

SUPPORTING "LEARNING BY DESIGN" ACTIVITIES USING GROUP BLOGS

Georgios Fessakis¹, Konstantinos Tatsis¹, Angelique Dimitracopoulou¹

¹Learning Technology & Educational Engineering Laboratory, University of the Aegean, Rhodes, Greece, //Tel +302241099151 // Fax: +302241099175 //

Emails: gfesakis@rhodes.aegean.gr // tatsis@aegean.gr // adimitr@aegean.gr

ABSTRACT

The paper presents a case study of the educational exploitation of group blogging for the implementation of a "learning by design" activity. More specifically, a group of students used a blog as a communication and information management tool in the University course of ICT-enhanced Geometry learning activities. The analysis of the designed learning activities, the blog content and log files, as well as the points of view of the students (via a questionnaire and a group interview) expressed upon completion of the activity gives significant findings supporting the researchers' initial hypotheses about the potential of blogs' educational applications. Blogs combined with a proper pedagogical approach such as 'learning by design' enable teachers to offer high quality learning experiences to their students.

Keywords

Blogs, Learning by design, e-Learning, Interaction analysis, Higher education

Introduction

The development and availability of social software applications sets new challenges and opportunities for the learning technology community. The term "social software" refers to computer network software applications supporting groups of actors in communication and interaction (Allen, 2004). According to Allen's historical record the term "social software" appears sporadically with the first groupware applications during 1990-1999. The term social software is systematically used from 2002 in order to include applications such as forums, wikis, blogs, online multi-user games etc., which are not usually covered by the business oriented term of "groupware".

The educational community's interest for social software is mainly based on the idea that it is consistent with the modern learning theories. This is especially the case for constructionism (Papert, 1993) and social constructivism theory (Ernest, 1994; Kim, 2001) that emphasize the importance of learners' active participation to social activities during learning, which is mediated by the design and construction of artefacts. This growing interest is reflected also on the increasing number of research papers concerning the investigation of social software exploitation for educational purposes. In this paper the authors focus on the use of blogs for the improvement of teaching Didactics of Mathematics to pre-service teachers for young children.

A general review and introduction to the educational uses of blogs is presented by Downes (2004). Downes proposes, among other things, the view that students participating in blogging have opportunities to a) reflect on their texts, b) engage in writing for significant time intervals, and c) trigger long dialogue with their readers leading to new writing cycles. According to the authors' best knowledge the relevant literature includes a rather small number of published studies concerning Mathematics education training using social software and an even smaller number of works using blogging. For example, Marcelo & Bairral (2007) describe the case study of a community of practice in which future Mathematics teachers interact using an electronic communication environment. The members of the particular community were supplied with content (html pages, java applets, URL directories etc.) as well as communication tools including email, forum and chat. One of the main goals of the researchers was the analysis of students' interactions in the electronic environment. The analysis of those interactions showed that the students formed a system significantly different from an ordinary community of practice, mainly due to the teachers' presence and the non-voluntary participation of the students. As a consequence, the researchers propose interesting additional analysis dimensions other than the meaning, community, identity and practice which constitute the basic components of

communities of practice (Wenger, 1998). The proposed set of dimensions includes the impact of the work assigned to students, the teachers' role, the participants' behaviour and intentions, the dialogic views of the implemented communication etc. In a second reading of Marcelo & Bairral's work it is possible to see the need for a focused study of the interaction between the learning environment's distinct characteristics and the pedagogical approach (instructional strategy). In other words, it appears that the electronic learning environments patterns of use are not neutral to the genre of the assigned work.

In Makri & Kynigos (2007) a case study is described concerning the integration of group blogging in a postgraduate course in Mathematics Education. Makri and Kynigos integrated blogging as a medium of asynchronous communication and reflection impulse. The researchers focused on the study of the participants' role and practices' changes, using findings from dialogue and social practices analysis. Methodologically they adopted the Garrison & Anderson's (2003) framework for the analysis of the online learning systems, which considers the following decisive quality elements: the social, cognitive and teaching present. From the preliminary research data analysis the researchers notice, among others, the possibility of the development of a long-lasting "warm"-informal dialogue and non-monologue narration emerging collaboratively. According to the researchers the discussion genres expose structured cognitive present and constitute a significant evidence for the learning value of blogging. A straightforward comparison of the documented blogging case to the online forum technology could further clarify the selection criteria between the two technologies that are not noticeably contradistinguished in the above mentioned case study.

In the direction of educational exploitation of social software this paper presents a group blogging case study concerning seven students collaborating for the design of technologically enhanced Geometry learning activities for young children. The choice of blogging technology in this case is based on the claim that, to a large extent, it fulfils the communication and information management requirements of the learning by design pedagogical approach. The importance of the adoption of a well-defined pedagogical approach for the successful integration of blogs and any other content management model (e.g. wikis) is mentioned also in Chen et al. (2005) where a case of blogging integrated with the learning portfolio approach is described.

The main aim of the authors is to test the hypothesis that educational blogging in combination with the appropriate pedagogical approach could enhance the quality of learning and teaching at least for Mathematics education in tertiary level. Goals of the implemented intervention are: investigation of students' familiarisation ability to blogging, assessment of the "learning by design" approach compatibility to blogging technology, investigation of the quality of the obtained learning and the analysis of the interaction developed by the participants.

In the following the theoretical framework for the case study is presented initially, then the research conditions and the main research questions are reported, next the research evidence are presented along with authors' interpretations and finally a general discussion is provided.

Theoretical framework

Learning and language

Our basic theoretical framework stems from the sociocultural view of learning; this theory (or to be more precise this group of theories) is mainly based on the work of Vygotsky (1986) and stresses the importance of social interactions in the establishment of knowledge. Language plays a basic part in this process, because it is more than a means to express and communicate the persons' ideas; it is the means by which they think and learn together (Mercer, 1995). Written speech in particular, given its systematic organization and intentionality (Duval, 1999), can be a powerful means to examine not only cognitive, but also communicative functions.

The sociocultural approach is related to collaborative learning, which in turn involves participants' interactions. An important aspect of all human interactions is, according to Goffman (1972), the participants' face, i.e. the positive social value that one claims for him/herself. In simple words, when

people interact, they firstly consider how they will protect themselves from possible verbal (or non-verbal) threats. Most of the times people also consider the other participants' face, so they implement various politeness strategies (Brown & Levinson, 1987) in order not to pose any threat to them. The above remarks need to be taken into account during the analysis of the participants' roles even in the blog medium.

The design of the experimental part of the study is based on the hypothesis that educational exploitation of blogging should better be combined with an appropriate pedagogical approach. This combination leads to a controllable goal setting and educational efficiency assessment. In this study, the blogs seen as a communication medium are considered compatible to "learning by design" pedagogical approach (Orey, 2001) and to the development of a special writing, dialogue and reflection community.

Learning by design

Learning by design is related to constructionism, according to which new knowledge is more effectively developed by students when they are actively engaged in the construction of an external, shareable artefact that helps them to reflect and collaborate. Learning by design emphasises the learning value of the artefact design and at the same time underlines the learning benefits of the process regardless of the final product. In learning by design activities the designed artefacts are of personal significance for the students and 'represent' the learning outcome. There are several views on what constitutes learning by design; according to Han & Bhattacharya (2001) learning by design environments include: authenticity of the design theme, a balanced mixture of constrained, guided, scaffolded challenges and open design tasks, a rich variety of feedback information for designers, discussion and collaboration, experimentation, inquiry and reflection.

During learning by design activities students follow repetitively, in general, the following stages: theme-question selection; target group description; design and first implementation of the artefact; pilot application of the artefact; feedback information gathering; reflection; and design adaptation. Learning by design activities foster interaction between participants (students and teachers). The teacher's role includes supporting the students' efforts and guiding their interaction in order to obtain the desirable learning result. Teacher needs to supervise systematically the group interactions and decide for the quality of their verbal exchanges. In a conventional classroom students' interaction is often not allowed at all (frontal teaching); furthermore, in the case of non online group-teaching, teachers can not easily monitor and intervene during the collaboration, focusing mainly on the output-product of the activity. The employment of an online environment seems to be an efficient solution for managing the increased number of learning interactions occurring in group collaboration and for the improvement of the provided education quality. The selection of the appropriate online environment is considered to be an open problem; in the following, the specific features of the blogs that ground their selection for the present case study are described.

The blogs

The weblogs or just blogs are World Wide Web (www) sites where a group of users can publish hypermedia articles (posts), presented in reverse chronological order. Modern blogging systems provide automatic chronological archive of posts, search service based on key words, user defined tags annotating posts, tag based indexing of articles etc. As far as the interactions facilities are concerned, blogs permit users and readers to publish comments on articles. Furthermore, blogs provide mechanisms for inter-blogging communication, such as distribution and re-publication of articles (rss syndication), and mechanisms for tracking the references to specific articles in other blogs (TrackBacks). In other words, it is possible for a blog to automatically receive information for the references to its articles and publish digests of the corresponding articles. All this interchange between blogs interconnects them in a hyper structure known as blogosphere.

Blogs as described above constitute a content management and an online publishing model capable of fulfilling the requirements of many different applications ranging from simple internet portals, newspapers, newsletters, to personal web sites. Additionally, the blogs' minimum requirements for technological skills make them quite popular. Many technological solutions for the implementation of

blogs are available, including open source or proprietary stand alone systems, free blogging services available mainly from major internet search engines and blogging solutions embedded in learning management systems like moodle. All this spectrum of solutions practically means that internet access is the only essential prerequisite for educational blogging.

Educational features of blogs

What are the educational uses of blogs? How can a teacher integrate them to a real course? In an educational technology wiki hosted at <http://edutechwiki.unige.ch/> it is suggested that students can use blogs in order to:

- take notes from the classes
- collect learning resources and share ideas and experiences
- log notes and observations during an inquiry learning activity
- manage a project
- publish news and information about the course, like course syllabus, calendar, handouts etc.
- develop dialogue like in an online forum
- reflect and communicate with teachers and peers-students
- improve their writing skills
- develop collaboration and social skills
- obtain the motivation of writing for readers who comment you in order to participate more actively in the course; and
- run online school newspapers

Teachers can utilise blogs in order to increase the communication among the participants of the course as well as the level of their participation and the depth of engagement. Blogs support students' collaboration and enable teachers to monitor the evolution of students' interactions, intervene whenever needed and obtain diagnostic information during the implementation of the assignments. Additionally, the teacher can store selected learning resources to a class blog in order to express and form the desirable direction.

As far as the support of learning by design activities is concerned blogs seem to fulfil the requirements of every distinct stage of it. More specifically, in the stages of theme selection and target group definition students can use blogs as a dialogue medium giving equal opportunities for expression to all. Students can also document target group characteristics producing hypermedia articles and also improve them by commenting and reviewing. In the stages of design, pilot application and revisions, blogs can serve as the means for the revision process by producing several document versions through the automatic archive and the tag and keyword-based search facility. An important feature at every stage is the projection of the contribution of each participant separately. The comparison of communication and information management requirements of learning by design activities to blog facilities clarifies the advantages of blogging for the support of such kind of activities especially to non-technologically supported implementation. The selection of blogs instead of other social software applications for the support of learning by design can be justified comparing their basic features:

Blogs vs. simple html pages: The result of this comparison is rather obvious. In simple html pages there is no automatic chronological archive service, no articles indexing according to tags, no separation of each participant's contribution etc. The simulation of these services demands advanced technological skills prohibitive for most students.

Blogs vs. online forums: Forums have a narrower application range than blogs. Forums' main advantage is the graphical representation of the time and of the participants' relationships in a dialogue using a tree structure. Forums are not designed for the posting of extensive articles; unlike blogs they usually do not permit the publishing of simple pages, link directories and resource collections. Furthermore, blogs can exploit plugins in order to provide more specific services for education like geographical information management, photo albums, resource centres etc.

Blogs vs. wikis: The basic idea behind the wiki content management model is the collaborative authoring of an online document. Despite the page version comparison and log facilities there is no automatic chronological archiving of the articles, making it more difficult to support the repetitive stages of learning by design activities.

Blogs vs. Content Management Systems: General purpose CMS demand unnecessary complexity and familiarisation load for the typical educational use.

Blogs vs. Learning Management Systems: Blogs and LMS are in a rather complementary relation, because blogs can be used as building blocks for instructional design in LMS. Embedding blogs in LMS gives the additional advantage of controlling the readers' population and avoiding side effects like spam email. On the other hand, LMS reproduce the traditional educational relationships and are not appropriate when the goal is to transform the relations and provide conditions for more voluntary and informal engagement of the participants.

Research

Conditions

The participants in the research were the first author as teacher and seven volunteer students from the audience of a University course called "ICT applications and product development for mathematics instruction". In the following, students are referred using nicknames. Students' participation in the blog fulfilled their project obligation for the above course. The particular course aimed to enable students a) to get familiar to ICT applications in young children mathematics education, and b) to design and develop simple educational applications and learning activities for technologically enhanced mathematics learning environments. After having been informed about the research the students participated in a three-hour training for blog use. All the communication and interaction among the students had to be accomplished through the blog since there were no face-to-face meetings of the group.

The whole project that was assigned to the students was divided in the following four phases:

Phase 1. Students study some articles (Clements & Sarama, 2000a, 2000b, 2002; Fessakis & Tassoula, in press) about geometry education for young children, and the use of ICT for mathematics education. At the end of phase 1 the students had to post an article to the blog summarizing the papers they studied along with their own thoughts and comments. This phase aimed to set a more or less common theoretical view about the opportunities of ICT exploitation for young children geometry learning.

Phase 2. Students familiarize themselves with the use of the "Ladybug Leaf" and "Turtle Geometry" java applets from National Library of Virtual Manipulatives at Utah State University (NLVM, 2007) inspired from logo programming language and developmentally adapted for young children. At the end of this phase students had to post a review article to the blog putting together their thoughts about the applets (advantages, disadvantages, opportunities for utilisation, difficulties, developmental appropriateness etc.). Students were encouraged to comment on each other's articles.

Phase 3. The third phase is the most demanding in terms of mental and collaboration effort required. Students had to design common classroom learning activities making use of the given java. In addition, students had to peer review and comment on the designed activities proposing corrections, improvements extensions etc. The goal of the group was to publish a common set of activities as their collaborative final product.

Phase 4. In the last phase students assess their collaboration and participation in the blog in general by posting a final informal article.

The duration of each phase was about one week except from phase 3 that lasted two weeks because of its work load and importance. The above learning by design activity was implemented during the second semester of the academic year 2006-2007.

Technological platform

The course blog was implemented using a free blogging service of a Greek portal which can be found at URL: <http://gfsakis.pblogs.gr>. The selection of the specific platform is based mainly on the availability of a user friendly article and html pages editor with a satisfactory Greek language support. The platform was adequate for the purposes of the research, but for general educational use blogs embedded in LMS are preferable.

Research hypotheses and questions

The basic hypotheses for the design of the above described intervention are:

1. Students can rather easily get familiarised to the use of blogs in such a degree that they can successfully participate in corresponding learning activities.
2. Blogs can efficiently support the communication and information management requirements of learning by design activities in such a degree that participating students can have increased opportunities for: a) meeting high quality learning experiences; b) communicate and interact with their peers and teachers; c) get feedback information in order to review and revise their designs; and d) develop a dialogue relative to the content.

Methodology

The presented research constitutes basically a case study. The research approach is based on the design-based research model (Collective, T. D.-B. R., 2003) and the view that mathematics education can be considered as a “design science” (Wittmann, 1995). According to Wittmann (1995) mathematics education is more like engineering because they both study artificial objects in contrast to e.g. Physics which studies natural environment objects. As a consequence, Wittmann proposes that significant mathematics education research results have the form of well-designed and empirically studied instruction units, consistent to fundamental education theoretical principles.

Research data collection instruments

The research data collected and analysed include the user-to-blog interaction log files, the published content of the blog (articles and comments), the questionnaire that students answered upon the completion of the activity and an audio-recorded students’ group interview by the teacher and the second author that was also organized after the completion of the activity.

Research data analysis-findings

The research data has been analysed according to the following four axes:

Axis 1. Learning outcome: The learning outcome assessment of the students’ participation to the specific learning by design activity is undertaken through the produced learning activities and the quality criteria proposed by the students.

Axis 2. Blog content analysis: The content of the blog, i.e. the participants’ contributions are analysed concerning their content and their communicative and interpersonal purpose.

Axis 3. Participants’ views: Upon the completion of activity students answered a questionnaire and participated in a common round-table conversation. Students’ view about their experience is documented analysing the corresponding research data.

Axis 4. Quantitative summary of participants' interaction: Interaction log files of blogs usually contain data like the time and duration of user connections, the number of articles and the corresponding comments, etc. Processing these raw data makes it possible to gather useful information about the engagement of each student, the level of interaction etc. This information gives an overview to the teacher and can form a kind of mirror for the group.

In the following the main findings for each analysis axis are presented.

Axis 1. Learning outcome

In learning by design the learning outcome is mainly expressed by the final design. The detailed presentation of the students' designed activities is out of the purpose of this paper. The learning outcome is going to be approached by the students' answers to questions asking them to present the best and worse learning activities according to their opinion. We adopted this approach because it shows that students did not only manage to design interesting and high quality learning activities but in addition they became more conscious of the evaluation criteria that could be used for the assessment of such activities. Students invoked several assessment criteria like: to be interdisciplinary (e.g. combining arts and mathematics), to be related to everyday authentic themes, to create a pleasant atmosphere, to concern mathematical concepts [e.g. counting and shape recognition], to be clear, conceivable for children and feasible with the specific technological tools. The most popular learning activity, according to students' answers, was the use of applets for the production of figures for the composition of a collage to decorate the classroom. Students' answers to the question about the worse proposed learning activity refer to six different learning activities. Some characteristic answers are the following:

A12E15. Which Geometry learning activity from those proposed in the blog did you like the most and why?

Valia: *I mostly like the combinational ones, more specifically the activities which concern orientation, counting [and] geometrical shapes recognition. I find more appropriate those that are based on maze escape.*

Tassos: *I liked one of John's entitled "painting construction using geometrical shapes" because except from the mathematical learning goals it combines arts education.*

A12E16. Which Geometry learning activity from those proposed in the blog did you least like and why?

John: *The activity I least like is one of Kate's about perspective because I didn't manage to understand its main idea and purpose. I also, cannot understand how it is going to use the java applets since they do not provide the corresponding functions.*

Evi: *The activity I like the least is one of Valia's entitled "Paths" because I think it is complicated.*

Mina: *The "Complete the shape" [one of Roula's] because whatever the child configures is going to be a shape but not necessarily a triangle, square etc., which is the real intention of the activity designer. The instructions for the children have to be studied carefully.*

Axis 2. Blog content analysis

The data analysis was performed in two stages; initially, every article and every comment was categorised according to its content and its communicative purpose. Regarding the comments, we decided to categorise only the comments that had an informative purpose (and not for example the few ones that had a personal character). We ended up with the following categories:

INF1: Original article

INF2: Enrichment of one's own original article

INF3: Comment on someone else's article

INF4: Reply to a comment on one's own article

INF5: Reply to a comment on someone else's article

Table 1 shows each participant's post in the blog, concerning the above categories:

Table 1. Number of publications per category

	INF1	INF2	INF3	INF4	INF5
Mina	4	0	21	2	4
Tassos	5	2	6	2	1
Valia	3	1	13	0	0
Evi	5	0	3	2	1
Roula	4	0	0	0	0
Kate	4	5	10	4	1
John	3	0	7	0	0

It is obvious from Table 1 that there has been a differentiation between the participants concerning the number and the type of their posts. The INF1 category contains at least three articles per participant, which were defined as the minimum needed. Only three students enriched their articles (INF2), with Kate being the most active in this category (and in general). The category INF3 contains a big number of posts, since all students – with the exception of Roula – posted many comments on each other’s articles. The posts of the INF4 category are relatively few, since there were comments that didn’t receive an answer. The students justified this by saying that they found it difficult to be informed about recent comments in non-recent articles. The posts of the category INF5 are even less; this demonstrates the limited participation in this kind of exchanging comments.

Figure 1 demonstrates each student’s participation according to these categories.

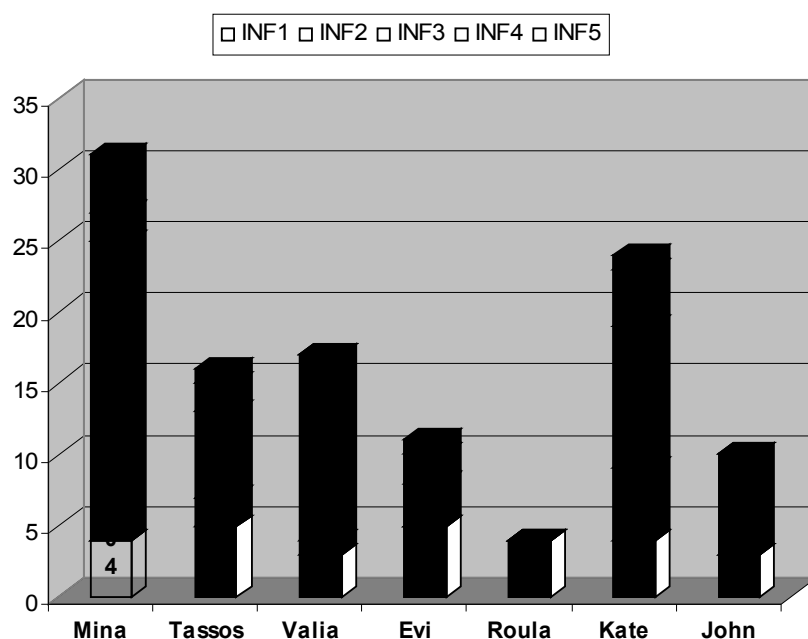


Figure 1. Students’ contribution per post/comment category

In the second stage of analysis we adapted Mercer’s (1995) methodology in order to study each contribution’s function in two levels. In the first level, we categorised each comment into educational, academic and everyday discourse. In the second level, we examined the speech acts that were performed by each comment, mainly bearing in mind the face-saving perspective.

Concerning the first level, there were many instances when the students used academic discourse:

“Learning aims: Orientation, understanding of the concept of degree and its correspondence to the relative motion.” (Evi, 29/5)

The above excerpt contains a list of concepts expressed in an impersonal manner without using any verb. Many participants (including the teacher) also used educational discourse in their posts:

“Kate, your first activity is very good. I believe that it can be easily comprehensible by an infant... Moreover, in this activity children can make comparisons and get familiarised with the notions of “smaller” and “bigger”.” (Valia, 14/6)

Apart from an initial positive evaluation, the above excerpt contains a summary of the whole idea; this is a common strategy used by teachers when they evaluate their students’ views. Everyday discourse was rarely found in the informative posts and this is an indication of the students’ attitude towards the educational use of the blog.

The second level of analysis revealed the students’ communicative and interpersonal intentions. In other words, we have found rich evidence of the students’ concern to respect their fellow-students’ face. The vast majority of comments – even the harshest ones – were based on the scheme: initial positive remark followed by the basic remark:

“John, your ideas are interesting...*I would suggest not to use the term collage since you are not going to stick anything. Moreover, the term “knowledge: does not seem appropriate; it’s better to use the terms familiarisation, informing, briefing when you talk about the aims ...”* (Mina, 29/5)

The above excerpt, apart from being based on the scheme that we mentioned, it also contains what Brown and Levinson (1987) call politeness strategies; the words marked in italics all serve the same purpose: to “soften” the threat to the reader’s face produced by the information that follows (see e.g. Tatsis & Rowland, 2006).

Another remark, which connects the two levels of our analysis, is that we believe that the participants incorporated the academic and the educational discourse in their posts in order to maintain or even strengthen their own face. Academic discourse has a high status in the educational community, thus it can be seen as a tool to strengthen or maintain one’s position. Another strategy towards this direction was the avoidance of answering to comments or to the teacher’s prompts for further investigation on particular issues.

Axis 3. Participants’ views

The participants’ views about their blogging experience have been recorded using the final questionnaire and the common round-table conversation. The students’ views analysis is organised according to the following four dimensions:

- 3a. writing for readers-commentators and peer reviewing
- 3b. the features of constructive comments
- 3c. appropriateness of blogs for the pedagogical approach
- 3d. general opinion and difficulties

Open questions with unfinished sentences have been used for the examination of the students’ views. In the following the most significant findings are presented per sub axis.

3a. Writing for readers-commentators and peer reviewing

From answers to questions:

A3E1. Writing articles for my fellow-students as readers...;

A3E3. Writing comments for my fellow-students articles...; and

A3E5. The comments of my fellow-students for me ...;

it seems that students were initially hesitant about posting articles and especially about commenting their fellow-students’ articles. They state that initially they were uncomfortable and seriously thought about the possibility of being misunderstood. Finally, most of the students overcame their diffidence; in

addition some of them state that they were excited by the exchange of opinions. Despite the general enjoyment and excitement one student did not post any comment and another declared that he posted intentionally neutral comments in order not to cause bad feelings and conflicts.

Students in general, believe that the comments they received helped them to identify their mistakes and improve their designs. In the negative features of the comments students stated that they were not always informative and some times others seemed to hesitate in expression of judgments. Some students declared that they could produce more comments if they had internet access from their homes and/or there were more participants to the blog.

Some characteristic answers are quoted:

A3E2. Writing comments for my fellow-students' articles ...

Valia: *was not an easy task because it was only based on our personal judgement rather than on a general model.*

John: *I can say that they contributed in the improvement of my opinion about some questions....*

Kate: *It was difficult especially in the beginning because there was the risk of misunderstanding. I was careful about the way of expressing my opinion.*

Mina: *It made me feel uncomfortable initially but in the course I liked the process of commenting on mine and my fellow-students' articles.*

Tassos: *It puzzled me in the beginning because I did not like to comment negatively my colleagues despite the fact that it could help them improve their errors.*

Roula: *It was something that I did not do many times over [actually she did not post any comment].*

3b. The features of constructive comments

An interesting point is the students' views about the features of constructive comments. To investigate this issue, students answered the completion question A3E10. The comments help more when... Students mention that comments should: be well-intentioned, have friendly style, be clear, mark problems while proposing solutions, aim to continuous improvement. Some characteristic answers are quoted:

A3E10. The comments help more when ...

Valia: *They are clear and potentially propose some ways to face a problem.*

John: *they aim to get you improved by vital remarks. Even for the best article you should prompt the author for improvement.*

Evi: *They are honest despite of the interpersonal relations of the participants.*

Kate: *They are guiding and mention the mistakes.*

Mina: *They are well-intentioned, informative and written by people having knowledge about the article theme.*

Roula: *They have a friendly-consulting style.*

Tassos: *They point out mistakes we have done in some activities helping us to improve them.*

3c. Appropriateness of blogs for the pedagogical approach

The students' point of view about the appropriateness of blogs publishing model for the support of learning by design activities is investigated through the answers to the question A4E6. If the blog was not available for the implementation of the same work then... Students' answers show that they understand the communication requirements of the pedagogical approach as well as the value of the capability of monitoring the whole process during the activity. Students point out the difficulties they could have in order to organise the required face-to-face meetings; in addition students mention that without the blogging system they could not comment each others' articles in such an extent and depth while they were continuously monitoring the evolution of the proposed designs

The quoted answers of students are indicative:

A4E6. If the blog was not available for the implementation of the same work then...

Valia: probably we could not have the feeling of collaboration and responsibility to each other so intensively.

John: in order to manage taking our collaborators' opinions we should arrange meetings for all the members. Even if this was feasible we were going to face difficulties because of the lack of the capability to continuously monitor the work of others.

Evi: we could not easily have our own designed activities commented and articles by the rest of the participants.

Kate: we would face a coordination problem. Each one of us has many obligations and blogging is highly demanding in terms of the required meeting.

Mina: we were going to need much time, many transfers or the use of some other software that would demand special skills.

Roula: we were probably going to use the "traditional" methods and lack this experience.

Tassos: we wouldn't have the chance of direct communication between us. (Comments between us)

3d. General opinion and difficulties

In questions about their overview of the blogging experience students were satisfied in general with their participation, most of them mention that they will participate in group blogging in the future while some of them intend to run a personal blog as well. Students' proposals, for the improvement of similar activities in the future, include extending of the duration, increasing of the number of participants, and developing a new activities notification service. The lack of a notification service was a disadvantage of the selected technological platform. During the group interview students mentioned that it was difficult for them to know about new comments in their "old" articles or comments. Students invoked this awareness difficulty as a major reason for some unanswered comments and questions that were observed in the blog.

Axis 4. Quantitative summarization of participants' interaction

The analysis of research data in this axis aims at quantitative and graphical summarisation of participants' interaction. The following graphical representations of the interaction raw data stored in the system log file gives an overview of the group work course at a glance. Two diagrammatic representations are presented: the first is a bubble chart summarising the article posts while the second is a social network chart depicting the commenting relations of the participants. During the learning by design activity the participants posted over 50 articles and 100 comments in total.

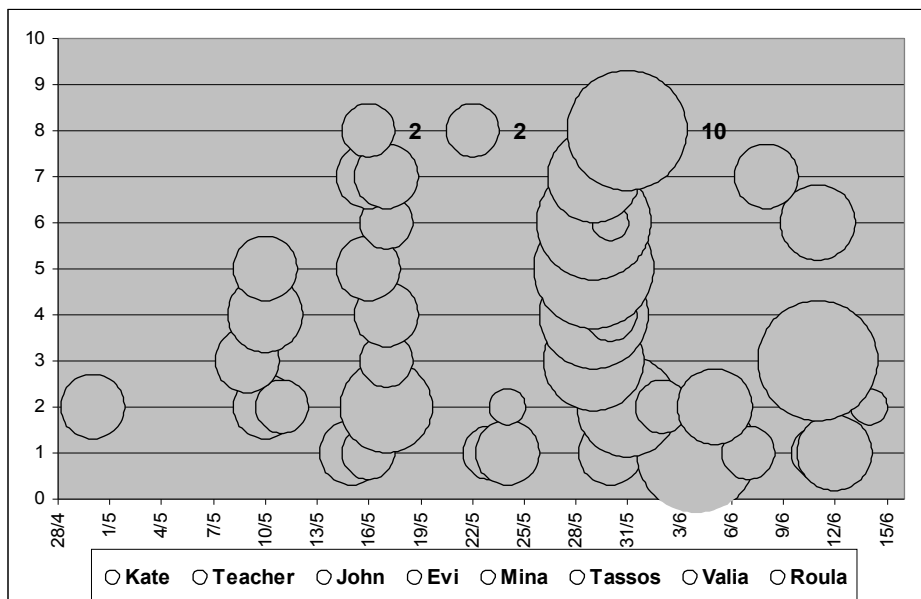


Figure 2. Articles production synopsis

The bubble chart of figure 2 constitutes a projection of the blog to the articles posting dimension. The horizontal axis corresponds to the publishing dates while the vertical to participants. Bubbles with their centre in the same height of the vertical axis have the same fill pattern and represent the article posting of a specific participant. Articles of a particular participant posted within the same day are depicted by one bubble the diameter of which is the sum of the diameters of the bubbles for each article. The numbers next to the bubbles refer to the number of the comments posted for each corresponding article increased by 1 (in order to have a bubble even for uncommented articles). In other words, the diameter of the bubbles is proportional to the impact of the articles in terms of comments. The height of each participant's line of bubbles is related to the total number of comments his/her articles received. More specifically, the lowest (heavier) line (Y=1, Kate) has received the most comments for her articles while the highest (lighter) line (Y=8, Roula) the least.

The bubble chart depicts the contribution of each participant to the blog in terms of articles and corresponding comments. It gives a kind of relative weight measure for the articles' impact. The specific chart shows a significant number of articles and an interaction intention increasing by time. This is depicted by the diameters of the bubbles which get longer by time. This is consistent with the students' statements that initially they hesitated to publish but felt comfortable in the course. It is also possible to see the deadlines of the project because of the accumulation of the bubbles in the corresponding dates (e.g. 17 and 29 of May).

The bubble chart gives an overview of the articles production, their impact and the participants' relative contribution for this but it contains no information about who is commenting whose articles, what is the participants' relative contribution on comments, etc. The comments dimension of blogging is equally important to the articles one because it includes the basic mechanism for feedback information supply and reflection prompt. The blog activity is projected to the comments dimension using the social network graph presented in Figure 3. The social network graph has been produced using the Ucinet v6 software system (Borgatti et al., 2002). The graph shows the comments production for the specific blog.

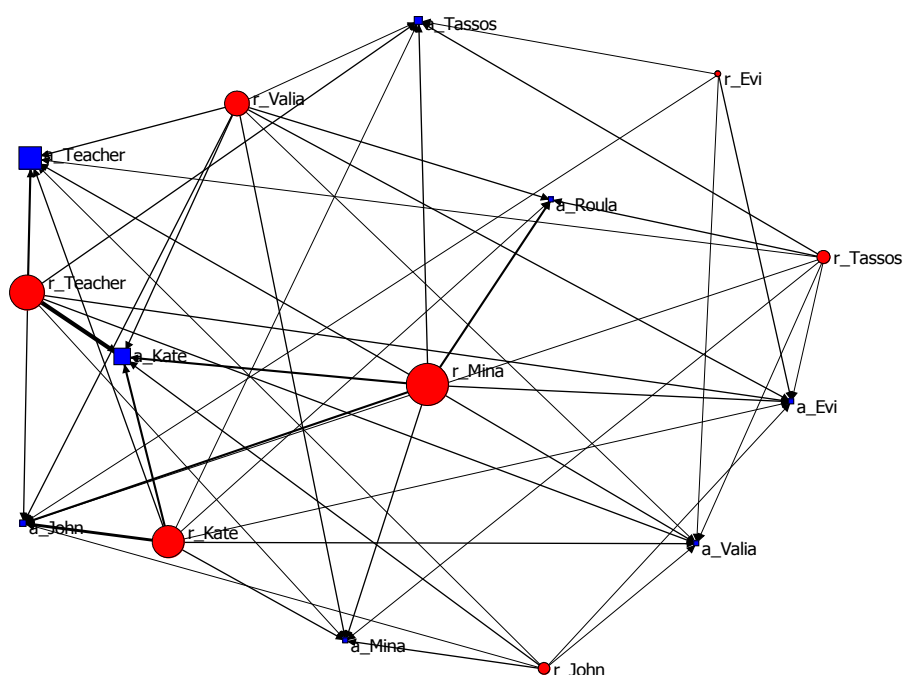


Figure 3. Comments production synopsis.

The nodes shaped as circles represent the participants as commentators-reviewers (labels with prefix "r_") while nodes shaped as squares represent the participants as article authors (labels with prefix "a_"). The size of the nodes is proportional to the total number of comments and articles of the corresponding participant for the circles and squares respectively. The arcs are directed from the commentator to the corresponding author. The thickness of the arcs is proportional to the total number

of comments for the corresponding couple of participants. It is worth commenting that in this version of the diagram the thickness is related only to the number of comments and contains no information about the quality of it (positive or negative).

By observing the graph it is obvious that *r_Mina* posted the most comments of all, and *r_Kate* takes the second place on comments production. It is also apparent that all participants with the exception of Roula have posted comments to every other. Roula did not post any comment since there is no circle node labelled *r_Roula*, although her articles received comments. As far as the topological orientation of the nodes is concerned, the left part of the graph hosts in general the participants who were more productive in comments and the authors (squares) are located near their more frequent commentators. The optical observation of the graph gives rich information about the commenting interaction of the blog. The viewer can readily find out who is commenting whom and in what frequency. It is also possible to compare the relative contribution of the number of comments of each participant. In the specific graph we see a high degree of connectivity that is a strong evidence of the appropriateness of the learning by design approach which required peer review of the designs fostering the comment production.

Of course the simple quantitative overview offered by the above graph allows a useful estimation for the intensity and extension of the interaction but does not allow an accurate quality assessment of the participants' learning experience; this assessment needs the combination of the content review and analysis.

Discussion-conclusions

In this paper a case study for the use of blogging in a learning by design project is described. The reported work is inspired by the use of social software for the construction of teachers' professional development communities of practice (Marcelo & Bairral, 2007), while at the same time considers the results about social practices of teachers when blogging that are reported in Makri & Kynigos (2007). The presented case study extends the mentioned works focussing on the particular case of group blogging as a communication and information management system in combination with the specific pedagogical approach of learning by design. The main idea behind the study of blogging use for collaborative learning by design was to investigate the education enhancing opportunities of such a constantly gaining in popularity software system.

As far as the familiarisation of students with blogs is concerned, the successful completion of the activity, the articles, and the comments' quantity and quality shows that despite the initial difficulties, students quickly acquired the required skills for blog use.

As far as the appropriateness of blogs for the implementation of learning by design activities is concerned, students had increased opportunities to receive feedback information in the form of fellow-students' and teachers' comments. Furthermore, the participants have described the features of constructive comments that helped them to overcome their initial hesitation about the peer review and commenting. The blog support for the learning by design activity communication and information management was decisive, according to the students. The blog enabled them to coordinate and communicate efficiently without the need to meet face-to-face.

As far as the learning outcome is concerned, in learning by design activities the learning outcome is mainly represented by the final design of the students. Students managed to design a variety of learning activities which were revised according to their fellow-students' comments. The successive, in general, understanding of the learning activities designed by others and the accurate critique, as it was recorded in students' answers to the last questionnaire shows a rather satisfactory learning outcome. The students' participation in the blog has given them the opportunity to experience a rich set of learning activities ideas in order to obtain the general learning activities quality assessment criteria declared in their questionnaire answers.

The content analysis has shown that all participants implemented some face-saving strategies in order to protect their own and their fellow-participants' face. This has not restrained them from posting

meaningful and useful remarks that contributed to the ongoing learning activities design and discussion on it. For the teacher it proved easy to monitor these discussions and intervene whenever necessary.

The above remarks lead to the conclusion that the students have experienced a high quality learning experience, which contained a high density and long duration dialogue relative to the learning content, as well as opportunities for collaboration and reflection.

Improvements for similar future applications could include: increased number of participants, longer duration, and the development of a new blog activity notification service briefing any new comment or article for each participant separately. As for the research dimension, the presented work could be continued with more sophisticated interaction analysis techniques, the consideration of other pedagogical approaches, and the comparison of blogs to other social software.

Our conclusion is that blogs exploitation in combination to the proper pedagogical approaches has the potentiality to enrich the quality of future teachers' education.

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