the progress to the next. However, frequently, the groups’ progress through the phases is interrupted so that they remain in one of the lower phases. Table 1 shows the operational criteria that enable the differentiation of the reached level by a group in a specific task.
I. INITIATION PHASE

The final product elaborated by the small group is a document based on the juxtaposition of the different individually produced parts by the members of the group, each of the parts without contributions from others.

II. EXPLORATION PHASE

The final product elaborated by the small group is:

a) an initial document in which the group members have gradually made an accumulation of contributions (without modifications of the previous content)

b) a document elaborated by one of the members of the group based on the juxtaposition of the different individually elaborated parts, which have been discussed and/or revised.

III. NEGOTIATION PHASE

The final product elaborated by the small group is:

a) an initial document in which the members of the group have gradually made contributions to modify and revise previously contributed content, but without a final revision of the document that is handed in

b) a document elaborated by one student on the basis of the joint discussion of the initial individual documents (total or partial) elaborated previously by the members of the group, but without a final revision of the document that is handed in.

IV. CO-CONSTRUCTION PHASE

The final product of the small group is a document corresponding to a phase III product which, in addition, has been subject to revision and explicit approval by the majority of the group members.

Table I. Operational criteria for the delimitation of the phases of the collaborative construction of knowledge

For the analysis of the teacher's assistance all the contributions (messages and documents) that involved some kind of support for the students' realization of the given task and the required products were identified. These contributions were described following three criteria. Firstly, the timing of the assistance offered was considered, distinguishing between the help mechanisms "a priori" – assistance offered by the teacher before the groups started the realization of the task and the elaboration of the corresponding products, for example while presenting the activity or the task-, assistance mechanisms during the process – help from the teacher parallel to the resolution of the tasks by the groups-, and assistance mechanisms "posterior"- assistance provided by the teacher after the resolution of the task by the groups, for instance through the correction of the final products and the delivery of the marks to the students. Secondly, aspects of the task for which assistance was offered were considered, distinguishing between assistance centred on the processes of planning, organizing and the functioning of the small groups, and assistance centred on the resolution of the task, the elaboration of the products and their content – a distinction inspired by some of the works on the roles of the teacher in online environments (Mason, 1991; Berge, 1995; Paulsen, 1998). The final consideration was if the assistance offered by the teacher was spontaneous or required by the students.
Results

We begin with the presentation of the results corresponding to the analysis of the phases of the collaborative elaboration of the tasks and the products by the small groups, and then move on to the results connected with the help offered by the teacher.

The process of collaborative elaboration of the tasks and the products

As mentioned earlier, the primary body of data for the analysis of the processes of collaborative construction of knowledge is constituted by all the interchanged messages and documents by the three groups of students with regard to the resolution of the task. Table 2 recapitulates the number of analyzed messages and documents, indicating the percentage that represents the sum total of the interchanged messages and the documents by the students and the teacher in the small group spaces throughout the analyzed sequences.

<table>
<thead>
<tr>
<th></th>
<th>Analyzed messages</th>
<th>% of total</th>
<th>Analyzed documents</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence 1</td>
<td>44</td>
<td>17,53%</td>
<td>56</td>
<td>80%</td>
</tr>
<tr>
<td>Sequence 2</td>
<td>83</td>
<td>21,45%</td>
<td>102</td>
<td>72,34%</td>
</tr>
<tr>
<td>Total</td>
<td>127</td>
<td>19,91%</td>
<td>158</td>
<td>74,98%</td>
</tr>
</tbody>
</table>

Table 2. Number and percentage of analyzed messages and documents.

We have been able to adequately describe the process of elaboration of the required products in the different tasks, as reflected in the chosen messages and documents, in terms of our previously proposed phases. In the following, we begin by describing the general features of the identified phases and then the concrete phases reached by each of the three analyzed small groups in each of the four registered tasks.

During the initiation phase, the messages that the members of the groups interchanged are pertinent to the theme of the conversation but of independent nature: the participants contribute with their ideas and perspectives on the task through a brainstorm. The level of reciprocity and contingency between the participants’ contributions is low and usually there are no explicit or implicit references to the previous contributions. Participants present and justify their own ideas, but do not question those presented by others. The typical way to proceed with the elaboration of the final product in the small groups that remain in this phase is the division of the task between the members of the group. Each student individually produces a document with the part of the task that he/she was assigned and presents it to the group. Theses documents are simply accepted without any questions or comments from the others. The compilation of these partial documents is presented as the final product of the task without any proposal of modification by the students, although there usually are general comments of approval from some or all of the students. The final product handed in by the students essentially corresponds to a strategy of “cut and paste” with contributions that can clearly be identified as having been written by the different members of the group.
In the **exploration phase** the level of reciprocity and contingency between the participants’ contributions is higher than in the previous one, with continuous explicit and implicit references to previous contributions. Even so, the majority of these references to previous contributions are acceptances of the presented information, without critique or questions, in such a way that the interchange typically takes the form of turns of presentation and acceptance where specific points of agreement are established, where as the disagreements are virtually non existent; when they appear, they are not taken up or discussed. Hence, in the groups which remain in this phase, the members share and jointly evaluate their ideas in the beginning of the resolution of the task, but the effort to understand the task as defined by the others does not extend beyond the initial moments. One example of this is found in the procedure of group 2 to resolve task 2.2. At the beginning of the task each group member contributes with an individually produced document describing the different educational contexts (family, communications media, school, education from adults). Following the guidelines given by the teacher, the group members revise the initial document produced by a group companion. The comments made by the students are basically positive, supportive and accepting valuations, although we do find additions to and comments of subtle distinctions in that written by others. However, these additions and distinctions do not elicit questions, answers or arguments within the group. One of the members of the group takes the responsibility of composing a final document based on the initial documents of all group members, and it is he alone who decides to consider or not, and in what way to consider, the different expressed comments. The final products produced in this phase correspond essentially, as in the case of the previous phase, to a strategy of “cut and paste”, but in this case the fragments are not big parts, as in the previous phase, but rather phrases or short paragraphs, in a way that the document looks like a “puzzle” of contributions. Typically, the final product is handed in without a joint revision by the group members, although in some cases there may be messages from some group members displaying approval. However, such messages do not include any arguments or reasons for the approval of the text.

In the **negotiation phase** the interaction and the dialogue are produced continuously throughout the process of resolving the task. The interchanges reflect a high degree of connection and contingency, with continuous references to the previous contributions. There continue to be many turns of presentation and acceptance in this phase as well, but we also find complex sequences where the group members explain, clarify, verify, correct and confirm their contributions, as well as disagreements, although to a lesser extent. These sequences lead to several redefinitions of the product and joint decision making with regard to the meanings of the concepts and their interpretation in the context of the task, as reflected in the final document. One example of this process is found in how the members in group 1 set about the elaboration of task 1.1. In the beginning, each group member elaborates individually on one of the presented situations and writes a text explaining and illustrating the process of development in that situation from a particular theoretical perspective. Each student reviews the text of one other group companion inserting comments in the document. These revisions include valuations, confirmations, re-elaborations, reformulations, or rejections of the ideas and proposals made by the other participants. In the following we offer a couple of illustrating examples of this kind of comments (see table 3). In the first one, the reviewer, after having made a positive valuation of the companion’s work, presents two proposals: the first is an extension of the presented ideas, justifying their pertinence and relevance, and the second is a proposal to modify the central focus of the explanation in the initial document. The second example corresponds to a revision...
of the description of the cognitive process of a child from the moment of her first encounter with a jigsaw puzzle to the point of mastering the game. In this case, the reviewer questions some of the aspects of the companion’s proposal.

Table 3. Examples of comments to the contributions of the other participants, typical for the negotiation phase. The examples correspond to task 1.1 in group 1.

After revisions, the person responsible for the activity gathers the initial corrected documents in a new document and explicitly asks the group companions to examine the new document. All the group members contribute to the one document, along with comments concerning the made modifications.

The co-construction phase distinguishes itself from the previous in that, once the final document based on the negotiation between the different members is constructed, the group, or at least a large part of it, give the final document yet another “go”, reviewing the content and/or explicitly showing general approval of it. Hence, a process of revision and/or explicit approval of the last version of the document by all the group members before the formal delivery to the teacher is added to the process of negotiation typical for the previous phase.

4 Original version in Catalan in appendix
In all the analyzed tasks, very rarely do the groups reach the higher phases of collaborative elaboration of tasks and products: only one group, in one single task, reaches the fourth and last phase of co-construction. In the majority of the tasks (8 of 12 analyzed tasks) the process is closed in the second phase of exploration, and in the three remaining tasks the process never moves beyond the initiation phase. Group 1 is the one that reaches the most advanced phase in one of the tasks, while group 3 is the one that to a large extent remains in the first phase of the process. The complete data are presented in figures 1, 2 and 3, which show the reached phases by each one of the groups in each one of the tasks of each one of the studied sequences.

Figure 1. Phases of collaborative elaboration reached by group 1 in the different analyzed tasks.

Figure 2. Phases of collaborative elaboration reached by group 2 in the different analyzed tasks.
The teacher gives detailed instructions of the different aspects of the dynamics of the groups, offering a high level of help “a priori”. In the presentation of the course, the teacher indicates that for each task one student should assume the role of being responsible for regulating the process of task resolution and giving it a uniform format. Additionally, in the beginning of each didactic sequence, the teacher presents, amongst other documents, a chart with detailed description of the interactive dynamics of the group, thereby indicating for each of the tasks the sub-products that the group needs to elaborate and for each of them indicating who should be doing it, how the task should be done, the name of the product that should be sent to the shared space of files, the evaluation criteria and the final date of handing in. Table 4 recapitulates a fragment of the teacher’s instructions for task 2.1, illustrating their features.

<table>
<thead>
<tr>
<th>Task</th>
<th>Who does it</th>
<th>How it is done</th>
<th>Document to hand in</th>
<th>Evaluation criteria</th>
<th>Date of delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Complete in a rough copy the tables that appear in the presentation of the activity, by filling out all the boxes</td>
<td>Every one by himself</td>
<td>Each member of the group fills out the table corresponding to the analysis of each educational practice (family, communications media, school, permanent education), as well as the systems that characterize it.</td>
<td>Each one sends his/her task to the area of files of the group space: TEAM (nº)-(letter)-Task 1</td>
<td>Hand in the document by deadline. Identify the important information in order to characterize the educational practices based on the different dimensions and applied systems.</td>
<td>23.11</td>
</tr>
<tr>
<td>2. Gather the tables developed by the different group members in the previous part.</td>
<td>The responsible</td>
<td>The responsible develops two tables that integrate and at the same time synthesize the</td>
<td>A document to the area of files in the group space with developed tables. Identification: TEAM (nº)-TASK 2</td>
<td>Hand in the document before deadline. Collecting the answers.</td>
<td>25.11</td>
</tr>
<tr>
<td>Task</td>
<td>Who does it</td>
<td>How it is done</td>
<td>Document to hand in</td>
<td>Evaluation criteria</td>
<td>Date of delivery</td>
</tr>
<tr>
<td>------</td>
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<td>------------------</td>
</tr>
<tr>
<td>3. Write in a document, context to context, the way in which they are characterized, emphasizing the common elements and the differences.</td>
<td>Each one separately.</td>
<td>Each member of the group develops thoroughly the type of information that characterizes an educational practice and the systems that distinguishes it.</td>
<td>A document to the area of files in the group space. Identification: TEAM(nº)-(letter)-TASK 3</td>
<td>Hand in the document by deadline. Gather the most relevant information that enables the characterization of the educational practices and the systems that distinguish them.</td>
<td>28.11</td>
</tr>
<tr>
<td>4. Constructive comments to the work of a group companion.</td>
<td>Each one separately.</td>
<td>The companion in the couple adds suggestions for improvement or, when it is the case, approves it justifying why.</td>
<td>A document to the area of files in the group space. Attention, task 4 is the revised work of your companion in a different colour (which you were given in activity 1).</td>
<td>Hand in the document by deadline. Some comments with justifications, for improvements (additions or reductions) as well as acknowledgements (left just as it is).</td>
<td>30.11</td>
</tr>
<tr>
<td>5. Collection of all the tasks in only one document</td>
<td>Responsible</td>
<td>In order to make the revision easier for the responsible, enclose in only one document all the parts of the features and systems (with regard to the different educational practices) obtained in task 4.</td>
<td>A message to the area of files in the group space. Identification: TEAM (nº)-TASK 5</td>
<td>Hand in the document by deadline. Having gathered all the contributions and made an understandable presentation.</td>
<td>03.12</td>
</tr>
<tr>
<td>6. Reflection on the value for the development of the different contexts.</td>
<td>All at the same time.</td>
<td>The group members, while keeping in mind the features of the contexts, elaborate a reflection of the value of each one for the development of the persons.</td>
<td>Send one document to the area of files in the group space. Identification: TEAM (nº)-TASK 6</td>
<td>Contributions by deadline. Comments with justifications.</td>
<td>06.12</td>
</tr>
</tbody>
</table>

Table 4. The instructions provided by the teacher for the performance of task 2.1.

With regard to the assistance from the teacher during the process, 19 of the teacher’s interventions focused on the questions related to the process of planning, the organization and the operation of the work in the small groups. Of these 19 interventions, six are initiated by the teacher in order to remind the students of the instructions of the activity and when they are expected to hand in the sub-tasks,

5 Original version in Catalan in appendix
and 13 are responses to explicit requests from the different small groups, primarily related to the nature of the sub-task (group or individual) or with the formal aspects of the final document that will be handed in. The assistance during the process specifically related to the elaboration of the products and the content of the tasks occurs much less, in only five of the teacher’s interventions, and four on teacher’s own initiative. The five interventions refer to different themes, from specific theoretical concepts which cause misunderstandings, to the logic of the sequencing of the sub-tasks or the necessity to reach consensus about how to approach a task in the group.

Finally, we also find, although only occasionally, some teacher interventions, which we could be considered as assistance “posterior” to the students carrying out of the task. This assistance is related to the correction and the grading of the products: one week after the termination of each sequence the teacher returns the final documents of both tasks to each group, with diverse comments and valuations and the mark that the group is given. The teacher’s comments basically are related to the students’ use of the basic concepts and ideas that constitute the content of the module and occasionally include some general references or valuations with regard to the group process of carrying out the task. Table 5 recapitulates one of these valuations, where the first bullet is a general comment about the level of group elaboration of the document.

<table>
<thead>
<tr>
<th>DOCUMENT P.234⁶</th>
<th>g1</th>
</tr>
</thead>
<tbody>
<tr>
<td>In general you’ve done a good work where the following stands out:</td>
<td></td>
</tr>
<tr>
<td>- You’ve done good team work, you’ve joined the criteria for carrying out and structuring the questions, which provides it with a lot of internal coherency, but in the first part, the comparison between the contexts is a little bit fragmented. (...)</td>
<td></td>
</tr>
<tr>
<td>- You’ve based the questions on the worked concepts in the course material corresponding to the module 3, but in some cases you haven’t been able to use this knowledge in order to refer to the different contexts, for example, use the concept of “guided participation” for explaining the process of learning, not only in the family, but also in other contexts, as in the groups of equals, or for example, in the educational use of TV.</td>
<td></td>
</tr>
<tr>
<td>These aspects, amongst others, which I have been commenting on through out the work process, make your mark in the PAC3 a B.</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Teacher’s valuation of the tasks 2.1. and 2.2. accomplished by group 1.

Discussion

Considering the process of collaborative construction of knowledge in small groups – the first objective of our investigation –, our results show that the development of these processes in the tasks of collaborative elaboration of written products can adequately be described, in the small studied groups, in terms of a sequence of phases similar to those established in previous works centred on the analysis of forums of discussion. The four identified phases (initiation, exploration, negotiation and co-construction) reflect levels of the small group members’ successive shared elaboration of knowledge, and generally fit with the characterization of the process of collaborative elaboration as a process of

⁶ Original version in Catalan in appendix

Hence, in the initiation phase, the group members show each other their ideas, but there is hardly any joint elaboration of them, so that the joint activity acquires the features of “sum of monologues” rather than a dialogue. The members of the group hardly get involved in the explicit process of negotiation of meanings during the resolution of the task, so that the final document that is delivered to the teacher is more the result of a juxtaposition of elements carried out by the student who acts as the one responsible for the activity, rather than a joint and shared construction by the members of the group. The level of intersubjectivity assumed in the process of the construction of the product is, therefore, minimal: the only shared thing is, basically, the formal delivery of one sole product. In the second phase, that of exploration, we find a higher level of intersubjectivity: the members of the group consider the other group members as their conversation partners sharing some of the aspects of their contributions and constructing a somewhat shared body of knowledge and comprehension. However, this construction is of a rather accumulative nature, based on the acceptance of the others’ contributions without much criticism. The third phase, that of negotiation, entails a new level of intersubjectivity, based on the explicit and continuous process of negotiation of meanings produced throughout the process of elaboration of the document. As a result, the products produced in this phase recapitulate jointly constructed ideas, based on a chain of elaborations and re-elaborations of the partial documents and the final document of the group, reflecting a high degree of shared comprehension and consolidation of the proposed solution to the task. Finally, the fourth phase adds yet another level to the process, based on the existence of a final systematic revision made by the different members of the group document to be presented. This explicit revision and approval of the last version of the final document underlines and strengthens the genuinely shared and unanimous nature of the produced group document.

At the same time, the phases that we have identified noticeably correspond to the type of task that was analyzed, the elaboration of written documents. Therefore, the concrete indicators that have enabled their establishment and the way in which the students collaborated are clearly different from those indicated by the works that have centred on the analysis of forums of conversation. In our case, the necessity to produce a final written product unquestionably characterizes the functioning and the interactive steps of the groups. Consequently, the students’ contributions and the process of shared production is not done as much through the interchange of messages in the forum as the interchange of documents, and the production of consecutive versions of those documents converts itself in to a fundamental tool for the collaborative process of construction. The way in which the documents are combined in the joint document of the group, the way in which the proposals of change made by the different members of the group are incorporated in to the group document, or the way in which revision is made (or not) and how the approval is formalized with the final version of the group document, are key elements in the progression of the groups throughout the different phases that arise from the specific nature of the type of analyzed task, and which we do not find in the works that have analyzed forums of discussion. Accordingly, the identification of these aspects, and the concretion of the indicators of the different phases in the type of task that has been analyzed here, are specific contributions of our study, which complement the previous works which we have used as points of
reference, and which confirm the necessity, recently stated by some authors (Lockhorst, 2004), of investigations to consider different types of tasks.

In other respects, our results coincide with the previous studies in establishing that the students rarely reach the more advanced phases of collaborative development. Mostly, the groups that we have analyzed develop their products through the typical processes of the exploration phase, based on a type of interaction very similar to what Mercer (1997) calls “accumulative conversation”, where the students use the language in order to put together their own contributions to those of others, with acritical acceptance and many affirmations, and where the joint knowledge is developed through a process of accumulation. The strategy of “cut and paste” and the “puzzle” format of the final document are typical for this kind of interaction.

From our point of view, it is possible to establish some relations between this type of collaborative production, mainly developed by the students, and the ways in which the teacher has provided assistance throughout the sequences - the second objective of our study -. Two of the features of the teacher’s assistance, as manifested in our analysis, are in our opinion of particular relevance: the features of the instructions of how to carry out the tasks that the teacher presents at the beginning of each didactic sequence, and the limited availability of assistance during and after the tasks have been carried out.

The teacher’s instructions end up being the main assistance available for the students’ accomplishment of the tasks. According to the information from the interviews with the teacher, the objective of the instructions is to guide students to accomplish the tasks in a genuinely collaborative fashion, promoting the processes of co-construction of ideas and the mutual monitoring and control of the work. This objective is, no doubt, underlying several elements in the instructions: the specification of different roles in the group, and especially the role of the coordinator or the one responsible for each task; the requirement that all group members initially develop their own individual product in order to make sure that they all are involved from the beginning of the task; the insistence that all should read and revise the contributions of the others; the requirement that the final product be different to the initial individual products of each group member. However, when the indications in the instructions are examined in detail, it becomes clear that it is possible to follow them literally without really having to get involved in depth in the collaborative processes that are supposed to be promoted. If we take the instructions recapitulated in table 4 as example, it is possible to follow these instructions and that at the same time, for example, that the students give a mere formal approval to the contributions made by their companions, that the responsible person develops a final product of the task in a merely accumulative manner and through a strategy of “cut and paste” or that the final product is not up for revision by all the group members. For that reason, the behaviour of the students seems to indicate that they end up following the literal meaning of the instructions, rather than their underlying purpose, using them as a formal list of requirements that have to be fulfilled rather than an orientation of the type of collaborative processes in which they should get involved – something that also has been established in some studies of the use of scripts in CSCL environments (Weinberger, Fischer & Mandl, 2002; Weinberger, Ertl, Fischer & Mandl, 2005). The fact that the instructions include very detailed indications related to the organization and management of the work in groups, or with the formal features of the final product (name of the archive, space to which it should be sent, dates of expected
delivery) could have contributed to the students’ literal use of the teacher’s instructions as a list of requirements. It is definitely possible that the students’ performance is at least partially the result of following the teacher’s instructions, but in a very literal and formal way, attending in terms of Dillenbourg (2002) to the “syntax” of the instructions – the formal sequence of the phases and sub phases and the minimal expectations from each one-, but not to its “semantics” - the mechanisms of collaborative construction that the instructions intended to promote.

This kind of performance by the students may also have been favoured by details such as the fact that the instructions do not give any clues or explicit guidance regarding some of the key elements in the processes of negotiation and construction in the more advanced phases of a genuinely collaborative construction, i.e. the establishing of explicit relations between their own ideas and those of other members of the group, the justification and argumentation for their own perspective, the presentation of good explanations, or the posing of good questions to the other group members with regard to their contributions (Kobbe et al., 2007).

Finally, the scarce presence of assistance from the teacher during and after the processes of development of the tasks facilitates explaining why the students maintain this kind of use throughout the different tasks. As stated earlier, the assistance provided by the teacher throughout the sequences for the production of the products and the carrying out of the task is very scarce, as well as the references to the processes of production in the teacher’s valuation at the end of each sequence. Once again, using a distinction proposed by Dillenbourg (2002), we could say that there are no acts of “regulation” by the teacher, which could compensate for the way in which the students seem to have interpreted the guidelines that were given when the activity was “structured” at the beginning. Instead, what we usually find during the process is assistance related to the management of the group work and the formal features of the tasks, mainly required by the students, which only confirms that these are essentially the aspects that preoccupy the students.

In summary, our results permit the confirmation as well as the extension of the previous studies of the students’ processes of collaborative production, and indicate the relation between efficient assistance from the teacher and the features of such processes. At the same time, they show the difficulty in assisting students for the improvement of their processes of collaborative accomplishment of tasks that imply the production of written products, and underline the necessity to undertake new studies that consider this, which permit the identification, in different scenarios and under different circumstances, of the forms of teacher’s assistance that can most efficiently improve these processes.

References


Appendix

Original version of table 3 in Catalan. Examples of comments to the contributions of the other participants, typical for the negotiation phase. The examples correspond to task 1.1 in group 1

<table>
<thead>
<tr>
<th>DOCUMENT N45/24.10</th>
<th>g1</th>
</tr>
</thead>
<tbody>
<tr>
<td>N, felicitats per la feina realitzada. He fet un petit incís en un parell de frases. Fas una descripció molt correcta de tots els conceptes de Piaget, potser anegiria el concepte de desequilibri: Segons Piaget, cada progrés del nen/a en el seu desenvolupament prové d’un “desequilibri”. Cada ruptura de l’equilibri comporta un seguit de reaccions que tendeixen a restaurar l’equilibri. En el cas de la Laia el desequilibri es produiria en el moment que ha de formular hipòtesis per defensar una idea en el text argumentatiu si encara es troba en l’estadi de les operacions concretes. El desequilibir és, segons Piaget un factor per a produir el desenvolupament. Potser, i de cara al treball final, no sé si haurem de tenir en compte l’extensió, si fos així, ja hem centraria més en l’explicació que fas de les característiques pròpies de l’etapa en què es troba la Laia i no posar la visió general que dones de la Teoria de Piaget. Què et sembla? Això en el cas que s’hagi de tenir en compte l’extensió. També he corregit algunes faltes que he vist.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Document M41 24.10</th>
<th>G1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(...) La nena ha de tenir prou capacitat com per entendre el sentit d’unes peces desordenades que cal organitzar per a que formin una totalitat i per tant ha de dominar ja certs conceptes, com ara el tot i les parts. Segons Piaget en aquest estadi el nen no és capaç de tenir present simultàniament el tot i les parts, quan el tot es descompon al nen li és difícil establir la relació de les peces amb el tot. (...) Com hem dit en l’inici de l’explicació el que durà a la Paula a la resolució final del trencaclosques serà les interaccions que hi realitzi. És possible que els pares provin d’ajudar-la, però des del punt de vista de Piaget, això serà quelcom anecdòtic, que com a molt accelerarà una mica el procés d’aprenentatge. El que realmente estarà en joc serà la capacitat d’assimilació i acomodació d’esquemes que posseeixi la nena. No seria tant d’esquemes que posseeixi la nena sinó que en funció d’allò diferencial de la seva experiència amb l’objecte entrarà en joc l’acomodació dels seus esquemes i l’assimilació. (...)</td>
<td></td>
</tr>
</tbody>
</table>

Original version of table 4 in Catalan. Instructions offered by the teacher for the execution of task 2.1.
<table>
<thead>
<tr>
<th>TASCA</th>
<th>QUI LA FA</th>
<th>COM ES FA</th>
<th>DOCUMENT A LIUAR</th>
<th>CRITERIS D’AVALUACIÓ</th>
<th>DATA LLIURAMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Completar en un esborrany les taules que apareixen a la presentació de l’activitat de manera que totes les caselles estiguin omplertes.</td>
<td>Cadascú per separat</td>
<td>Cada component de l’equip omple la taula responent a l’anàlisi de cada pràctica educativa (família, mitjans de comunicació, escola, educació permanent), així com els sistemes que la caracteritzen.</td>
<td>Cadascú envia la seva taula a l’àrea de fitxers de l’espai de grup identificat com: EQUIP(núm)-(lletra)-TASCA 1</td>
<td>Lliurar el document en el termini establert. Identificar la informació pertinent per caracteritzar les pràctiques educatives a partir de les diferents dimensions i sistemes implicats.</td>
<td>23.11</td>
</tr>
<tr>
<td>2. Unificar taules elaborades pels diferents membres del grup a l’apartat anterior.</td>
<td>Respon-sable</td>
<td>El responsable elabora dues taules que integrin i alhora sintetitzin les aportacions dels diferents membres del grup. La resta de companys donen el vist i plau.</td>
<td>Un document a l’àrea de fitxers de l’espai de grup amb les taules elaborades. Identificació: EQUIP(núm)-(lletra)-TASCA 2</td>
<td>Lliurar el document en el termini establert. Recollirem la informació més relevant que permet caracteritzar les pràctiques educatives i els sistemes que les configuren.</td>
<td>25.11</td>
</tr>
<tr>
<td>3. Redactar en un document, context a context, la manera en què es caracteritzen, enfascitant els elements comuns i diferenciadors dels altres.</td>
<td>Cadascú per separat</td>
<td>Cada membre de l’equip elabora més a fons el tipus d’informació que caracteritza una pràctica educativa i els sistemes que la configuren.</td>
<td>Un document a l’àrea de fitxers de l’espai de grup Identificació: EQUIP(núm)-(lletra)-TASCA 3</td>
<td>Lliurar el document en el termini establert. Recollirem la informació més relevant que permet caracteritzar les pràctiques educatives i els sistemes que les configuren.</td>
<td>28.11</td>
</tr>
<tr>
<td>5. Recopilació de totes les tasques en un mateix document.</td>
<td>Respon-sable</td>
<td>Per tal de facilitar la revisió la responsable adjunta en un mateix document totes les parts de la caracterització i sistemes (referent a les diferents pràctiques educatives), obtingudes en la tasca 4.</td>
<td>Un missatge a l’àrea de fitxers de l’espai de grup. Identificació: EQUIP(núm.)-(lletra)-TASCA 5</td>
<td>Lliurar el document en el termini establert. Haver recollit totes les aportacions i fer una presentació de la informació comprensible.</td>
<td>03.12</td>
</tr>
<tr>
<td>TASCA</td>
<td>QUI LA FA</td>
<td>COM ES FA</td>
<td>DOCUMENT A LLIURAR</td>
<td>CRITERIS D'AVALUACIÓ</td>
<td>DATA LLIU-RAMENT</td>
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<td>------------------------------</td>
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<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>6. Reflexió sobre el valor per al desenvolupament dels diferents contextos</td>
<td>Tothom a l’hora</td>
<td>Els membres del grup, tenint en compte la caracterització dels contextos, elaboren una reflexió sobre el valor de cadascun per al desenvolupament de les persones.</td>
<td>S’envia un document a l’àrea de fitxers de l’espai de grup. Identificació: EQUIP(núm)-TASCA 6</td>
<td>Aportacions dins el termini establert. Comentaris argumentats.</td>
<td>6.12</td>
</tr>
</tbody>
</table>

Original version of table 5 in Catalan. Teacher’s valuation of the tasks 2.1. and 2.2. accomplished by group 1.

| DOCUMENT P.234 g1                                                                                   |
|-----------------------------------------------------------------------------------------------|---|
| Heu realitzat, en general, un bon treball, del qual destaquen els següents punts:                 |   |
| - Heu fet un bon treball d’equip, heu unificat criteris de realizació i d’estruccació de les preguntes, la qual cosa el dota de molta coherència interna, però en el primer apartat, la comparació entre contextos s’ha presentat d’una manera fragmentada. (...) |
| - Heu fonamentat les respostes en els continguts treballats als materials de l’assignatura corresponents al mòdul 3, però en alguns casos no heu sabut utilitzar aquests coneixements per referir-vos als diferents contextos, per exemple, utilitzar el concepte de “participació guiada” per explicar el procés d’aprenentatge, no només a la família, sinó també a d’altres contextos, com el grup d’iguals, per exemple, o l’ús educatiu de la TV. |
| Aquests aspectes, i d’altres que us he anat comentant al llarg del treball fa que la vostra nota a la PAC3 sigui una B |   |
In order to mention this document


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Digital learner portfolio as a tool for innovating assessment in the European Higher Education Area

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Summary

The present article comes from a doctoral thesis that turns on digital learner portfolio, which is an innovating methodology from the perspective of European Higher Education Area. First, the educative concept of eportfolio is described in the sense of its procedure and its structure, by means of the technological support of a platform of virtual campus. Second, it is shown the pedagogical model of an eportfolio that adapts subjects with an instrumental character to one organization based on tasks and reflections. This design of virtual learning environment is based on a teaching-learning methodology sustained in the activity of the student, which tries to give support to the management of his or her own process of learning and assessment. Finally, the article illustrates the experience of implementation of the first digital learner portfolios in the University of Barcelona and the Autonomous University of Barcelona, with the objective of reflecting about the pedagogical consequences that this assessment model with technological support has in a traditional higher education institution.

Keywords

Digital learner portfolio; Higher Education; Methodology of Assessment; European Convergence.
INTRODUCTION

Portfolio, as an educative methodology, appears documented about the middle of last century in Anglo-Saxon countries. Nevertheless, it acquires relevance as an assessment system in the decade of the 80 in U.S.A. in the field of teacher portfolio, as an alternative tool of accreditation of the state teaching staff, as well as in specific scopes, being a support for lecto-writing, for teaching languages, etc. One decade later, in nineties, with the fast expansion of the Information and Communication Technologies (ICT), in the university scope it resurges as an assessment instrument centred in the academic profit of the students. It emerges as a new way to conceive the assessment that offers the opportunity to design a different system, with a new tool, which facilitates the acquisition and pursuit of learning, through the new rolls assigned for teachers and students. This innovating character has been mainly the one that has contributed to its recognition in the present educative context.

In Europe, its use in the scope of the higher education extends at beginnings of year 2000, through created home-grown applications working as a Virtual Learning Environments (VLE) that acted as a digital learner portfolio. The approach to this system is made of a specific way, which is centred in the production of students in a certain course. In the North American tradition, it is used an institutional online assessment systems to provide university digital portfolios, whereas in Europe, its application is usually less amassed, with home-grown or adapted platforms to the student and centred in the academic achievement. The objective, in any case, is to facilitate to the student the pursuit of his or her own learning, through the use of the portfolio as an instrument of measurement of his or her own progress, to include in his or her repertoire some didactic resources as a support to the learning process, as well as to follow his or her process of formative and summative assessment, in which the students must involve themselves and take responsibilities (premises of learning autonomy).

This conceptualization of assessment has motivated organizations of diverse character (academic, enterprise, political, etc.) to gather around groups such as the "European Institute for Elearning" ("EIfEL") in order to undertake the study of electronic portfolio or "ePortfolio" (as usually it is denominated at international level), as much as from the advance of its technology of support as well as from its possible applications to different scopes, among which is the educative one, our area of interest.

In our context, just a few years ago, the digital portfolio has begun to be used by universities. In our study it must be remarked two of the first universities that initiated experiences of this type: the University of Barcelona (UB), whose implementation arose from the Group of Research in Education and Virtual Learning (which acronym in Spanish is "GREAV") with the Moodle, an open source platform (2004) and the Autonomous University of Barcelona (UAB) with the prototype PRACTUAL (2003), based in its “Autónoma Interactiva”, a home-grown platform. At Spanish state level, diverse universities, as an educational innovation, also initiated their first works to adapt eportfolios. In these proposals it is possible to observe: first, a clear bet by blended learning with ICT support and, second, the consideration that the eportfolio constitutes one of the new methodologies that can give answer to a assessment system set from the conception of the European convergence.
THE EPORTFOLIO WITHIN THE FRAMEWORK OF EHEA

This exposition of the assessment by eportfolios adapts to the European system of credits and qualifications of the European Higher Education Area (EHEA). In the new paradigm of the European university education, the credit corresponds to the unit of measurement of the student’s work, in order to obtain the objectives programmed by the subjects of the curricula, integrated in an official title. This measurement can imply a new system of learning in which the student organizes and manages his or her academic activity, this aspect, according to diverse authors (Goñi Zabala, 2005; Garcia Suárez, 2006), constitutes the key piece of the new European university reform. It is considers that the assessment has to be oriented to the student, therefore it would have to happen through the reconstruction of the curriculum and it should go beyond the simple cognitive dominion of the discipline, including the acquisition of techniques, competencies and abilities of communication, creativity, critical analysis, independent thought, work in equipment in diverse contexts, etc. In other words, the assessment must be based on reorganization and the reflection about the curricular planning on the basis of: competencies, activities and assessment, to potentate the interrelation between the three axes of the EHEA: teaching-learning-assessment.

THE EPORTFOLIO AT THE PRESENT TIME

Eportfolio is defined as a methodology of alternative assessment comparing with traditional one, which it is based on an online application that allows: the management, organization and distribution of the personal information related to the academic and/or professional activity of the student. The specialists in the theme (Cambridge, Kahn, Tompkins & Yancey, 2001; Kankaanranta, Barrett & Hartnell-Young, 2001; Barrett, 2003) considers that the information of the contents of eportfolio must be selected by the own student (owner of digital portfolio) to be able to show his or her educative achievement and reflections about his or her own learning, in such a way that it reflects to himself or herself and to the others (teachers or "peers"), the knowledge acquired in a certain period.

One of the main authors of this educative theme is Barrett, a North-American researcher that at the end of nineties spreads her work (that covers research, seminars, etc.) and participates in the main academic events (http://electronicportfolios.com/portfolios.html). At the same time, other authors like the mentioned ones previously, also have developed the theme in their contexts and have contributed to their spreading, like Cambridge from the North American Association of Higher Education, Hartnell-Young from the Institute of Research in Educational Sciences form University of Nottingham in United Kingdom, and Kankaanranta, from the Digital Portfolio Project of the Institute of Educative Research of the University of Jyväskylä in Finland. With this review, the origin of the work is framed, that has stablished the foundations of digital learner portfolio, since at the present time a publication proliferation exists, which centres their premises in the work of these authors. However, the investigations of empirical character are scarce, especially from the university scope and in relation to the European convergence.
PREVIOUS STUDIES TO THIS DOCTORAL RESEARCH

Before the implementation of eportfolio, a set of investigations was carried out on this theme, because at the beginning of 2000 almost did not exist published literature related to digital learner portfolio in the university.

First, on the basis of the state of the question, the pedagogical criteria for assessing university digital portfolios were created (Lopez-Fernandez, 2004), which allowed developing a pilot instrument for the analysis of eportfolios in universities, considering the point of view of three macro-criteria: the context, the contents (products and processes) and the agents (figure 1). This previous work was validated by university lecturers’ specialist in this theme at international level. These criteria were used as a tool to analyze the university digital portfolios, published and used by universities of different countries, based on their objectives and characteristics. They were also used to know their structure and procedure with the objective to decide the characteristics to consider later in the implementation of our prototype.

In particular, the first macro-criteria, the context of the digital portfolios were based on its multimedia and instructional design. The second macro-criteria, the components of the digital portfolios, made reference to their products: tasks, reflections and learning objectives, as well as its processes: assessment, feedback and presentation of evidences. The third macro-criteria, the agents, contemplated the type of learning fomented from eportfolio, being this either individual, social or mixed of both possibilities.

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Proposal of Pedagogical Criteria for Digital Portfolios in Higher Education

**CONTEXT OF DIGITAL PORTFOLIOS**

2. Instructional Design: Integration: Table of contents in the Product Learning Components, Organization of Academic Evidences, Audience and Purpose, Educational Philosophy, Virtual Learning Environment

**COMPONENTS OF DIGITAL PORTFOLIOS**

Product learning components
3. Artifacts: Organization of artefacts, Variety: typology and expertise, Appropriate content, Creativity of the artifacts
4. Reflection: Connection between reflections and artefacts, Meta-cognition, Level of reflection, Overall reflection of the e-Portfolio.
5. Standards: List of standards, Grade of understanding, Achievement of academic evidences, Process Learning Components

Process learning components
6. Assessment: Criteria for assessment, Opportunity in order to create his/her own assessment, Opportunity in order to participate in assess other peers, Instruments for assessing the PLC during the process
7. Feedback: Between the student and his/her teacher, Other participants, Communication tools, Validation of the learning evidences.
8. Presentation: Development of academic evidences, Learning goals, Portray of the owner, Culture of evidence, Final components.
Secondly, a study was made to know how an educative portfolio was boarded in the initiated European proposals in 2001, in relation to the European Language Portfolio and ePortfolio 2010.

Thirdly, in the case of the University of Barcelona, the main VLE with an open code were analyzed in order to evaluate whether they could give us an optimal solution to our intention of implementing a digital learner portfolio. The only existing application in 2003 the "Open Source Portfolio Initiative" (OSPI, version 1,5) was chosen as an eportfolio. We studied its basic characteristics (to register, to reflect and to share) in order to adapt it to our model (Lopez, Rodriguez and Rubio, 2004), but finally it had to be discarded for technical reasons. Because of this it was continued the process to explore other alternatives and, once selected, Moodle was chosen by its advantages: flexibility, versatility, ease use, and adaptability to our model of digital learner portfolio. Parallel to the investigation made from UB, collaboration with the group of research SINTE, from the Autonomous University of Barcelona began, which had initiated their work with university digital portfolios (Monereo, Sanchez and Sanz, 2004).

Summing up, the objective pursuit was to create eportfolios as tools for alternative assessment, and that provided the development of a method of work, based on tasks and reflections about the own learning of the student in a blended strategy of teaching and learning in the University. We tried to promote a progressive acquisition of the autonomous learning, understood as the own capacity of the student to manage his or her learning. In both institutions, eportfolio was an innovation, reason why an adaptation of a platform to eportfolio of the student was made. This consisted of a process of induction to the innovation for the students. Furthermore, several contents of complementary support were designed: informative webs, online tutorials... as well as teaching aid with the eportfolio tutor (Lopez, 2005).

INVESTIGATION OF UNIVERSITY DIGITAL LEARNER PORTFOLIO

The main objective of the present investigation was the design and the implementation of digital learner portfolios as systems of assessment of the university leanings.

It was tried to obtain a greater understanding of the operation, achievement and consequences of this methodology in the students who attended subjects adapted to EHEA framework. These students characterized themselves to have a basic baggage in: the use ICT, the mediated communication with technology and the learning by tasks. The purpose of this proposal was to promote the self-management of the student’s work, following the premises dictated by the European convergence and, at the same time, to be able to obtain an improvement of the academic yield.
In the UB three prototypes of digital learner portfolios were based on Castelló and Monereo’s pedagogical model of virtual folders (2000), but they were developed with Moodle platform (figure 2).

The digital portfolios consisted in a private VLE, where the student was the owner and acceded through a university username and password. It was structured by sections, where the main one (represented by the central column of figure 2) was a structure public to teachers and students, but the content was private for each student. In this first section (the one which is without a number) were stored the common resources for the group-class: the directory with the contents of classes, the online tutorial of portfolio of the subject (figure 3), the criteria of assessment among other didactic materials. The rest of sections were private (numbered sections of the central column of figure 2); their content depended on the work of the student organized for: a brief curriculum vitae, a set of evidences formed by tasks (described with: title, date of delivery for the assessment, objectives, materials of support) with associated reflections and, to conclude, a final synthesis.
Figure 3. Webpage related with assessment criteria of MME digital portfolio (MME DP), as a part of the students’ online tutorial made with Note Taker.

The UB eportfolios fulfilled established requirements for the investigation. The teachers must have experience in the use of portfolios, use of ICT for their teaching, and use of European convergence credits. The students would have experience in the use of the ICT. These conditions also occurred in the case of UAB eportfolio, denominated "virtual folder Practual", whose model was very similar (figure 4).

These models of digital learner portfolios located under the constructivist learning perspective, established phases of development that constituted periods of work for the students to manage their activities and assessment. In both cases (UB and UAB) the calendars were scheduled for allowing learner-centred formative assessment, by means of a feedback established for each task displayed to the teacher during a semester.
In relation to our proposal of pedagogical criteria for digital portfolios in higher education, both prototypes of eportfolios had an optimal level as far as the three described macro-criteria.

As far as multimedia design is concerned, both eportfolios (UB and UAB) fulfilled the most basic aspects:

- they allowed a fast navigation, although barely intuitive for some students, due to the complexity of the platforms structure (because both eportfolios were adapted from virtual campuses platforms)
- the election was something limited, since the students could not modify the structure of his or her eportfolio, which responded to the instructive and assessment needs of the subject (although they could make the essential: to publish their works in private spaces and to communicate privately or in a group mode)
- the use of the multimedia was the suitable one, both allowed to publish evidences in diverse electronic formats and with great capacity (50 Mb)
- the text use was appropriate (both contained text processors)

As far as the instructive design is concerned, both eportfolios were designed on the basis of their subjects:
- in both eportfolios, students were informed with an introductory text; in Practual (UAB) through the first access to the Web, and in DP prototype (UB) with an online tutorial included in the eportfolio (figure 3)
- the structure of the eportfolio components (contents and processes) were clear from the introductory text of Practual (UAB) and in the main page of DP prototype UB (figure 2)
- the audience and the intention also were clear from the beginning, because both eportfolios were introduced in the presentation of the subject by the teachers team and, later, sessions were dedicated to introduce this innovation

The products of both eportfolios contained the essential elements:

- they based its organization on the tasks (in greater measurement the design of the UB) with a progressive level of complexity, adapted to the content of the subject, so allowing certain degree of creativity
- the reflections to the connected tasks, also had a progressive level of complexity that finalized, in the case of the design of the UB, with a general synthesis of eportfolio
- they content a list of objectives in relation to the academic evidences (with greater visibility in design of UAB, because the information was contained from the beginning of the application; whereas in UB, the information was stored inside each task)

Also, in relation to the processes both eportfolios were similar:

- they contained as a purpose the subject assessment, structured by phases throughout the learning process (formative assessment) and, at the end, with the final product (summative assessment)
- they had a tutor to give support to this process: to answer the commentaries of each student, to value their evidences, to manage the group communication through forums, etc. It worked in a teacher team (formed by a senior teacher of the subject and an eportfolio tutor)
- they based the presentation of learning products (tasks and reflections) on a progressive sequence, starting from some simpler components to others more complexes

Finally, in relation to the eportfolios agents:

- both eportfolios were individual, which promoted the students’ autonomy
- although eportfolios were individual, they also provided opportunities for the collaborative learning, specially Practual, which had as objective create a community of learning

In summary, both prototypes studied during the academic course 2004-2005 contained the main components of the academic eportfolios for assessing university students. On the one hand, they had its advantages derived from the instructive properties of the design as well as of the teaching support. On the other hand, we must emphasize the difficulties derived from the adaptation of virtual campuses platforms and the novelty of the teaching-learning-assessment process.
CONCLUSION

The experience of implementing digital learner portfolios, created by the own university teacher team, on the basis of the premises of the European convergence and to the new educative models, inspired this work from their origin. It was tried to aboard thoroughly, a method that conjugated the pedagogical, technological and psychological dimension, to centre the study of this doctoral thesis in the obtaining of knowledge about the future forms and instruments of teaching and learning at the University. For that reason, it was tried to restore in practice an educative methodology that, in one hand, was an innovation that affected to teachers and students, and that on the other hand, implied all the educative process, reason why the assessment was selected, as focus of the university educative action.

In conclusion, it has been described in a detailed and summarized way, the concept of eportfolio and an initial model for its implementation in higher education, as an example of learner-centred assessment. The "good practice" of this methodology has facilitated new processes of teaching-learning-assessment and new roles, for both, teachers and learners. At the same time, it has been tried to foment in undergraduate students the necessary training to exert professionally in a society characterized by: the management of information and knowledge, being at the moment more global and intercultural as well as complex. Thus, other elements arise from reflection about the implication of this type of processes addressed to these students and the own institution. The possible future lines for investigating the impact of this innovation are addressed to different types of subjects, students, teachers, universities, platforms, etc. One hopes that this one and other works, in the line of educative innovations, contribute to the development of empirical studies that foment the advantages of these practices and minimize, as well, their disadvantages, to accomplish with a scientific base, the challenges raised by the new century for the Higher Education.
Referentes


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Teachers’ interactions in a virtual learning environment:
A comprehensive approach

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Summary

The goal of studying interactions in online environments is to know the kind of interactions which take place in discussion forums. This article contains the results of an exploratory, descriptive research that analyzes, with both quantitative as well as qualitative approaches, a virtual learning environment for comprehensive teacher training in their whole: the course, the platform, the tutor’s role, the exchanges between the tutor and the participating teachers in the discussion forum, analyzing those exchanges, to whom they are addressed and their collaborative or personal natures. Regarding this experience, the results show a positive evaluation for the course, the tutor’s role and the platform; as to the interventions which arise between the tutor and the participants in an interactive context, at the beginning, the participants’ interactions are personal, though, little by little, they become more collaborative.

Keywords

Virtual teacher training; analysis of virtual interactions; virtual environment for learning.

INTRODUCTION

As Information and Communication Technologies (ICTs) become more interactive and collaborative, we see the birth of new opportunities to create learning experiences relying on approaches based on interaction and collaboration. The use of the interactive potential of ICTs allows us to substitute methodological approaches which have been developing for a while in pedagogy. Most of these virtual
training systems, focused on collaborative work and construction of knowledge in a network, originate in theoretical frameworks built on the notion of constructivism, especially social constructivism.

Virtual Learning Environments (VLEs) are spaces relying on a system of communication through a computer, in order to facilitate interaction between the participants and the tutor. Such interaction is key in educational processes present in the social construction of knowledge (Garrison & Anderson, 2005). In an environment which encourages the construction of knowledge in a network, interactions are essential to achieve quality learnings (Schrire, 2006, Stacey & Rice, 2002). These virtual environments are used preferably in pre and postgrade formation, although they are starting to become valuable spaces to help in professional development, like continuous teacher training, making it necessary to analyze virtual interactions, in the particular context of the formation of that body of professionals. The research on interactions and collaborative work is done using different methods and reliability levels (De Wever et. al. 2006).

This article features the results of an exploratory descriptive research which analyzes, with quantitative and qualitative approaches, the virtual learning environment for comprehensive teacher training: the course, the platform, the tutor’s role and the interventions between the tutor and the teachers present at the discussion forum, examining the contents of those interventions, to whom they are addressed and their personal or collaborative nature.

**ICTs and Communication**

The impact of ICTs on communicative aspects is such that we call “Computer-Mediated Communication” to all instances of synchronous an asynchronous communications carried out through technological resources. Research has demonstrated that computer-mediated communication can affect communication models, organizational systems, identity and society as a whole Dahlberg (2004). These communicative instances facilitate agreeing on ideas, sharing, reflecting, developing cooperative and/or collaborative tasks, having feedback and guidance from the tutor (Cook, 2002; Nussbaum et al., 2004; Murphy et al., 1998). The correct insertion of these communication tools into learning and formation processes, when they are well assisted, can favor collaboration. The advantages of online collaborative learning are well-known, however, it is also clear that, due to a series of reasons, some implemented learning experiences have different degrees of success (Macdonald, 2003).

Among communicative tools, there are discussion forums (Computer-mediated Conference), an asynchronous communication mode that allows for a dialog based on written text (Ryan, et. al, 2000). Discussion forums have a great potential to transform teaching-learning processes, allowing for group discussion and other participants’ access to socialization and communication (Salmon, 2000; Harasim et al., 2000; Bates, 1995).

The use of discussion forums creates learning environments based on constructivist models of a socio-cultural nature, resulting in collaborative work and the construction of knowledge in a learning community. These communication tools play a key role by helping participants reduce a lack of interaction, typical of distance education, as there are more exchanges between the students and the
teacher, as well as between the students themselves (Ryan et al, 2000, Salmon 200; Wallace, 2001). Interactions in virtual environments are fundamental to generate formation instances based on computer-supported collaborative learning (CSCL).

**Virtual interactions**

ICTs offer ways that ease and enable communication, but this sometimes occurs at a level of participation which does not mean interaction. It is necessary to establish a difference between these two concepts as sometimes they are understood as being synonyms. "Whereas by participation we understand the presence and virtual contribution of the teacher's, but above all of the student's, the interaction adds the reply and the chain of mutual understandings realized through the language" (Barberá & Badia, 2004, p.26). The interaction is vital for the construction of knowledge through the exchange of messages with other participants and the tutor, revolving around the topics discussed, messages which are, initially, built from the personal experience, and, later, enriched with other people’s contributions. In contrast, the participation only supposes a simple “being there and intervene”; it does not require a reply or encourages one, necessarily. Several studies have shown that a great deal of the messages exchanged in discussion forums are mostly situated at the level of participation than interaction (Cabero, 2004). We need to relocate virtual interaction within completely psychopedagogical coordinates, so as to improve the processes of teaching and learning in virtual environments (Barberá & Badia, 2004).

Technologies facilitate interactions which are relevant for virtual teaching and learning processes, as they foster collaboration and the social construction of knowledge, key factors to achieve quality learnings (García Aretio, 2003; Stacey & Rice, 2002; Schire, 2006). The communicative potential of ICTs incorporates the decisive feature of the formal educational model: interaction between teachers, students and contents (Garrison & Anderson 2005). ICTs’ communicative potential unites this learning modality with the positive impacts that interactions have had on the learning process of face-to-face environments, incorporating the merits of online interaction, too. However, we also have to bear in mind that technology itself does not create communication or learning (Gros, 2007).

Asynchronous interaction in virtual environments is different from that interaction occurring in a face-to-face class as the former has characteristics not seen in the latter; it is neither better or worse, it lacks some verbal aspects, but it has advantages in the gaining of time and space; certainly you lose on emotions but you win in permanence of contents. The time and space dimensions on which the interactions take place suggest different forms of support to construct knowledge (Barberà, & Badia, 2004).

Some factors affect the frequency and quality of the interaction in a virtual environment (Barberà, Badia & Momino, 2001). Such factors are grouped around 3 areas: the teacher whose highlights are the control and the skill, the help provided and his social presence; the student with his previous knowledge, the sense and meaning he gives to his task and the type of evaluation; the task with its characteristics, the size of the virtual classroom and the time involved. In more globalized training processes, or in multiculture countries, it is important to know and care for, from the discussion design and its later moderation, the students’ cultural differences which sometimes are manifested in
discrepancies; their learning styles; their communicative styles and forms, social interaction and use of the language.

Among the successful features of asynchronous online learning environments, there are 3 factors which dramatically favor interaction: a transparent interface, an instructor who interacts often and constructively with the students, and a dynamic and appreciated discussion (Swan et al. 2000). The tutor’s role is crucial for the success of an online training experience, for he has to operate on pedagogical, technical, social and management aspects. He has a major role as a moderator in a discussion which promotes collaborative learning within a learning community. Both the frequency and quality of interventions in a discussion forum are, to a great extent, the result of the teacher’s role as a moderator (Berge, 1995; Salmon, 2000). Finally, the platform must stimulate interactions, providing differentiated spaces for social, pedagogical, technical and administrative actions (Pérez, 2004).

Interaction analysis

Analyzing the interactions produced in online discussion rooms aims at understanding how the teaching and learning process happens in a collaborative virtual environment. It is necessary to analyze online discussions to determine how it is that the social construction of knowledge is produced through them. "So that collaborative learning processes are visible to the researchers, the interactions between participants must be available for careful study, and the researchers must be able to interpret them appropriately “(Stahl 2002, 178 in Puntambekar & Luckin 2003).

In online discussion forums, the text that shows those interactions is digitally available for analysis from different viewpoints: the researchers’, the teachers’ themselves or for whomever develops these training experiences (Rourtke et.al, 2005; De Benito & Pérez, 2003; Naidu & Järvelä, 2006). Despite having those texts with interactions available in electronic format, their analysis is not trivial. It looks simple at the beginning, but it is a complex task: it takes time and needs clear theoretical and methodological frames (Rourtke et. al., 2005). A complex aspect in the analysis of virtual environment interactions is found in the need to establish analysis systems for the messages, so as to understand the interactions and how they are generated. The tools to evaluate the discourse produced in asynchronous interaction environments have had an interesting evolution, worth pointing out to understand the research methodology in this area (Gros, 2007).

To explain this type of interaction, especially the one going on between the students, between these and the teacher, either in a social or a cognitive context, several models have been developed to classify such interactions, built on the pedagogical conceptions their authors adhere to regarding online learning. In Gros & Silva (2006), there is a compilation of the main models, developed in the last 20 years, for the analysis of online interactions. Trying to explicit the pedagogical proposal they make, these are the analysed models: Bullen, Gunawardena and collaborators, Garrison and Anderson, Scardamalia and Bereiter, Järvelä and Häkkinen, among others. The proposed categorization models were created by different researchers or research groups. Those models were made from diverse theoretical frameworks: some of them are more explicit than others. In all of these studies there are varied alternatives, mainly in relation to the units of analysis being utilized, e.g. in some cases, they
chose topic units (Henri), in others, they analyze complete messages (Gunawardena), and in Jäverlä’s case, the whole discussion constitutes the unit of analysis.

A revision and synthesis of the research on the online context interaction analysis concludes with the following results (Wallace 2003 en Marcelo & Perera, 2004):

- Researchers have been developing models for analyzing online teaching and learning by studying the records of online discussions. These models have incorporated variables related to cognitive and metacognitive social aspects. Some studies have tried to find out about the students’ progress as to thought levels based on their online discussions.
- By using these models, the researchers have concluded that it is hard work for online teaching to take the students from the stage of sharing and exchanging ideas to the construction of knowledge. The students are willing to share ideas but not to deepen their knowledge through discussions.
- In online teaching, teachers take over different roles: they facilitate or moderate discussions, they give answers to individual students and to the class as a whole, they manage the flow of contents through homework, etcetera.
- There is plenty of evidence to highlight both the importance of social interaction as well as the teacher’s presence in online courses.
- An online community is a most important variable in online teaching. But, even when the community may have an important role, not enough research has been done on how this is produced.

THE RESEARCH

In Chile, the Enlaces Network has made it possible for 88% of primary education centers and 85% of secondary education establishments to have access to IT; 82.5% of current teachers were trained to use ICT, especially in digital literacy programs and integration of ICT into school syllabuses (Enlaces, 2005). Starting from that base scenario, the Centro de Perfeccionamiento Experimentación e Investigaciones Pedagógicas (CPEIP) from Chile’s Ministry of Education (MINEDUC) has carried out 5 massive distance teacher training experiences in fields like: maths, sciences and English (Arellano & Cerda, 2006). The evaluation made by the CPEIP on these experiences is very positive regarding the transcendence of the courses and the number of people who passed them. There is a deficit in interactive processes, as they have detected an individual process that does not use interactive spaces; teachers prefer face-to-face interactions (Borrero, 2006). In order to better interactions in online formation experiences, it is necessary to understand the way that interactive process develops.

That is why we decided to do research with this goal: to describe the interactions in a virtual learning environment for continuous primary school teacher training, considering the general opinion on the formation experience, the importance of the tutor’s role, the use and evaluation of interactive spaces provided by the platform, and the characteristics of the tutor’s and the participating teachers’ interventions in the discussion forum. Specific goals:
• To know the opinion of the teachers who take part in the course: resources, attendance, factors, positive aspects and sections that need to be improved.
• To know the use and evaluation of participants in spaces of interaction provided by the course platform.
• To determine the opinion of participants on the tutor’s role as a teacher and conductor in a discussion forum.
• To know and describe the interventions of the tutor and teachers participating in discussion forums.
• To determine the sort of interaction aimed at based on the messages published by the participants in the forums.
• To determine either the personal or collaborative nature of the interventions published by the participants in the forums.

THE EXPERIENCE

In 2005, at Universidad de Santiago’s Centro Comenius, development a course denominated “Geometría.cl: Aprender Geometría Creando Soluciones” [Learning Geometry by Providing Solutions] was given to teachers who are in the second phase of Primary School. Such course was given in a b-learning mode and was funded by Chile’s Ministry of Education. 786 teachers from all across the country took part in it (Silva, 2006). All the participants were subdivided into 26 subgroups of 30 teachers each.

The research was done by tracking one of those groups, constituted by 38 teachers who work in the second phase of primary education in the Chilean school system (fifth to eighth grades). From those teachers, 84.2% are female; 55.3% have more than 12 years’ experience; 68.4% are general primary education teachers, so they do not have a specific formation in Maths; 84.2% work as in-room teachers. As to the use of ICTs, they have good use of Internet surfing, information searching and resources. However, their use of discussion or conversation spaces, like forums or discussion groups, is low or nil. 63.2% of the participating teachers have no experience of distance learning via Internet. Regarding the place where they connect to the platform, 63.2% does it from their homes and 73.7% from their schools.

The tutor in the group being tracked is a Secondary Education Maths teacher with a lot of experience. He has been a tutor in two previous courses and received positive comments from the participants. Within the experience’s coordinating team, he was the tutors’ tutor.

METHODODOLOGY

To understand the process of interaction and construction of knowledge in a network, we need a comprehensive approach that allows the analysis of the several dimensions that come into play: interaction patterns; the characteristics of the discourse; how the process of construction of knowledge takes place and what the role of the teacher in the interventions is (Gros, 2007). The quantitative aspects provide data related to the number of sent messages, the topics in the interventions, the type of intervention, among others, and allows to have a general view of the amounts and flows of
interactions without having to go into the contents of them and the consequences on the students’ work (Shire, 2006). It is necessary to analyze the interaction contents and how they are built. Only through a combination of quantitative and qualitative methods, the collaborative construction of knowledge in a network can be well studied (Hmelo-Silver, 2003; Puntambekar & Luckin, 2003).

In order to assess the results obtained from the study on interactions and the conclusions drawn from it, we used the reliability between the testers, that is, to what degree the different testers assign the same category to a given unit of analysis. This is a crucial aspect to give validity to the results obtained and the conclusions derived from them. Whenever a study on content analysis presents its reliability data, it will be possible for the research community to quote and use those findings and/or results with a scientific support. To measure reliability, one of the simplest and commonest methods is percentage agreement, which informs the number of agreements related to the total of analysis units categorized by both the researcher and the experts.

The work methodology used in the study (Table 1) featured both qualitative and quantitative elements to cover all the different aspects under inspection. These are developed at different stages in the study and involve several processes and roles.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Methodological elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opinions from teachers participating in the experience</td>
<td>• Building of questionnaire &lt;br&gt; • Validation with Experts &lt;br&gt; • Questionnaire at end of course, answered by the 34 participants. &lt;br&gt; • Focus Group with 4 participants &lt;br&gt; • Analysis of the information &lt;br&gt; • Triangulation of the information</td>
</tr>
<tr>
<td>Quantification of participations</td>
<td>• Recording and quantification of interventions by teachers participating in interactive spaces &lt;br&gt; • Recording and quantification of interventions between teachers and tutor participating in interactive spaces</td>
</tr>
<tr>
<td>Characterization of tutor’s and participating teachers’ interventions</td>
<td>• Definition of analysis categories for tutor’s and participating teachers’ interventions. &lt;br&gt; • Validation of categories with experts &lt;br&gt; • Categorization in the 3 intervention forums between tutor and participating teachers. &lt;br&gt; • Validation with Experts in one of the forums. &lt;br&gt; • Analysis of tutor’s and participating teachers’ interventions</td>
</tr>
<tr>
<td>Interaction of interventions and nature of texts.</td>
<td>• Definition of type of interventions: tutor, class or general. &lt;br&gt; • Definition of nature of texts: personal or collaborative. &lt;br&gt; • Those two tags were added to each teacher’s intervention across the 3 forums.</td>
</tr>
</tbody>
</table>

Table 1: Methodological Aspects and methodologies used

Some instruments (validated by experts) were built to characterize the participating teachers and to collect their opinions on the course, the role of the tutor and the convenience, level of use and usefulness of interactive spaces. The first instrument was applied in the first face-to-face meeting attended to by the participants at the beginning of the course and before they moved on to the virtual
environment; the second instrument was applied at the end of the course in the third face-to-face meeting, after 14 weeks had passed.

The information collected from both the questionnaires and the platform was systematized and analyzed independently. It was triangulated with the info obtained from the focus groups which were asked about aspects related to the course in general, the tutor’s role, the use of interactive spaces, the interactions as well as the platform and its interactive spaces.

To quantify the tutor’s and the participating teachers’ interventions in the different interactive spaces provided by the course, we used the statistics rendered by the Moodle platform involving activities in such spaces.

To analyze the interventions by the tutor and the participants in the discussion forum, we considered as units of analysis: messages and topic units, that is to say, considering the whole message or a single unit of thought or idea extracted from a segment of the content in the intervention, prioritizing the detection of analysis units which refer to the same idea.

We built categories to analyze the tutor’s interventions (Table 2) and the participants’ (Table 3), using both deductive and inductive methods. To build the categories of analysis we used elements from the literature referred to the interactions and the role of the tutor in virtual learning environments, as well as the observation of the interventions in the experience being studied. We did not use protocols of existing categories, because they account for regulated areas in pre and post grade formation, thus are not apt for the context of this study: interactions between teachers. These categories were validated by experts so as to have a clear definition of them and their application at the moment of the categorization. For this aim, the experts received an instrument with the categories and examples of their application. The categories were validated with examples taken from the 3 forums.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of discussion</td>
<td>Introduction of topic and questions which will trigger the discussion.</td>
</tr>
<tr>
<td>Partial synthesis</td>
<td>Summary of what is being discussed, highlighting main contributions and putting forward new questions to redirect discussion</td>
</tr>
<tr>
<td>Final Synthesis</td>
<td>Summary of what is being discussed, highlighting main contributions, bringing topic to an end.</td>
</tr>
<tr>
<td>Justification</td>
<td>The participant is invited to give more details for the topics he is dealing with.</td>
</tr>
<tr>
<td>Applicability</td>
<td>There is a reflection on how the class work may contribute in the teacher’s professional development</td>
</tr>
<tr>
<td>Exchange of experiences and information</td>
<td>Interventions meant to make the participants share their experiences and information which may be useful for other participants.</td>
</tr>
<tr>
<td>Orientation</td>
<td>Interventions that guide the participant in the class work and use of resources.</td>
</tr>
<tr>
<td>Feedback</td>
<td>Positive responses to the participant’s interventions, congratulating him and encouraging him to continue working.</td>
</tr>
</tbody>
</table>

*Table 2: Tutor’s Interventions categories*
### Theoretical elements
Introduction of theoretical elements related to learning theories, cognitive bases related to the course contents.

### Previous Experience
Intervention from their own teaching-practice related experiences or from the ones of other participating teachers’

### Evaluation of course
Course is evaluated and commented on how this will influence professional growth.

### Transfer into classroom
This refers to how the different aspect seen in the course are transferred to a classroom: activities, materials, teaching strategies, among others.

### New training needs
This refers to the need to have further teacher training in the contents of the course, didactic strategies for the teaching of that course, and mastering and integrating ICT resources.

### Structural problems
This refers to structural problems which hamper both teaching activities and the implementation of innovation. They do not depend directly on the teacher, e.g. lack of technological infrastructure, time, materials and support from managers.

<table>
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</tr>
<tr>
<td>Structural problems</td>
<td>This refers to structural problems which hamper both teaching activities and the implementation of innovation. They do not depend directly on the teacher, e.g. lack of technological infrastructure, time, materials and support from managers.</td>
</tr>
</tbody>
</table>

#### Table 3: Participants’ interventions categories

For the categorization of tutor’s and participants’ interventions one forum was picked and classified by both the researchers and experts, using, first, the agreement percentage as a reliability factor, which reached a mean of 72.2% for tutor’s interventions and 69.7% for participants’. After contrasting the differences between the values, the reliability turned to consensus percentage agreement, reaching 80.3% for tutor’s interventions and 78.3% for participants’. The other 2 forums were categorized independently by the researchers, first; then, starting from the criteria set by the experts’ validation, they were categorized again to unify the categorization in the 3 forums.

An element which was worth considering, in the light of the analysis to the texts from the participants’ interventions, was to whom the interventions were addressed and whether these constructions were personal or collaborative in nature. These two aspects were incorporated into each unit of analysis already categorized. To determine the type of interaction (Table 4), we considered the addressee of the intervention: tutor, class (a participant or everyone), or general. The first two take place in an interaction context, but the third does not, as it is not possible to determine an addressee.

<table>
<thead>
<tr>
<th>Interaction type</th>
<th>Description</th>
<th>Some examples</th>
</tr>
</thead>
</table>
| Tutor            | Interventions aimed at the tutor                                            | • Dear teacher  
• Teacher  
• Ricardo (tutor’s name)  
• Hello, Ricardo |
| Class            | Interventions aimed at another participant or at the class group            | • Dear colleagues  
• Colleagues  
• Dear Participant  
• I was very interested in your reflection...  
• I do not agree so much with you...  
• I think you are dead right...  
• As to Mr X’s opinion... |
| General          | Interventions where it is not possible to identify addressee                | • Geometry has to be taught because...  
• I use ICTs for ...  
• I think it is important to use real material ... |

#### Table 4: Type of interactions in the interventions by participating teachers
To determine the nature of interventions (Table 5), we considered whether they were made on the basis of personal arguments or based on the tutor’s or other participants’ previous participations. This way, we determined whether the intervention of the participating teacher was personal or collaborative.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Description</th>
<th>Some examples</th>
</tr>
</thead>
</table>
| Personal     | Interventions built from the personal domain, they do not take into consideration other participants’ interventions, are built on personal beliefs or experiences. | • I think  
• In my opinion  
• I believe  
• According to my experience  
• I guess  
• I Consider |
| Collaborative| Interventions built on the contributions from other participating teachers. | • As they have mentioned this earlier  
• I agree with Ms Y’s opinion…  
• I’ve read your intervention. I agree on …  
• I disagree with Mr Z’s opinion…  
• I was about to give my opinion, but Mrs A has just spoken for me  
• I totally disagree with Mrs B’s opinion… |

Table 5: Nature of participating teachers’ interventions

All of the intervention analysis-related qualitative aspects, based on the categorization of interventions from the tutor and participants, as well as the nature of interventions and their collaborative character, were made using ATLAS-TI qualitative analysis software. The results were made into tables which contain the existence of each category used on a general level or a forum level. In the same way, it was also possible to view the whole set of texts in a given category to find characteristic aspects in each category and link these with representative examples.

RESULTS

The main results of the study show: a positive evaluation of the course, the tutor’s role and the platform; the tutor’s interventions focus on favoring interaction; the participants’ interventions are mainly made from theory and practice; the greatest percentage of participants’ interventions happen in a context of interaction, either with the tutor or the group, though they center on the tutor; the participants’ interventions are principally personal ones, though gradually they become more collaborative. Next, you will see these results in more depth.

Course evaluation

As a way to evaluate the course, teachers were asked to give their opinions on several aspects of it, especially those connected with: the resources introduced and their usefulness in teachers’ tasks, the work methodology and feeling as part of a learning community that grows through collaborative work in a network.
The factors which received the best evaluation were related with the quality of teaching resources and the quality of technological resources provided in the course: they were graded with 94.1% and 91.1%, respectively. Lower values were given to the perception that the learning is done collaboratively and feeling as part of a learning community: 47.1% and 50%, respectively.

**The tutor’s role**

The tutor has an important role as a conductor in the discussion forum where he has to turn this into a space where knowledge is constructed, by interacting with participating teachers and facilitating the interaction among these. To determine how this component was perceived by the teachers, there was an evaluation on the students’ level of agreement/disagreement regarding some tasks considered to be relevant when it comes to analyzing the tutor’s behavior in discussions.
In all the items, high percentages show the teachers’ complete agreement or agreement with the statements. Aspects like *introduction of discussion topics, he summarized the contributions, he systematized the information* and *information exchange* reached 94.1% agreement. The lowest agreement was obtained in *calls end of session at the forum* with 85.2%. In the focus groups, its participants say: “clearly, he read the messages, as he knew Mrs A’s opinion, or quoted someone else, so you’d say he actually read it and is able to reply” (teacher 1). “He summarized everything, said “congratulations”, “nice job”, “I do share your views” (teacher 2); “He was always attentive and with a good disposition, trying to make you be involved” (teacher 3).

**Platform Evaluation**

A key factor in the success of the long distance courses is a platform which can be perceived as user friendly and easy to use (Pérez, 2004). Teachers were asked about different platform-related aspects.
Figure 3: General evaluation of platform

Figure 3 shows that 97.1% of participating teachers find the course’s platform either good or very good; only 2.9% think it is so-so. Somehow, teachers appreciate the virtual work space which was designed in the course’s platform, its functionality and ease of use.

Quantification of Interventions

There are three stages in a discussion forum: topic introduction, making of summary and reorientation of discussion, and end and final synthesis.
In the three forums (Figure 4) there were 294 interventions altogether. From these, 78.2% were from participants, and 21.8%, from the tutor. The participants’ interventions grow and the tutor’s decrease as the forums develop. In general, the tutor’s interventions do not go over the 25% of the total suggested in the literature.

**Characterization of tutor’s interventions in Discussion Forums**

In general, in the 3 discussion forums, 67 tutor’s interventions were classified under 73 categories; 8.2% of them (6) were given 2 categories.

![Figure 5: Categories of tutor’s interventions](image)

When analyzing the type of interventions (Figure 5), we can see there are 2 big families: the ones addressed to the class, found at the start of the discussion, the partial synthesis and the final summary, which make up for 13.7% of all interventions; the remaining 86.3% happen in the context of an interaction between the tutor and the participant.

The interventions addressed to the class group are not so numerous as they only happen once or twice in each forum. Thus, *start of the discussion* accounts for 4.1% – there is an intervention at the beginning to introduce the discussion –; *partial synthesis* accounts for 6.8%; and to make a general summary to close the discussion, i.e. *final synthesis*, accounts for 2.7%. These categories are related to specific moments in the forum’s moderation. They are interventions addressed to the class group, and in the cases of *start of debate* and *final synthesis*, they can occur once in each forum.

Interventions addressed at one participant arise in different ways in a forum; depending on its length they tend to be more frequent. Consequently, *feedback* in the form of congratulations and encouragement to keep on participating concentrates 28.8%; exchange of experience and information, 21.9%; *Applicability*, aiming at reflecting how the course work may contribute to the participant’s professional growth, represents 17.8%; *Justification*, where the participant has to give arguments to support his interventions, 11%; *Orientation*, to lead the teacher through the different tasks in the course, 6.8%.
Categorization of participants’ interventions

In general, in the 3 Discussion forums, 236 participants’ interventions were categorized and 276 categories were assigned to them; 16.9% of interventions were given 2 categories.

When analyzing the categorization of participants’ interventions in the 3 discussion forums (Figure 6), we can observe that the Previous Experience and Theoretical Elements categories concentrate most of the participants’ interventions with 40.9% and 29.7%, respectively. These 2 categories make up 70.6%, so the bulk of the teachers’ discourse is built on either their previous teaching experience or on theoretical elements, aspects which allow teachers to give a basis to their interventions which, in turn, inform about the teachers’ firm beliefs and ideas. The Course Evaluation category shows 11.2%. This category is related with the effects of the course on the teacher training, from the dimension of methodological changes, management of contents, incorporation of different resources and the experience to be trained with peers in a virtual environment.

There is a group of 3 categories which present percentages below 10%. This is the case of Structural Problems (8.4%), related to difficulties found within the educational system: lack of time, shortage of materials or being unable to afford technology, as well as problems connected with the actual practice of being a teacher; Formation Needs (5.4%), dealing with the teachers’ detection of needs to access training for improving their knowledge on how to manage contents and be given new teaching approaches. Those two categories have a direct impact on current teaching practices; Transfer into Classroom (4.3%) has to do with transferring of course proposals into the classroom: activities, materials and resources. This is also reflected in proposed approaches. There are Concrete Transfers and there is also Planning of the Transfer.

Type of interaction

To identify the kind of interaction for an intervention, it was necessary to determine the intervention’s addressee: either tutor; or class, which is for the class as a whole or for another participant; or
interventions where it is impossible to determine an addressee. The first two happen in an interaction context whereas the third one does not. In the first two, there is a clear intention to interact with the tutor or with a classmate or with the class, approaching the addressee either directly or indirectly.

**Figure 7: Type of interaction**

On a global level, Figure 7 shows that 60.1% of all the interventions happen in an interaction context—with the tutor or the class—, the remaining 39.8% of interventions are general. Interactions with the tutor represent 34.3% of the total. We can also observe there are two ways to address the tutor: either using his name, “Ricardo”, or as “Teacher”. In no intervention he is called “Tutor”.

Interactions with the class represent 25.8% of the total. They could be classified in 2 big families: the ones in which the other person or the class is directly mentioned, and the ones which do not name the receiver, although we can clearly understand they refer to a specific participant or to the class.

**Nature of Interventions**

An additional approach on the interventions has to do with their nature: personal, based on personal arguments, unrelated to previous interventions; and collective, triggered by other participants' previous interventions.
Generally speaking, 72% of participants’ interventions are personal and only 28% collaborative. But we can see that there is a growing tendency for the latter in forums. Collaborative interventions allude to some other participant’s previous contribution.

CONCLUSIONS

The participants appreciate the course in general and its different aspects, as well as the materials, the contents and the varied resources provided. They recognize its usefulness for their teaching work and its possible transfer into a classroom. The least valued aspects deal with a perception to build knowledge collaboratively and feeling as part of a learning community. From this, we can conclude that teachers perceive the experience as more of a personal experience than a collaborative one.

The role of the tutor is key for the course’s success, as there is a very positive opinion on his operation as moderator and encourager in forums. The participants realize the tutor is actually reading their interventions, summarizing them and enlivening the discussion. The role of the tutor is rated very highly in social, technical and general management tasks, and in his presence as a moderator, too.

There are also very positive comments on the platform and the way interactive spaces are provided. Participants remark its ease of use, they find it friendly. The spaces are frequently used, and “useful” in their words. Providing differentiated spaces for discussions, sharing resources, clarifying doubts and interacting in free topics, as in the “social forum”, all assist to increase and organize interactions. When the participants were asked about the platform, they ended up talking about the course (a clear signal that the platform was invisible); it merged into a single element: the course.

The analysis approach which was used supposes a categorization process that implies a double analysis. Firstly, once the categories are established, the researcher must let them be studied by other experts in the area. Once they are analyzed and contrasted, the researcher has to analyze the
messages against those categories. There is a second level of contrast which incorporates the approach we propose, and it is about validating this second analysis level with experts. In other words, there is a validation of the categories and of their applications. This second validation level allows to secure a consensus on the application and interpretation of the data. In the research we did, as to tutor’s interventions, there is an average consensual percentage agreement of 80.3%; in the case of participants’ interventions, the average consensual percentage agreement was 78.3%. With these reliability values, we analyzed the 2 remaining forums to inform on the tutor’s and participants’ interactions at this teacher training experience.

The tutor’s intervention categorization clearly depicts that most of his efforts go to favoring the interactions with the participants. However, there are some aspects which happen at specific times and are key for the discussion development: to start the discussion, to make a partial summary and to make the final summary. In the case of participants, their interventions spring from theoretical elements or from their teaching experiences.

From the perspective of interactions, the main percentage of interventions is interaction with either the tutor or with the group, either with all of this or with one participant. The level of interaction is growing from the first to the third forum. To study this type of interaction is fundamental, as there are several studies which report that the bulk of interactions is between the tutor and the participants, and there is not necessarily interaction between peers (Cabero 2004; Adrián, 2003). To inform on the nature of the intervention is crucial for understanding to what extent the teacher is involved with the group work in a virtual learning community, where he can make contributions with his personal interventions and can also benefit from the ones by other participating teachers’. These indicators also reflect the tracking of the development of the discussions held by participating teachers, for it is necessary to read the others’ interventions to start building from them. The field literature shows that the interactions between peers goes up along with the course development, because there is more commitment to it and to the classmates (Lipponnen, 2002; Macdonald, 2003).

One of the aims of these training experiences is the creation of learning communities where it is necessary to receive help from others to construct knowledge collaboratively. In this context, we have observed that the participants’ interventions go from being personal, at the beginning, to being more collaborative. One of the aspects to highlight in the study of online discussions is the capacity to construct knowledge in a network (Harasim et al., 2000; Murphy et al., 1998; Salmon, 2000). But also many studies show that this collaboration is not easy and that it is common to find discussion forums built on personal contributions (Macdonald, 2003; Lipponen et al., 2002; Cabero, 2004).

No matter how many provisions are taken to favor interactions in virtual learning communities, we cannot disregard the teachers’ cultural and social aspects as they may conceive their profession as an isolated activity, even within the same school. This is manifested in their interventions which are more personal than collaborative in nature. This tendency is modified, though, as the course unfolds.

Presumably, as the teachers use virtual communication spaces more systematically, the interventions will be more and better. It is recommendable that initial teacher training includes this type of learning experiences, because young people are better acquainted with an interactive culture.
This research presented concrete results as to the analysis of teachers’ interactions in virtual environments. Starting from this work, new studies may be launched to know, for instance: what results could be obtained with teachers coming from subjects closer to the use of language? What happens with teachers in other countries? What would happen with students who are studying to be teachers as they are better inserted in a communicative culture which is encouraged by ICTs? In all these cases, are the proposed categories for analysis useful? Will there be a similar or different level of collaboration? Are there more personal or more collaborative constructions? The ones who interact and collaborate are many or just a few?

References


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Using E-Maps to Organize and Navigate Web-based Content

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Summary

Many university faculty create their own websites or use a course management system to upload course materials for online instruction. Course content and files are mostly organized and presented in a linear structure and placed in a series of folders and subfolders. An alternative approach to navigate, organize, and sequence Web-based content is to use a computer generated mind map – an E-Map. With its unique storage and organizational capacity, E-Maps not only provide a user-friendly e-learning structure, but also can effectively manage knowledge in a much more efficient manner than using a linear approach to navigate and access Web-based content. The purpose of this article is to examine how E-Maps can be used as a graphical interface for presenting and organizing Web-based course content and files online. Explored in this article is a brief overview of mind maps, mind mapping software, how using E-Maps as a graphic organizer can facilitate learning, and some instructional application examples of using E-Maps for Web-based instruction.

Keywords

Mind maps; concept maps; graphic organizer; E-learning; Web-based course design.

7 Michael F. Ruffini is an Assistant Professor of Educational Technology in the Department of Educational Studies and Secondary Education at Bloomsburg University of Pennsylvania. He teaches both undergraduate and graduate courses in educational technology. He just recently published a book on designing virtual field trips with Pearson Custom Publishing. Dr. Ruffini uses the E-Map technique for presenting his courses online and has had tremendous success with this approach. His website is Map-a-Course (http://www.mapacourse.com) where he displays many of his E-Maps. He can be contacted at mruffini@bloomu.edu, office: 570.389.5310, cell: 570.394.6777
INTRODUCTION

It has been said throughout time that a picture can be worth a thousand words. Pictures are worth a thousand words because they can generate more cognitive associations that enhance critical thinking and memory than words can by themselves. E-Maps are computer-generated mind maps that can represent complex information in an organized, easy-to-understand visual format. E-Mapping is a powerful e-learning and organizational technique that can visually display main topics, subtopics, concepts, images and the interrelationships between them.

Many university faculty design and upload course materials to the Web using either their own website or a course management system such as Blackboard™, TopClass™, or eCollege™. However, whether using a website or course management system, most all content is presented in a linear or sequential structure using hyperlinks to access course files, websites and folders. Sequential ordering of content may be displayed in a chronological or alphabetical order, or can be arranged in subject matter progressing from general to specific. Using an E-Map can organize and sequence content in a non-linear structure on one webpage, by placing the main topic in an image-centered diagram with interrelated main and subtopics connections or branches in a radial format. E-Maps can be useful for presenting and summarizing information in a format that shows the overall structure of subject content.

ABOUT MIND MAPS

Mind Maps® were developed by Tony Buzan in the late 1960s as a way of encouraging students to take notes using only key words and images. The mind forms associations almost instantaneously, and the Mind Map approach helps students quickly relate a central word or concept to other pieces of information (Buzan 2002). A mind map makes information more memorable than just memorizing the information because a mind map, just like concept maps, places the information being learned in a context of existing knowledge. Furthermore, a mind map allows instructors to organize information into “chunks,” which enables students to remember more information for a longer period of time (Figure 1.1).
E-MAPS AND MEANINGFUL LEARNING

An E-Map is a graphic organizer that can create concise representations of ideas, complex relationships, knowledge, and information quickly and can be used on the Web. Mind and concept maps are a visual way of constructing knowledge and organizing information. They provide a powerful visual image which can depict complex relationships and information, and relate new information to prior knowledge. There are many learning theories and research studies to support the effectiveness of using graphic organizers such as E-Maps to facilitate learning.

Graphic organizers are particularly suited to:

- aiding learning by explicitly integrating new and old knowledge
- generating ideas such as brain storming
- assessing understanding or diagnosing misunderstanding
- increasing recall
- designing a complex structure (long texts, large websites, etc.)
- communicating and understanding complex relationships

Concept and mind maps are grounded in learning theory and research. They are based primarily on the learning theories of cognitive psychologists David Ausubel's (1968) Assimilation theory and James
Deese’s (1965) Associationist theory. Ausubel was influenced by Piaget’s cognitive development theory and was very active in his field in the 1950s to 1970s.

The primary concept in Ausubel’s assimilation theory is meaningful learning. According to Ausubel, “the most important single factor influencing learning is what the learner already knows.” Thus, meaningful learning results when a student relates new knowledge or information to what they already know (existing knowledge). Ausubel contrasted meaningful learning to rote learning, in which students incorporate new information into the knowledge structure without interaction.

Rote learning occurs when a student simply memorizes information with no attempt or motivation to relate that information to prior learned knowledge. The new information is easily forgotten and not easily applied to problem-solving situations because it was not linked to concepts that were already learned. This is why meaningful learning is enduring, whereas rote learning is easily forgotten and not easily applied to new learning or problem-solving situations.

Meaningful learning anchors new ideas or concepts with previously acquired knowledge in a non-arbitrary way (Novak & Gowin, 1984). The associationist theory states that memory consists of a network of concepts that is not hierarchical, although it is supportive of hierarchies. Relationships between concepts are formed naturally when two overlap on some dimension. As learning occurs, this network of concepts and relationships becomes more and more elaborate and complex. Regardless of the theory behind it, a concept map is intended to externalize an individual’s cognitive structure (Freeman, 2004).

Other Research

There has been much research done on how using graphic organizers such as concept and mind maps can facilitate learning by using a pictorial way of constructing knowledge and organizing information. The following summations are noted theorist and studies that support graphic organizers in the teaching and learning process:

• Use of graphic organizers aids students in retention and recall of information (Inspiration Software, 2007).
• Semantic networking tools enhance comprehension and retention of the ideas being studied by helping learners construct structural knowledge. In addition to improving comprehension, structural knowledge improves retention of content being studied (Jonassen, 2000).
• Concept maps helped preservice teachers map their subject-matter knowledge as a precursor to lesson planning (Ferry, 1996).
• Students show some of their best thinking when they try to represent something graphically, and thinking is a necessary condition for learning (Jonassen, 1996).
• Dunston found that the effects of graphic organizers are greatest when students have in-depth instruction and training in their use and when students construct graphic organizers themselves (Dunston, 1992).
• Graphic organizers were found to help students transfer retention and recall skills to new situations (Griffin, Simmons, & Kammenui, 1991).
• Creating graphic organizers to illustrate the organization of ideas and information aids comprehension and learning (Flood & Lapp, 1988).
• When important information is isolated, we can see how concepts are connected, and this makes it more easily understood (Novak & Gowin, 1984).
• The mind arranges and stores information in an orderly fashion, so that when new information is added, the framework is already there on which to attach new knowledge (Rumelhart, 1980).
• A visual graphic containing key ideas and information is easier to remember than extended text, whether the text is visual or verbal. The use of both visual and verbal language to create graphic organizers results in active learning (Vygotsky, 1962).

**E-MAPPING SOFTWARE**

In 1993, Mindjet (http://www.mindjet.com) released MindManager®, which was one of the first professional mind mapping or E-Mapping software programs developed for business, education, and corporate training. A MindManager map can be exported as a clickable image map, exported as an image, PDF file, PowerPoint presentation, Word document, or webpage’s. Today there are many E-mapping software companies that offer E-mapping software on both the PC and Mac platforms (Table 1.1).

<table>
<thead>
<tr>
<th>E-mapping Software</th>
<th>Platform Support</th>
<th>Web Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>MindManager® Pro 7</td>
<td>PC</td>
<td><a href="http://www.mindjet.com">http://www.mindjet.com</a></td>
</tr>
<tr>
<td>MindManager® Lite 7</td>
<td>MAC</td>
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<tr>
<td>INSPIRATION™</td>
<td>PC and MAC</td>
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</tr>
<tr>
<td>ConceptDraw MINDMAP™</td>
<td>PC and MAC</td>
<td><a href="http://www.conceptdraw.com/">http://www.conceptdraw.com/</a></td>
</tr>
</tbody>
</table>

One of the advantages of working with E-mapping software is its ease of use. You do not have to have any advanced computer skills to learn how to use the software. If you can create a PowerPoint presentation, you can learn how to use this software very easily.

**CREATING AN E-MAP FOR AN INSTRUCTIONAL MODULE**

There are seven basic components when constructing an E-Map (Figure 1.2). These components include:

1. A central or module topic of the map is automatically added to every new map.
2. Main topics branch off the module topic of your map. These should be the main content related to the topic.
3. Subtopics are used to provide details about their main topic.
4. A relationship exists between two (or more) topics.
5. Link to an existing file (including another map) Web page or folder.
6. Callout topics can be used for comments or to provide additional information for a specific topic.
7. Floating topics can be used for comments or to label the map.

Figure 1.2 E-Map components, created with Mindjet MindManager Pro 7.

Color and Graphics

Color and Graphics

The use of color is a very important attribute to use in designing E-Maps. Color can be used to reinforce associations and for differentiating categories or topics, depict themes, and make relationships stand out. Graphic images and other visual aids such as arrows and icons are another important element in serving an organizing function by illustrating the relationships among similar and different topics (Figure 1.3).
INSTRUCTIONAL APPLICATIONS OF E-MAPS

E-Maps can be created for a whole course, a course module or a special topic within a module. Using an E-map enables the instructor to design instruction showing the interrelationships of content and complex concepts by linking websites, word processing and PDF files, PowerPoint Point presentations, video clips, Flash movies and many other files. An E-Map can be used as a classroom presentation or serve as a study guide on a particular topic.

E-Maps for the Web

To use an E-Map as a graphical interface for webpage’s and files, you first need to create a website for all of your webpage’s by using a web authoring program such as Adobe Dreamweaver. By using a web authoring program you can keep all webpage’s and files all in one location readily available for quick editing and can be uploaded to a server. Once an E-Map is completed, it can be exported as a clickable image map webpage (Figure 1.4).
The exported image map is saved in the website's root folder (Figure 1.5). The web pages and files can then be linked to the E-Map.

**Figure 1.5** Exported E-Map saved in website root folder.

**E-Map Planning and Examples**

Before creating an E-Map, formulate objectives for the module or topic. The objectives then can serve as a guide for creating E-Map topics and subtopics. In Figure 1.6 is an example of an E-Map created on the planets. Each planet branch extends out from the Sun, includes a numerical position from the
Sun, a picture of the planet, a call out indicating the distance from the Sun, a PowerPoint presentation on the planets, and planet hyperlinks to websites that correspond to each of the planets.

**Figure 1.6** E-Map of the Planets created with MindManager Pro 7.

In Figure 1.7 is an E-Map created on the Moon. Each branch extends out from the Moon image, included are; nine branches with an interesting fact on the Moon, a branch that includes Web links of information on the Moon, a branch which attaches a picture of the Moon’s phases, branches hyperlinked to a video clip on the Moon, PDF file articles, and a PowerPoint presentation.
CONCLUSION

An E-Map is an outstanding e-learning tool for organizing and navigating Web-based content and files. There has been much research indicating the effectiveness of using graphic organizers, such as mind maps and facilitating meaningful learning. Buzan and Buzan (1993) argue that mind maps better harness the way the brain works. The radiant structure is consistent with the radian nature of the brain; the colors, graphics, and nonlinear branches stimulates the entire brain.

Planning using a systems approach is important in guiding the E-Map design process. Using the E-Map technique gives instructors the freedom to express ideas and show interrelationships between concepts and content in a very visual and non-linear structure.
References


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Aquisition of basic competencies in physical education pre-service teacher training by integrating new technologies

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Summary

This study evaluates software a computerized time management sheet created to acquire a basic competence in initial teaching training, the management of time. It is designed for the Physical Education (PE) teacher at the early stages of training when the control the students’ motor engagement time is fundamental for students to achieve motor learning in this discipline, relating it with other interdependent temporal variables. Repeated measures are used to check the development of the adaptation of the planning of time to the reality of the session, observing the change in the desired tendency in the application of the treatment.

Keywords

Physical Education; planning; software; time management.

Introduction

8 Jesús Viciana Ramírez is the director of the Department of Physical Education and Sport Science of the University of Granada, as well as of the research group, Analysis and intervention in PE and Sport training of young people in the area of the humanities, code: HUM-764. Our main research lines are focused on training PE teachers and sport coaches from the educational point of view, and in the design of educational intervention programs oriented to health. At present we have various on-going projects dealing with initial teacher training to improve university teaching, both at the sociological level in Spain, to know the trends and general defects in teaching, and at the local level to apply the advances to teaching practice in the degree course in Physical Activity and Sport Science and to design a new Study Plan adapted to the European Higher Education Space.

Francisco Salinas Martínez is a graduate in Physical Activity and Sport Science, and has a Diploma in Physical Education; he is a research student and in the third cycle of the doctoral program of Physical Activity and Health in the University of Granada. He is a member of the research group, Analysis and intervention in PE and Sport training of young people. His research lines deal with the training of PE teachers as well as physical activity and health. His curriculum includes the following prizes: the extraordinary prize of the University of Granada in 2005 and the best academic record of the Faculty of Physical Education and Sport Science for the period 2000-05. In addition, he holds various research scholarships and has published several national and international works.

In initial teacher training a series of competences must be acquired to ensure the basic training of future teaching professionals in European university centers. The shaping of homogeneous guidelines in the plan for initial training in the European Higher Education Space for the degree in Physical Activity and Sport Sciences is key for the development of the future of physical education (PE). Among these guidelines is achieving basic competencies in teaching, and specifically in the first place to know how to plan PE classes efficiently to provide the teaching profession with sufficient resources.

Thanks to a Teaching Innovation Project (subsequently awarded a prize by the University of Granada), we turned to ICT to create a computer record sheet, subsequently referred to as a computerized time management sheet, to manage a most important competence in the initial training of any PE teacher, the management of time in class. This competence has acquired great relevance in our area since the classroom is open and changing, as are the organizational systems and the materials we use in the gym or the sports field. This setting results in time forecasts for the tasks in class being altered enormously in the early stages of training, where the scant or total lack of teaching experience makes it difficult to adapt teaching plans to the reality of the classroom.

Moreover, the correct management of time in the PE class is an important index of teaching quality; it must ensure that the students have enough time for the physical practice necessary to achieve a degree of motor learning in educational centers. Other temporal variables such as organization time or students’ attention time are detrimental to practice time, and therefore must be controlled to guarantee the effectiveness of classes (Placek & Randall, 1990; Barret, 2000; Momodu 2000; Viciana, Fernández, Zabala, Requena & Lozano, 2003; Lozano, Viciana & Piéron, 2006). Thus, research in this field is of general interest for all faculties awarding these degrees and for the Knowledge Area of PE and Sport.

**Aims and hypothesis of the study**

In this study, we followed the progress of a teacher doing practice while studying for a degree in Physical Activity and Sport Sciences in the University of Granada over several sessions of internship in an educational center and discovered to what extent the computerized time management sheet helped in that training. The objectives of the study were as follows:

To design and check the effectiveness of a computerized time management sheet for the recording, analysis and contribution of feedback to the training of future PE and sport professionals in a basic competence: the management of time in class.

To apply this ICT as a teacher-training strategy in an educational center, giving immediate feedback on the temporal adaptation by a pre-service teacher (PT) of planning classes to the reality of giving them in the compulsory subject of teacher-training practice in the degree course of Physical Activity and Sport Sciences.

To draw conclusions for the supervision of teaching practice during initial training and so to improve university teaching and the preparation of professionals.
The hypothesis was as follows: the administration of feedback of the teacher’s time management during teaching practice by means of the computerized time management sheet of record and analysis, together with a supervisory meeting, would improve the adaptation of planning to reality, supplying graphic information that would accelerate the correct management of time in the initial training of the PE teacher.

**Method**

The study was made through an intra-subject design where the development of the time planning of PE sessions made by the PT before the class compared to the reality of the classes given was analyzed through repeated measures throughout the period of practice.

The participants were: a Pre-service teacher (PT) in the last year of the five-year degree course in Physical Activity and Sport Sciences who was doing teacher training practice during the academic year 2001-2002 in the high school, “IES Albaycín”, cuesta de San Antonio s/n, 18011, Granada; the supervisor of the practice (a teacher in the Physical Activity and Sport Sciences Faculty and coordinator of this project) and the observer who recorded and analyzed the data in the practice, having previously trained in practice sessions unconnected with this study.

The instrument used for recording and analyzing was the software created for the temporal variables, the computerized time management sheet, (Viciana et al., 2003) on a portable computer. The application was made with Visual Basic and Excel Calculation Sheet, which supplied the comparative graphics of the time management plan and the real management of time in the sessions analyzed. Examples of the options of this software are shown in Figure 1.
Figure 1. Screens appearing in the software for time management and feedback analyses.

In addition two qualitative instruments were used: the reports of the in-depth supervisory meeting, where the main causes and solutions of the temporal disparities were noted down, and a final open and in-depth interview on the PT’s experience, recorded and transcribed to check against the numerical data of the computerized sheet.

The dependent variable of the research was the discrepancy in class time management compared to the planned time. It consisted of the sum of the differences between the various times planned and recorded [categories of the software record, modified from Siedentop et al., (1979)], and represents an index of effectiveness between the plan and the practice session interventions:

- Discrepancy in the student’s attention time (SAT). SAT is the sum of the time that the teacher devotes to explaining a task, giving the class initial general information and the time spent correcting the students in general.

- Discrepancy in the student’s organization time (SOT). SOT is the sum of the time the teacher devotes to giving out and collecting the material and organizing the students to carry out the tasks.

- Discrepancy in the motor engagement time of the student (MET). MET is the time that the student spends in practising physical activity in class.
Discrepancy in the unplanned time in the session. This time is a consequence of the students’ delay in beginning the class or some other unforeseen factor that occurs in PE classes (loss of material, minor injuries, drinking water, and so on).

The independent variable employed in the treatment was the supervisory meeting (between the PT and supervisor, the university teacher) where immediate feedback, was given through a graph from the computerized time management sheet, showing the discrepancies in the time recorded when observing the class compared to the planning, and interactive decisions about their causes and possible solutions were discussed for approximately 5 minutes.

There were five phases to the procedure:

The first phase consisted of the creation of the computerized time management sheet, on which the observer continuously recorded and analyzed the management of time during the class. For that, the history of this type of instrument and its application in PE teaching were reviewed (Lonzano et al., 2006), and finally the categories to be included in the software, modified from ALT-PE (Academic Learning Time in Physical Education, Siedentop et al., 1979), were decided upon, so creating the definitive software. The computer application permitted, through a simple visual structure and with a simple “click”, the change of categories in continuous time recording.

In the second phase, at the end of February 2001, the study began by recruiting a volunteer PT, who was not given specific information about the aims of the research. To do this a meeting was held with the PTs of the high school “Instituto de Educación Secundaria Albaycín” in Granada, where all six were offered the possibility of taking part in the study whose objectives were educational, but without explaining in detail what it consisted of. Finally, the PT was chosen completely at random among four volunteers.

The third phase was the establishment of a base line of the temporal variables during three practice sessions; no guidelines were given either before or after the class. The main premise was that a PE class should be planned, setting out the temporal distribution, and then applied in the school. For that the PT was given a scheme of PE content (Viciana, 2002a) that would continue to be used throughout the development of the study. As a further premise the total time distribution of the class should be so planned that it included at least 40–60% MET for the student (Viciana 2002b).

In the fourth phase, from March to May, the PT was told what the study would consist of, the aim of the software and that the treatment would be applied over ten sessions. The PT gave a weekly class in the high school and subsequently attended the supervisory meeting to discuss the observation data collected by the supervisor. A graph of the discrepancies in each of the temporal categories planned was given and the main differences discussed, going more deeply into the causes and finding possible errors in the planning of the class time and in the intervention during the practice. These two actions constituted further training in addition to the traditional supervision that the other PTs received during their practice, for although the supervisory meeting was still held, the other PTs were only shown the subjective data of their practice and without the aid of the computer graph of the results of the observation. The PE classes lasted 50 minutes in the school timetable, so that to achieve an acceptable
distribution of class time the PT should plan for motor activity of at least 20-30 minutes, the rest of the time being distributed among the other variables (Student Attention Time, SAT; Student Organization Time, SOT, and unforeseen time). At the end of the study the interview with the PT asked only one question about his opinion of his experience: How have your practice classes developed and what do you think of the experience?

The fifth and final phase was to draft the final report.

**Results**

The results of the study show the positive influence of the independent variable (feedback of time management in PE classes in the supervisory meetings) over the base line established, changing the evolutionary tendency and so confirming the hypothesis formulated at the beginning of the study.

The times of the sessions analysed are set out in Table I. To read and interpret them it is necessary to highlight that MET was kept fixed as a criterion at 30 minutes, while the planned temporal values of SAT and SOT (criteria to establish the discrepancy) were variables for each session, since the type of content, the type of organization (formal, informal or semi-formal), the structures of the tasks (individual, in pairs, threes or sub-groups), their difficulty and the material employed, meant that SAT and SOT were different for each one of them.

Furthermore, the temporal discrepancies of the sessions are interdependent, that is, a major discrepancy in any one of the times planned results in an equal discrepancy in the rest of the times. Thus, when there are major discrepancies in some of times (MET, SAT or SOT), the other times are also altered, so that the total discrepancy is higher. Equally, if unforeseen time is not included in the plan as happened in the three sessions to establish the base line, where the PT had no orientation in the planning of the sessions or feedback about his/her performance, the discrepancy is even greater, since all the unforeseen time is added to the discrepancy.

<table>
<thead>
<tr>
<th>Times (DV)</th>
<th>Baseline Sessions</th>
<th>Treatment-evolution Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET</td>
<td>22'02&quot; 24'37&quot; 23'10&quot; 24'01&quot; 26'45&quot; 25'54&quot; 31'02&quot; 27'19&quot; 27'58&quot; 30'10&quot; 31'30&quot; 28'49&quot; 30'27&quot;</td>
<td></td>
</tr>
<tr>
<td>SAT</td>
<td>14'44&quot; 14'23&quot; 12'50&quot; 12'58&quot; 14'30&quot; 11'06&quot; 7'46&quot; 12&quot; 10'28&quot; 8'21&quot; 8'27&quot; 10'11&quot; 9'23&quot;</td>
<td></td>
</tr>
<tr>
<td>SOT</td>
<td>10'14&quot; 10'20&quot; 12'33&quot; 10'11&quot; 9'34&quot; 9'40&quot; 8'08&quot; 9'04&quot; 10'30&quot; 8'09&quot; 8'05&quot; 9'45&quot; 9'15&quot;</td>
<td></td>
</tr>
<tr>
<td>Unforeseen</td>
<td>3'00&quot; 0'40&quot; 1'27&quot; 2'50&quot; - 3'20&quot; 3'03&quot; 0'17&quot; 0'30&quot; 2'20&quot; 1'50&quot; 1'15&quot; 0'55&quot;</td>
<td></td>
</tr>
<tr>
<td>Discrepancies</td>
<td>15'56&quot; 10'46&quot; 13'40&quot; 11'58&quot; 10'28&quot; 8'12&quot; 6'11&quot; 5'48&quot; 7'00&quot; 4'00&quot; 4'48&quot; 2'22&quot; 3'24&quot;</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>13'27&quot; 10'13&quot; 6'20&quot; 3'38&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Table I shows a highly significant improvement ($p < .001$) in the match between the time planned and the reality, since the values of temporal discrepancies drop significantly during the treatment tending
to zero, although obviously it is practically impossible to achieve this due to the many circumstances that affect educational practice in this discipline.

To make this development clearer the average discrepancy has been calculated in the last column in the table (the average of the three base line sessions, as well as the averages of the treatment sessions grouped in threes, except for the final group of four sessions). The evolution is evident, and therefore the influence of the independent variable over the dependent, when these measures are compared (base line: 13'27”; sessions 1, 2 and 3 of treatment: 10'13”; sessions 4, 5 and 6 of treatment: 6'20”; and sessions 7, 8, 9 and 10 of treatment: 3'38”).

In Figure 1 the evolution of the temporal discrepancy is shown in a linear graph, clearly demonstrating the tendency to zero and the change in the tendency of the curve from the moment of the application of the treatment to the experimental subject.

![Graph showing the evolution of the discrepancy between time planned and real time](image)

**Figure 1.** Evolution of the discrepancy between time planned and real time

The most important decisions recorded in the supervision reports, a product of the analysis of the discrepancy data and the agreement between the PT and the supervisor were as follows:
Table II. Most Important Decisions Analyzed and corrected

<table>
<thead>
<tr>
<th>Decisions</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Planning</td>
<td>- To Include unforeseen time, (not more than 1 or 2 minutes), since it was given in the base line and is essential in any plan</td>
</tr>
<tr>
<td></td>
<td>- We must be realistic in the general initial planning of the session, since normally more time is taken than planned. The main actions taken in this sense were: to match the designation of the time to the initial information of the class, to count in beforehand the time for explaining the task and also the transition time between tasks and organizational structures.</td>
</tr>
<tr>
<td></td>
<td>- WE must structure the teacher’s instructions and corrections in the task so that they are clear and so more effective, foreseeing the more important aspects of the task and the most common corrections</td>
</tr>
<tr>
<td>In the intervention</td>
<td>- To shorten the explanations of the tasks and the initial information of the sessions, which were very long, in order to increase MET</td>
</tr>
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<td></td>
<td>- To shorten SOT facilitating the transitions between tasks. This entailed not changing the organizational structure between tasks, but keeping the same groups of students and material to promote continuity of the practice</td>
</tr>
<tr>
<td></td>
<td>- The material could not be complicated to distribute and collect; if it were, too much MET would be lost in the session</td>
</tr>
</tbody>
</table>

These agreements set out in Table II helped enormously to achieve the temporal match between planning and performance in the treatment.

Among the statements made by the PT in his final interview that showed the effectiveness of the computerized time sheet, were the following:

"At first I did not plan well, because I always lacked time to finish the exercises..."

"The truth is that being able to observe immediately when finishing the class has had a lot of impact and has helped me to realise my mistakes and that has helped...On many occasions I did not know why things happened and this type of assistance together with the talks with the teacher makes you think about the reason and to go into your errors more deeply in order to solve them"

"I am pleased I took part in this work because it makes you realise how difficult it is to plan well and to carry it out correctly"

These qualitative data confirm the development shown numerically by the software, and the effectiveness of the supervisory process.

Discussion and conclusions

Among the limitations of the study we would highlight the need to repeat this research with a greater number of teachers, although our initial intention was simply to put the software created in practice
and check its efficacy. Equally, we have to confirm that comparative research shows that traditional supervision is less effective, although our teaching experience in the field of initial training of PE teachers has been along these lines.

The integration of new technologies in the initial training to help in the formative process of teachers has been recommended on previous occasions (Matos, 2005). Furthermore, in our research it gives an additional application to pedagogic and not only technical training. Since good time planning ensures a minimum rate of MET for the production of motor learning in PE, as shown by the Beginning Teacher Evaluation Study of Siedentop et al. (1979) or Telama et al. (1986), we can state that the application of this computerized time sheet in the PE teacher’s initial training is going to contribute substantially to what s/he is going to be able to do in the future, as the time planned is going to match reality more accurately. Byra and Coulom (1994) also reported the effectiveness of good planning for classroom success in PE, so that it seems to us of prime importance to ensure an acceptable degree of competence in this aspect of the initial training of future PE professionals, as we have managed to achieve with the use of this software in our research.

Similarly the work presented has demonstrated that using ICT collaboratively (PT-Supervisor, or PT-PT) is efficient, helps the process of analyzing pre-active and interactive decisions and fosters critical thought in teacher training, as mentioned by Lara (2006). The criticism of the small number of ICT credits in university education, resulting in little mastery in these technologies in the course of the profession (Matos, 2005) has been substantiated, as this research demonstrates the success in accelerating the process of training and skill acquisition in important competencies in the PE and sport areas. The results of our study confirm the comments of Brito and Duarte (2005), who highlighted the use of ICT in teaching practices as the prime factor with greatest impact in teacher training.

The main conclusions to be drawn, so responding to the hypothesis and objectives of the study, are the following:

1) The computerized time sheet is easy to manage and highly effective in training PE teachers. Therefore, we recommend its use to improve efficacy in acquiring basic competences, such as time management, in initial training.

2) The teacher in training values the experience positively and stresses the help given by the analysis of the data and the graph provided, becoming aware of planning mistakes and adjusting her/ his teaching accordingly.

3) The innovative supervision of teaching practice that using this system provides in the practice center of the school (with objective, immediate and graphic information about what the PT has done) is significantly better than traditional supervision and accelerates the training process, while at the same time it promotes the process of reflection in taking decisions in the difficult task of teaching.
References


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