The role of synchronous communication via chat in the formation of e-learning communities

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This study demonstrates the role of synchronous communication via chat in the formation of an e-learning community for mathematics teachers. The aim of this community was to prepare these teachers to introduce the use of educational software to their teaching practices. To form this community, the 'constructivist teaching experiment' methodology [1] was interpreted within the web context. A specific curriculum was designed for the participants in this e-learning community but was adapted during this experiment to take into account the specific learning needs of mathematics teachers, these being mainly investigated through synchronous communication via chat. The data collected provided evidence on: a) topics necessary for the formation of an e-learning community, b) important topics for effective synchronous Computer Mediated Communication (CMC), and c) significant topics for effective integration of the proposed software into the teaching practices of mathematics teachers.

Keywords: asynchronous communication; e-learning communities; chat

1. Introduction

The advantages of networking technologies in teaching and learning have been acknowledged by many researchers [2, 3, 4]. In particular, these technologies can be used for the formation of constructivist and cooperative learning contexts [5,6]. In such contexts, learners can take advantage of the learning tools provided in order to actively construct their own knowledge as well as to express their inter-individual learning differences. Moreover, learners can exploit the communication capabilities of networking technologies, to enhance their knowledge through negotiation with that of their teacher and of their colleagues. In addition, when learners participate in cooperative e-learning communities, they can learn in their own time and place. Theoretically, the learning time provided is boundless. On the whole, the e-learning context seems to provide equal learning opportunities to all people. These opportunities can help balance learning inequalities created by the time, space and physical health of learners [4, 7]. E-learning communities can be formed spontaneously and/or formally, emphasizing essential goals; however, this is not an easy task. Firstly, it needs a specific curriculum with essential and specific learning aims as well as a specific and accurate learning plan. Communication management between all participants is also crucial to the formation, preservation and development of each e-learning community, especially for teachers, as it provides them with opportunities for lifelong learning, which is necessary for the improvement of their teaching in their specific teaching subjects. In addition, as they live in the information age, teachers need to become literate in Information and Communication Technologies (ICT). Moreover, they need to be taught how to introduce the previously mentioned technologies to their teaching and learning. Without doubt, teacher education using traditional face-to-face educational settings is extremely difficult, not only because it involves adults who have problems arranging a mutually acceptable lesson time but also because they are scattered over different geographical regions which, in most cases, are remote.

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Taking the above into consideration, an e-learning community was designed for mathematics teachers. The main aim of this community was, firstly, to familiarize the teachers with the well-known Cabri-Geometry II educational software [8] and then introduce it to their teaching practices. Cabri-Geometry II has been designed for the teaching and learning of a variety of Euclidean geometrical concepts and can effectively support teaching and learning in the context of modern social and constructivist learning theories. More specifically, the strongest characteristics of Cabri are: a) the variety of tools provided which can support both inter-individual and intra-individual varieties of learners and b) the dynamic character of every geometrical construction performed using the tools provided. This means that the figure of a construction can be altered while retaining its properties. Thus, students can form and/or verify conjectures and hypotheses based on a superabundance of data. The formation of the said community was based on the theoretical background of constructivist and social theories of learning [5, 6]. The construction of the community was based on the 'teaching experiment' methodology, according to which the teacher does not rigidly follow his/her teaching plan at hand, but at any time acts as a researcher attempting to form models of the knowledge of his/her students. Next, the teacher transforms his teaching plan and intervenes so as to create an encouraging environment for the students to improve their knowledge according to their needs. This kind of e-learning community has not yet been reported.
In the following section of this paper, the context of the study, the specific aims and the curriculum designed for the said e-learning community dedicated to mathematics teachers are presented, followed by analysis of the data collected through asynchronous communication via chat. Subsequently, the data are discussed and conclusions are drawn.

2.The context of the study

The Mathematics Teachers E-Learning Community (MTELC) was designed to function within a wider e-learning context [9] dedicated to both the familiarization of ICTand its introduction to the everyday teaching practice of secondary and primary level education teachers. Teachers from a variety of teaching areas, such as mathematics, science and computer science, participated in this wider e-learning community. Thus, the wider community was distributed and sub e-learning communities were formed according to teachers' specific teaching subjects. All teaching processes in each community exclusively took place using the available networking facilities by Microsoft Sharepoint™ Portal Server 2001. The teachers of each e-learning community mainly used the following facilities: a) uploading and downloading learning materials, and b) communicating via forum, chat and e-mail. The learners participating in the community had the opportunity to download the provided learning materials, publish their written work and communicate via the previous mentioned technologies.
The main aims of MTELC were, firstly, to familiarize its participants with the tools of Cabri-Geometry II and, secondly, to exploit its advantages in their teaching of Geometrical concepts. The specific aims of MTELC, formulated by analyzing its main aims, were to help the participants: a) to cooperate in the context of MTELC in order to design learning activities exploiting the features of Cabri-Geometry II and taking into account both modern social and constructivist learning theories within the context of national Greek curricula for teaching and learning Geometry in secondary schools, b) to prepare teaching plans integrating the activities they designed, c) to teach lessons using the teaching plans they designed and d) to evaluate these lessons.
Seven Secondary Education mathematics teachers participated as learners in MTELC. The data collected from this 9-week experiment consisted of the learning materials provided to the participants, the course plan, the learners' work, the synchronous communication logs via chat and the logs of asynchronous communication via forum. The management of the work of MTELC was mainly performed through synchronous communication via chat. As this research is a qualitative study [10], the data collected has been classified into categories according to topics that emerged from them.
The MTELC curriculum. The primary curicullum of MTELC was designed before the course began and was organized into 4 learning units. Despite the fact that the duration of each learning unit was expected to be 1 week this was extended to 2 weeks to facilitate learners' needs, upon the decision of the

researcher, who acted as a teacher of MTELC, as she exploited the feedback given by the learners during synchronous communication via chat. The transformation of both curriculum and course schedule emerged from the interpretation of the given feedback. Thus, the duration of the course was 9 weeks: 4X2=8 weeks for the completion of the activities included in the total of learning units, plus 1 week for final conclusions. Each week, the learners were provided with a study topic and a main question for discussion. The content of each learning unit (LUnit) - in its final version – was as follows:

L.Unit 1. Introducing ourselves to MTELC. Presenting the outline and the aims of the course. Discussing the features of Cabri-Geometry II. Forming learner-groups and assigning a project to each group. This project was entitled: 'The design of learning activities by exploiting the features of Cabri, taking into account modern social and constructivist theories of learning in the context of Greek curricula for the learning of Geometry by secondary level education students'. (2 weeks were needed).

L.Unit 2. Correcting and improving the activities designed during the work in the context of Unit 1 so as to be more consistent with modern theories of learning and to exploit fully the features of Cabri II. This work was realized through small group and whole class discussions and negotiations of the opinions of all the participants in MTELC. Next, each group was given the task of writing a report and publishing it in the specific dedicated virtual place. (1 week for the design of learning activities and 1 week for improvements).

L.Unit 3. Designing a teaching plan accompanied by a pupil work-sheet. All participants of MTELC were asked to perform this task individually while at the same time exploiting the work performed in the previous units. This work was also realized through small group and whole class discussions and negotiations of the opinions of all the participants. Next, each individual was given the task of publishing his/her own teaching plans and pupils' work-sheets in the specific dedicated virtual place. (2 weeks were needed).

L. Unit 4. Real teaching using the learning materials constructed. Assessment of the teaching and learning processes. Writing and then publishing a final report demonstrating the work performed in the context of all learning units by each individual participating in MTELC. Final discussions, negotiations and conclusions of all participants. (3 weeks were needed).

3. Data Analysis and Discussion

The results emerging from the analysis of this 9-week experiment gave us evidence about the following issues: a) essential topics necessary for the formation of an e-learning community, b) important topics for effective synchronous Computer Mediated Communication via chat, and c) significant topics for the effective integration of the proposed educational software in the every-day teaching practices of mathematics teachers. These topics are reported in the following section.

3.1. Essential topics necessary for the formation of an e-learning community emerging from the experiment:

Maintaining an atmosphere of high self-esteem: a) acceptance of all members of MTELC as equals, b) acknowledgment of all opinions expressed, c) focusing on the positive points presented, d) using the negative points expressed by the participants as opportunities for positive discussions, e) encouraging participation, f) treating all members with respect, g) respecting each member as a professional as well as as a different personality, h) support, and i) future prospects.

Encouraging interest: Presenting the features of Cabri in relation to the positive experience emerging from their use by the teacher of MTELC as well as by other researchers.

Encouraging one's own initiative. Freedom in choosing both the specific topic of each learning activity and the persons to cooperate with when dealing with each activity. Encouraging the participants to impart the new knowledge they constructed during the experiment to their colleagues in schools.

Encouraging cooperation. Asking participants to form groups during chatting and then asking each member to negotiate his/her work with the other members of each group.

Deadlines. Defining specific deadlines in cooperation and agreement with all members of MTELC regarding each learning activity.

3.2. Important topics for effective synchronous Computer Mediated Communication via chat

Cultivation of a warm and friendly atmosphere: a) Exchanging information (in the form of text and/or images) about personal issues, family situation, job issues, b) using informal but accurate language, c) using humor, first names, d) the teacher entering the chat-room first and welcoming each member of the community (the teacher also wishes goodbye to each member of the community and leaves the room after all the other members have left), e) no question or opinion being left undiscussed.

Invitation to participate: a) emancipating the participants from their fears regarding the use of CMC, b) encouraging the participants to externalize their difficulties regarding the use of the proposed educational software in their teaching practices, c), challenging the participants to focus on the positive effects of the proposed educational software in their teaching practices, d) encouraging all participants to contribute within the community by asking each one – and especially those who remain silent - to communicate their ideas with the whole e-class, e) externalizing the e-teacher's personal experience, including both positive experiences and negative thinking, such as fears and difficulties and how these were overcome, and g) tolerating network interruptions.

Reflection on the experience. Challenging discussions among the participants of MTELC, after the learning activities have been designed and after their use in real classrooms.

Rising progression. Giving constructive feedback to each participant by commenting on their work.

Defining chat-meetings regularly. Two chat-meetings per week were needed. The time of each meeting was fixed in cooperation with the participants of MTELC. The length of each meeting was tailored to suit learners' needs; on average, each meeting lasted approximately ninety minutes.

Development of fast computer-mediated communication skills. Participants developed rapid reading and writing skills in order to answer a plethora of messages simultaneously posted through chatting. Participants also improved their computer-mediated communication skills by having to process the information from many messages simultaneusly posted while forming rapid written responses.

3.3. Significant topics for the effective integration of Cabri-Geometry II in the every-day teaching practices of mathematics teachers.

Familiarization with the operations provided by Cabri

Limitations in introducing Cabri to every day educational practices. Important issues addressed: a) the inadequate technical and human infrastructure in schools, b) the limitations of the current national curricula, c) the dominant dimension of the educational system, with the emphasis on success and students continuing to higher education, d) the limited number of appropriate learning activities as good examples, and e) the fear of the work involved in introducing a novelty.

Epistemological perspectives of Mathematics. The most significant topics addressed were related to: a) the absolutist perspective, emphasizing deductive reasoning, and the relativistic perspective, emphasizing the role of experimentation, as well as the role of inductive reasoning in the construction of mathematical knowledge, b) the role of approximation in the formation of mathematical knowledge, c) the role of tools in the construction of mathematical meanings. Traditional tools and tools provided by Cabri and their role in students' learning of Geometrical concepts. The role of approximation, the dynamic character of Cabri constructions, d) mathematics for all students versus mathematics for a limited number of advanced ones, and e) what is changed in students' constructions of geometrical meanings when they used the Cabri-tools.

Didactics of Mathematics within the context of modern social and constructivist theories of learning. The main issues addressed were: a) difficulties in moving from the traditional teaching approach emphasizing the presentation of geometrical concepts by the teacher, followed by students performing said activities, to the constructivist approach emphasizing initial student experimentation followed by theorization and proof, b) difficulties in integrating both familiarization with Cabri-tools and performance of the given learning activities during the same teaching period, c) the significance and the relation of mathematical thinking based on conjecture, formed by reflecting on a dynamically transformed geo-

metrical construction, to mathematical thinking based on typical deductive reasoning, and d) text-book activities emphasizing the proof of a specific statement versus Cabri-activities emphasizing the investigation of a specific geometrical construction and the formation and/or verification of conjecture.

Design, realization and evaluation of a teaching event using ICT. The issues addressed were: a) the design of a student work-sheet, b) class-lab PC management, c) evaluation of a teaching event when using ICT and taking into account what had been learned by the students, d) compiling a report about a teaching event, and e) how Cabri assists students to overcome their difficulties in learning geometry.

The role of the mathematics teacher in the context of ICT. Main topics addressed were: a) the role of life-long education in both personal and professional teacher development, exploiting both the experience of others and that of the scientific community, b) the need to move from the authoritarian teacher-telling approach to one where the teacher is a facilitator of learners becoming actively involved in their learning process, c) the need to move from a top down teaching approach, emphasizing deductive reasoning, to the opposite approach stimulating learners inductive reasoning, d) the need for teachers themselves to change focus from what they have to tell to what their learners have to do in the classroom.

4. Conclusions

This study presented the role of synchronous communication via chat in the formation of an e-learning community aiming at the familiarization and the introduction of the well-known educational software Cabri-Geometry II to the evryday practice of mathematics teachers in secondary schools. The theoretical background of the community was based on modern constructivist and social theories of learning while the teaching methodology used was the 'teaching experiment' methodology, as interpreted within the web context. This methodology gave opportunities for the development of an open, safe and friendly communication environment encouraging the participants to externalize and improve their knowledge of both teaching and learning using ICT as well as epistemological views of Mathematics. This communication environment also helped the participants to progress from familiarization with the technical skills needed for using the tools provided by Cabri to introducing Cabri to their teaching practices as well as imparting their new knowledge to their colleagues in schools. The data emerging from this experiment demonstrated the crucial role of synchronous communication via chat in defining: a) essential topics necessary for the formation of an e-learning community, b) important topics for effective synchronous Computer Mediated Communication via chat, and c) significant topics for the effective integration of the proposed educational software into the every-day teaching practices of mathematics teachers.

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