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Student Support in Web 2.0 CSCL: an exploratory proposal using Interaction Analysis

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Abstract

The development and availability of Web 2.0 applications, like blogs, set new challenges and opportunities for the Computer-Supported Collaborative Learning community. This paper aims to investigate the possibility of implementing Interaction Analysis techniques in educational group-blogging systems, as a tool for supporting students. To this end, the paper presents a case study evaluating an Interaction Analysis toolkit for blogs, called GIANT, in terms of general usability, usefulness and user interface satisfaction. Overall, research results indicate that students were to a large extent satisfied with their blogging experience, rating the automatically generated Interaction Analysis graphs as useful, easy to understand and decode, thus supporting our initial hypothesis that Interaction Analysis is an important module of any blog-based CSCL setting.

Keywords: Interaction Analysis, usability, CSCL, GIANT, blogs

Introduction

Computer-Supported Collaborative Learning (CSCL) is an emerging branch of the learning sciences, aiming at studying how people can learn together with the help of computers (Stahl et al., 2006). In all cases of contemporary learning theories, such as constructivism and sociocultural theory, the need to support and enhance interactions among participants is highlighted (Bratitsis, 2010). Nowadays, web-based environments for communicating, networking and sharing information, often referred collectively as "Web 2.0", have become universal (Duffy & Bruns, 2006). Thus, according to Bratitsis & Dimitracopoulou (2008), conjoining Web 2.0 tools and CSCL seems to be an obvious choice. The reasoning behind the aforementioned statement is that, in order to encourage and support social interactions – from a distance – among collaborating actors, both Web 2.0 tools and CSCL utilize computer-mediated communication, which in most cases is asynchronous and in the form of a text (Dettori & Persico, 2008). In the context of CSCL activities, it is mainly blogs that have been increasingly used, since they can offer new ways of collaboration, encourage participation, and support the dynamic real-time teacher-student and student-student interactions that are required to facilitate collaborative learning experiences (Churchill, 2009). In this vein, and since the main objective is to attain higher quality dialogue and this enhance learning, research currently focuses upon detecting methods that would make good use of interaction that takes place during asynchronous discussions, in order to support, in turn, critical thinking and knowledge construction (Stahl et al., 2006). Within the framework of CSCL, the research field of computer-based Interaction Analysis (IA) can contribute significantly (Bratitsis, 2009), aiming at fostering productive interactions among users by increasing their awareness, and by facilitating their self-regulation (Fessakis et al., 2013). The

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main objective of IA is to design, develop and apply tools that could offer real-time support to students and teachers (Dimitracopoulou, 2009).
However, even with the widespread adoption of educational blogs, there is a lack of research concerning automated IA tools for blogging technology. Working towards addressing some of the above issues, an IA toolkit for blogs, called GIANT (Graphical Interaction Analysis Tool), has been deployed. The GIANT is a tool for analyzing and graphically visualizing in real time the complex social interactions that take place during blog-based collaborative activities, allowing teachers and students to use it in order to support monitoring, awareness, and self-regulation of the collaboration process (Michailidis et al., 2013). Against this background, this paper focuses on students' perspective and presents a case study evaluating the usability of the GIANT toolkit, in terms of usefulness, ease of use, ease of learning and user interface satisfaction. The main goal is to advance the work of Michailidis & Tsiatsos (2014) and Michailidis et al. (2015), providing further evaluation data regarding the strong and weak points of the GIANT toolkit for blogs.

Theoretical Background

Computer-Mediated Communication (CMC) tools, employed to mediate teaching and learning processes, are being adopted at a growing rate. This has impelled the study of asynchronous communication as an activity that can reveal student behavior during the learning process (Lucas et al., 2014). As Bratitsis & Dimitracopoulou (2009) proclaim, current research also seems to shift towards finding ways to support and enhance critical thinking through interactions that take place within asynchronous communication activities. Since critical thinking is a process that allows learners to attain new knowledge through problem-solving and collaboration, high quality learning through critical thinking is, naturally, the main objective in these activities (Walker, 2005). In this vein, blogs have been gaining momentum over the past few years, and many educators have attempted to incorporate blogging to education, in order to enhance the element of communication among students and teachers (Kim, 2008). The educational applications of blogs grow strongly and are present in all levels of education, from elementary education (Davis, 2006) to tertiary education (Kerawalla et al., 2008) and teacher professional development courses (Marcelo & Bairral, 2007; Makri & Kinigos, 2007). Research results demonstrate that blogs encourage reflective learning and prompt a gradual shift from superficial learning to acquiring new knowledge (Williams & Jacobs, 2004). Compared with other forms of asynchronous learning, such as forums or wikis, blogs promote interaction among members, as well as flexibility and immediacy more effectively, offer feedback and ultimately, support reframing knowledge and learning (Williams & Jacobs, 2004; Yang, 2009).
Computer-based Interaction Analysis (IA) is an emerging research field, and aims at analyzing and visualizing in an automated way the complex interactions that take place among users, in computer-mediated collaborative learning activities (Dimitracopoulou, 2009). The IA results are presented to the learning environment participants (e.g. students, teachers) in an appropriate format (usually graphical), which can be easily interpreted by all users. The main objective is to offer the means directly to participants, so as for them to become aware of and regulate their behavior, either as individuals or as cognitive groups (Dimitracopoulou, 2009). In fact, the corresponding IA tools support the users in three major levels: awareness, metacognition and evaluation. The goal is to optimize any learning activity along two main axes: a) by helping students to refine their participation through reflection, self-assessment and self-regulation; b) by providing teachers with the means to

design, regulate, coordinate and evaluate any activity in a more efficient way (Bratitsis, 2010; Dimitracopoulou, 2009).

Related work and research approach

Our main research objective is peer support in asynchronous discussion learning activities, in order to provide users with tools to directly analyze and eventually, underpin learning activities. Focusing on asynchronous collaborative, communication-based activities, one can detect in the relevant literature systems like the Knowledge Forum (Scardamalia, 2004), which offers metacognitive tools, assisting students to reflect upon their performance and improve their learning strategies in problem-solving situations. The DIAS system (Bratitsis & Dimitracopoulou, 2007) targets asynchronous discussions and provides all actors involved in discussion learning activities with an extensive set of IA indicators. The Web2SRL system (Huang et al., 2012) provides learners with mechanisms for regulating their learning, including planning, practice and reflection. In fact, there has been some research work on applying IA techniques in blog-based activities, but without suggesting any supporting tools that would indicate encouraging results in various settings (e.g. Anjewierden et al., 2009; Fessakis et al., 2013).

In addition, research work mentioned above has studied IA mainly by ex-post messages activity analysis of student interaction. Moreover, the IA graphs of the aforementioned studies were produced off-line and in a non-automatic manner. It is, therefore, important to study IA in group blogs through which students implement collaborative learning activities. The main objective is to design and develop IA tools for blogging platforms, analyzing and visualizing the discussion activity data, providing feedback in terms of quantitative information directly to the blog participants, in order for them to become aware of and assess their activity. This paper attempts to address some of these issues by presenting a case study evaluating the GIANT toolkit for blogs, which took place during a CSCL activity in secondary education. Providing further evaluation evidence, in terms of usefulness, ease of use, ease of learning, and user interface satisfaction of IA tools for blogs is the main objective of this case study.

The Graphical Interaction Analysis Toolkit (GIANT)

WordPress is nowadays the most popular and commonly used social communication blogging software on the Internet, having a rich plugin architecture that allows users and developers to extend its abilities beyond the features that are part of the base install. The GIANT is a fully functional tool for real-time analysis and graphical visualization of the complex social interactions that take place during blog-based collaborative activities. The plugin can be seamlessly integrated in any WordPress blogging platform, allowing teachers and students to use it in order to support monitoring and awareness of, as well as self-regulation in the collaborative process, and thus, ultimately improve learning. The GIANT IA graphs are produced on the fly, in an automatic manner, by measuring quantitative activity data such as the number of posts and comments written and read by users, the time when this takes place etc. In total, thirty-two (32) visualized IA indicators (including all possible variations) can be produced and displayed by the GIANT toolkit, varying from simple statistical awareness information to complex cognitive and metacognitive IA graphs. Some of these graphs address individual users (e.g. individual activity reports), whereas others address groups. Some of them address mainly students and others address only teachers (Michailidis & Tsiatsos, 2014). All the IA graphs produced by GIANT incorporate a

short description of the graph in display, in order to assist teachers and mainly students to decode the information provided.

Case study: supporting student self-regulation using GIANT

Educational context

The blog-based activity implemented in this case study was conducted during the 2nd trimester of the 2015-2016 school year. Participants included 1 teacher, 1 teacher assistant, and 52 students (27 females, which makes up for 51.9% of the total number of users and 25 males, that is 48.1% of all users), all enrolled in a Junior High School in Thessaloniki, Greece. The activity was a compulsory module for the successful completion of the Informatics course, contributing 10 marking units to the final mark. In order to achieve the objectives of this case study, a WordPress blogging network, using GIANT, was deployed. Moreover, students were randomly divided into 12 teams, each of which had access to a team Blog, where they could post their articles and game designs. All students also had access to a central Blog, where they were advised to monitor the IA graphs automatically produced by the GIANT on a daily basis, throughout the activity.

Blog-based activity description and IA graphs used

The activity was based on Project Based Learning (PBL), in order to enhance social interaction among participants (Lee et al., 2008). The task of the students was to design and develop a computer game using Scratch programming environment (https://scratch.mit.edu/). The activity lasted 8 weeks in total, during which students had to complete five phases: Phase 1 – Socialization: Students worked individually in order to post an answer to a game design question, and to comment on at least five answers of their fellow-students (1 week). Phase 2 – Group Game Scenario/Peer Review: Students had to post the scenario of their game as a team, and constructively comment on at least five other group scenarios (2 weeks). Phase 3 – Group Game Development: Students had to work together as a team and develop a beta version of their game in Scratch (3 weeks). Phase 4 – Peer Review/Group Game Revision: Students were obliged to interact with the rest of their peers in the Blog by commenting freely upon the Scratch games they had created suggesting improvements. Each team had to revise the beta version of their game, taking into account the comments of their peers, and post the final version of their game (1 week). Phase 5 – Peer Marking: Students had to suggest a mark, rating the final versions of the Scratch games, on a scale from 1 to 5 using a star-based system (1 week).

Due to page limit constraints only 3 of the IA graphs utilized in the activity are described in this paper. The graph of Figure 1(left) addressed individual users, and bears a higher interpretative value. It is based on a gauge type chart, representing an overview of the active participation of the user, by displaying the total number of comments (blue pointer) in comparison with the general average number of comments made by all the users (black pointer) and also the team average number of comments made by the user's team members (white pointer). The graph offers metacognitive insight, by positioning the user in a colored 3-scale zone, using a predefined algorithm. Figure 1(middle) illustrates a bubble chart of the number of posts and comments published by each member in total. The height of the bubble is proportional to the number of comments, while the diameter is proportional to the number of posts, thus providing summarized data for comparison among group members according to their contribution to posting and commenting. Figure 1(right) shows a simple pie chart providing awareness information to all blog users, regarding total user activity

contribution (i.e. number of posts + number of comments + number of comment replies) as a percentage of the overall activity. This graph reveals which users are active and which are passive, as well as the ones who need encouragement or further assistance.

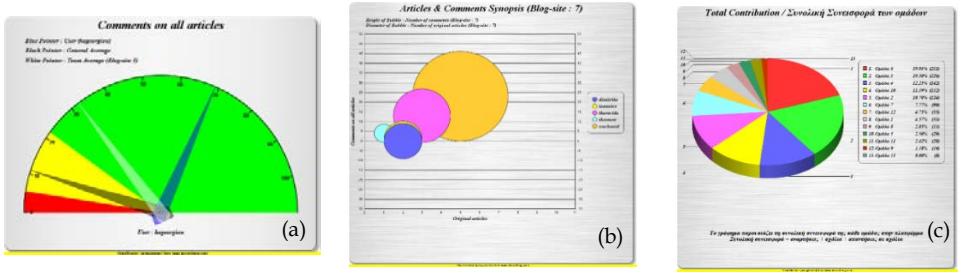

Figure 1. Screenshots of some of the GIANT's IA graphs used in the case study

Evaluation of the Case Study

Evaluation Methodology

The main goal of the study is to evaluate the usability of the IA tool for blogs called GIANT, in terms of usefulness, ease of use, ease of learning, and user interface satisfaction. Working towards this objective, the authors applied a four-dimensional evaluation process based on Lund's "USE" questionnaire (2001), which is a short questionnaire designed to measure the most important aspects of a product's usability effectively. It consists of 30 questions, grouped in four dimensions: (a) Usefulness, (b) Ease of use, (c) Ease of Learning, and (d) Satisfaction. The type of questions is a 5-point Likert rating scale with the following anchors: 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree. Furthermore, the participating students were randomly divided in 12 different groups and for research purposes, they were separated in two sub-groups in order to create an experimental group (27 students in 6 teams with GIANT support) and a control group (25 students in 6 teams with no GIANT support). At the end of the activity, students from the experimental group were asked to complete the online usability questionnaire. The statistical analyses were performed using the SPSS 22 statistical package and the level of significance was set to 0.05.

Results and discussion

At the end of the period when the activity was conducted, students from the experimental group (i.e. with GIANT support) were asked to complete the online version of Lund's questionnaire, in order to evaluate GIANT's usability. Descriptive measures of central tendency for each Likert-type item, such as mean and median, as well as frequencies, were explored. Moreover, descriptive measures of dispersion for each item were also examined, making the assumption that Likert type variables can have an internal order of numerical importance. However, it should also be noted that calculating the average value in ordinal variables can mainly serve for interpretive purposes and cannot be considered a resistant measure in all cases. Additionally, to complete the analysis, four (4) variables were used for each aspect of the Lund questionnaire: a) Ease of Use, b) Usefulness, c) Ease of Learning and d) Satisfaction. The central tendency and dispersion measures assessed for the students' answers are presented in Table 1.

Table 1. Descriptive statistics for the aspects of the Lund questionnaire

Variable	N	Min	Max	Mean	Std. Dev.	Skewness	Skewness Std. Error	Kurtosis	Kurtosis Std. Error
Ease of Use	27	3.18	4.91	4.06	0.52	0.194	0.448	-1.114	0.872
Usefulness	27	2.75	5.00	3.93	0.56	-0.023	0.488	-0.325	0.872
Ease of Learning	27	3.50	5.00	4.39	0.52	0.048	0.488	-1.647	0.872
Satisfaction	27	3.00	5.00	3.87	0.48	0.727	0.488	0.960	0.872

By interpreting the numbers in the Table 1, one can conclude that the answers of the students were satisfactory, although there is room for improvement. Each of the variables used in the analysis corresponds to one aspect of the Lund questionnaire. Starting with the factor that students had a more neutral to positive opinion on, Satisfaction scored a mean value of 3.87 and a standard deviation value of 0.48 (M = 3.87, SD = 0.48). Students expressed somewhat more positive opinion about the factor of Usefulness, which scored a slightly higher mean than the one of Satisfaction (M = 3.93, SD = 0.56). Despite the fact that the mean was higher, the opinion again is below positive but above neutral on average. Moving to the more successful factors, Ease of Use scored an even higher mean, which was just above 4.00. This entails that that students expressed positive opinions about the specific factor on average. However, the standard deviation which was 0.52 made the factor hold the ground of both neutral to positive opinions and positive to strongly positive opinions (M = 4.06, SD = 0.52). Last but not least, the factor that had the most positive feedback of all, that is Ease of Learning, scored a mean just below 4.50 and in combination with a standard deviation just above 0.50 (M = 4.39, SD = 0.52). Numbers show a totally positive range of opinions, ranging from the positive to the strongly positive end of the spectrum. Concluding, GIANT tool was overall evaluated positively, with opinions ranging from above neutral to just below strongly positive.

Apart from the questionnaire, students were able to comment briefly on three positive and three negative aspects of the GIANT tool. Among the positive aspects of GIANT according to the students' comments were ease of use, usefulness, organization, good presentation, functionality, user-friendliness, and help. For example, a student mentioned "*… reading the graphs was very easy…*", whereas another student affirms that "*...all the IA graphs were very easy to understand, requiring no special guidelines for their reading…*". Similarly, positive comments focused on more aesthetic concerns regarding the colors and the fonts used. A student mentions that "*… blogs are a very useful and necessary educational tool that could facilitate critical thinking,*" whereas another student states that "*…the interface of the blogging platform was functional and user-friendly […] the usage of buttons, icons & menus is obvious*". Students also acknowledge the simple and intuitive interface of the WordPress blogging platform that helps them become aware of the workspace, and thus facilitate the process of publishing posts and comments: "*… WordPress is a free & open-source tool that will definitely support the wider adoption of educational blogging collaborative learning …*". Furthermore, some IA graphs were preferred over others. For example, the IA graph of Figure 1 (left) and Figure 1 (right) gathered the most positive votes from the students, due to the fact that they provide metacognitive insight, and summarize awareness information for all blog participants. In this vein, a student stated that "*…the presence of the gauge and pie chart types of the IA graphs increased my workspace and group awareness without any effort …*" and "*… reading*

the IA graphs helped me to implement the activity's tasks faster …". All comments were taken into account for further extensions and updates of the tool.

Conclusions and future research

This paper has showcased a case study in which an IA tool called GIANT has been employed, in order to support a blog-based CSCL activity. The main goal of the study was to provide evaluation data regarding the strong and weak points of the GIANT toolkit for blogs, in terms of general usability, usefulness and user interface satisfaction. According to the results of the statistical analysis and the "USE" questionnaire of Lund (2001), the tool was assessed quite positively. The main conclusion is that the use of the IA produced by the GIANT toolkit in blog-based asynchronous discussion activities was an engaging and effective method. It was concluded that students were to a large extent satisfied with their blogging experience, as well as with the IA graphs produced by GIANT, rating the tool as a user-friendly and easy-to-use educational tool. The real-time generated IA graphs were useful, as well as easy to understand and decode. It is really encouraging that the ease of learning aspect specifically was the most positively evaluated factor, with opinions ranging from positive to strongly positive scores. These research findings reinforce the results of previous GIANT evaluations (Michailidis & Tsiatsos, 2014; Michailidis et al., 2015). The limitation of this study can be identified to the relatively small sample size. Aiming at further evaluating and validating the results presented in this paper, new case studies should be carried out in different educational and technological contexts, with larger sample sizes. Nevertheless, the proposed IA tool was shown to play an important role supporting students in CSCL blog-based activities.

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