

The Impact of Interaction Analysis Graphs on Groups during Online Collaboration through Blogs According to the “Learning by Design” Scenario

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Abstract: This paper presents empirical research results about the impact of Interaction Analysis (IA) graphs to groups of students collaborating through online blogging according to a “learning by design” scenario. The IA graphs used are of two categories, the first category summarizes quantitatively the activity of the users for each blog permitting the comparison of students’ activity level in a group while the second category permits the comparison among different groups. The statistical analysis of the students’ interactions shows significant impact of the graphs presence to the number of posts and comments produced by the groups. Furthermore the graphs of the first category (intra-group IA) have stronger consequences than the graphs of the second (intergroup IA). The results support the general claim that interaction analysis is an important component for self regulation in computer supported collaborative learning environments.

Introduction

Increasing interest has recently marked for the utilization of social software (Allen, 2004) by the educational community. This happens not only due to the currently increased availability of social applications of the internet (e.g. web 2.0 services) but also because they are consistent to modern learning theories. Indeed, educational use of social software is obviously consistent to sociocultural theory (Vygotsky, 1986) and to the social constructivism (Kim 2001). These theories advocate the importance of learners’ interaction during active participation to learning activities which provide for design and construction of meaningful artefacts. Blogs (Blog, 2010) constitute special instance of social software that is a network application supporting groups of actors in communication and interaction. In a general overview of educational uses of blogs Downes (2004) notices 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.

Several case studies provide evidence about feasibility and benefits of using blogs in learning environments. For example Makri and Kynigos (2007) describe a case study is concerning the integration of group blogging in a postgraduate course in Mathematics Education. From the preliminary research data analysis, the researchers underline the possibility of the development of a long-lasting “warm”-informal dialogue and non-monologue narration emerging collaboratively. In Chen et al. (2005) the researchers integrated blogging with the learning portfolio approach showing the importance of the adoption of a well-defined pedagogical approach for the successful integration of blogs or any other content management model (e.g. wikis). The study of the impact of the kind of work or the genre of learning activity (e.g. project, problem solving, brainstorming etc) to the educational blogging appears as interesting research direction. Fessakis et al. (2008) studied the combination of blogs to learning by design pedagogical approach and claim that teachers can utilize blogs in order to increase the communication and interaction in general among the students as well as their participation and engagement level. In this paper an extension of this work is presented concerning the quantitative interaction analysis of groups collaborating for learning by design activities through blogging.

Computer based Interaction Analysis (IA) is an emerging field (Dimitracopoulou, 2008) aiming at supporting directly or indirectly the participants in technology mediated activities. There are two main complementary directions of IA according to the end user of the information produced. In the first direction the IA informs the adaptivity components of the learning environment. In the second direction the participants have direct access to IA information supporting them to self regulate. Indicative works of the authors concerning interaction analysis include Fessakis et al (2004) for synchronous communication environments and Bratitsis & Dimitracopoulou (2008) for asynchronous.

This paper extend the work of Fessakis et al (2008) using a significantly larger number of groups that learn by design through blogging and focuses on the impact of graphical IA tools to the participants while they are collaborating. The main hypothesis tested in this work is that graphical synopses of the interaction raw data of the group blogging helps the group to increase the level of awareness and to regulate its function leading to better collaboration by students and moderation by teachers. In the followings the research conditions are explained along with the research questions and data collection tools, then the data are analyzed and interpreted and finally an overview discussion is provided.

Research Conditions

Aim of the present research is to explore the impact of IA graphs on the members of group blogs during collaboration. The main research question is therefore: **RQ:** *To what extent the interaction analysis graphs affects self-regulation of the group blog members? Are there any significant differences for impact among the different kinds of graphs?*

The experiment took place in the interval 19 FEB – 04 JUN of 2009. The participants were 147 students of the University of the Aegean in Greece, who were attended a course about the design and development of ICT applications in education. The majority of the students were at the third year while some of them at the second or forth. The age of the students is considered insignificant factor in this research since all of them are adults with similar education. Students were organized in 21 groups, 7 members each, using the list of their surnames in alphabetical order. For each group a blog was created in a popular free blogging service. The access to the blog content was private to the group members. Students attended three hours of training for familiarization with blogs at the beginning of the research. In addition, students had available on each blog a detailed manual of use. The students' task was to design technology enhanced lesson plans. The learning activity was structured according to the following phases: **Phase 1. Socialization:** Each student publishes a brief presentation of him/her and a short reflection on the lesson plans models; **Phase 2. First design and peer review:** Each student publishes on the blog the designs of 1-2 lesson plans and makes comments for the designs of the other members of the group; **Phase 3. Revision and peer review:** Each student revises the designs as many times his/her thinks necessary, taking into account the comments of his/her colleagues. Students continue also, the commenting of the others' designs and revisions; **Phase 4. Final project deliverable:** Finally students compile the deliverable for the project by selecting, after discussion, the best of their designs.

The groups were separated in three categories. The first category (K1-intragroup analysis) included the groups: (1, 2, 3, 7, 8 and 17). The researcher was supplying these groups with the IA graphs (A1-A4, figures 1-4) which are summarizing data for comparison of the group members according to their contribution on posting and commenting. In addition the groups of the category K1 had available social network analyses diagram (A5, figure 5) about who was commenting whom. The second category (K2 - inter-group analysis) included the groups: (10, 11 and 19). These groups were supplied by the researcher with IA graphs that was comparing the groups of this category to other groups in terms of total number of posts and comments (B1-B3, figures 6-8). The difference in the case of category K2 is that the members of each group are allowed to compare quantitative data of their group to other groups without reference to the individual contributions of members. The third category (K3 – Control groups) included the remaining groups and did not have available any IA graph. The posting of the graphs to the blogs has been scheduled to be done after completion of each main phase of the scenario. The graphs are presented in detail per group category in the next section.

The Interaction Analysis Graphs of the Research

The decision for the number and the kind of graphs has been done taking in consideration that most of the students were not experienced social software users either experienced graph readers. So the selected graphs are quite simple with the exception of the social network analysis diagram. The SNA diagram was included because students are using it also in other mandatory courses of the first year in the University.

Graphs for the Groups of Category K1

The interaction analysis graphs enabled students to retrieve information about the actions (including their own) of the members of their group. More specifically the graphs for category K1 groups were: **Graph A1:** Bar chart of the number of posts of each member per period and in total (Figure 3). **Graph A2:** Bar chart of the number of comments published by each member per period and in total (Figure 4). **Graph A3:** Bar chart of the number of comments received by each member per period and in total (Figure 5). **Graph A4:** Bubble chart for the number of posts and comments published by each member in total (Figure 6). The height of the bubble is proportional to the number of comments while the diameter is proportional to the number of posts. **Graph A5:** Social Network Analysis diagram (Figure 7). The nodes represent the students while the arcs show commenting.

Graphs for the Groups of Category K2

For the groups of the K2 category (10, 11, 19) the graphs were comparing the number of posts and comments of each such group to those of category K1 groups (1,2,3,7,8,17). More specifically the graphs in this case were: **Graph B1:** Bar chart for the number of posts of each group per period and totally (Figure 8). **Graph B2:** Bar chart for the number of comments of each group per period and totally (Figure 9). **Graph B3:** Bubble chart for the number of posts-comments for each group (Figure 10). The height of the bubble is proportional to the number of comments while the diameter is proportional to the number of posts.

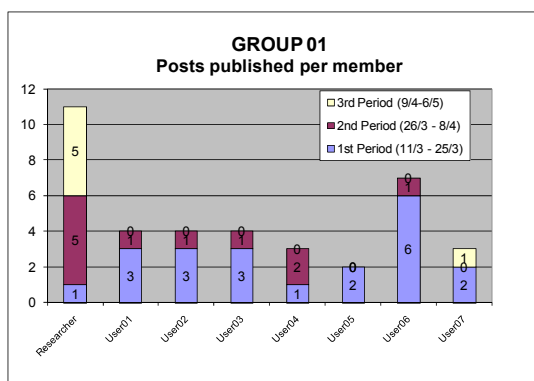


Figure 1. Graph A1.

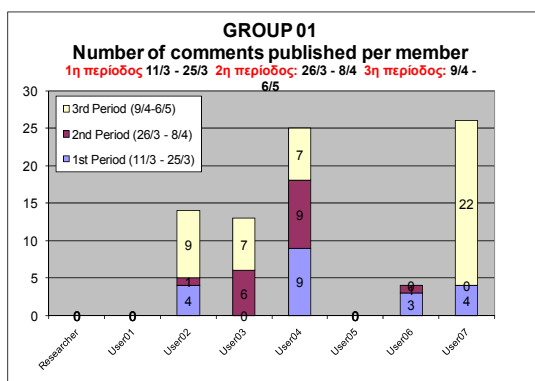


Figure 2. Graph A2.

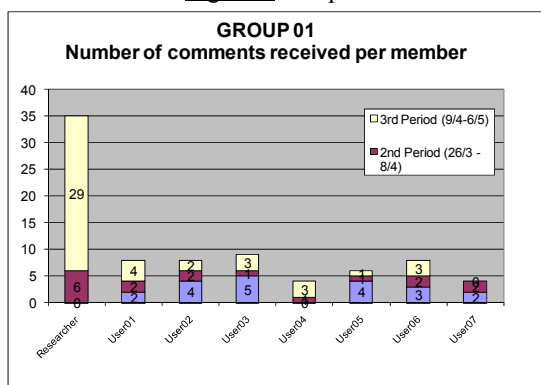


Figure 3. Graph A3.

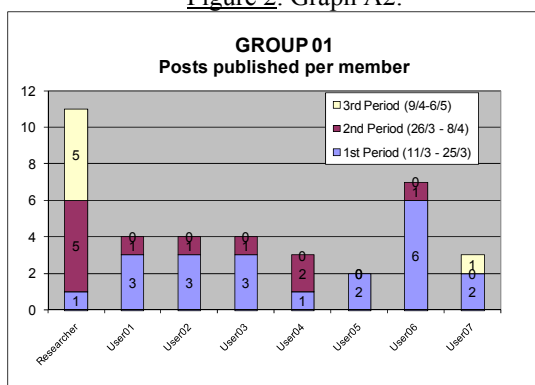


Figure 4. Graph A4.

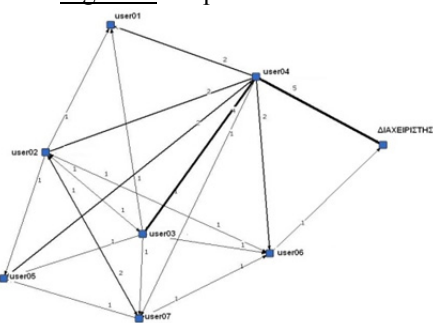


Figure 5. Graph A5.

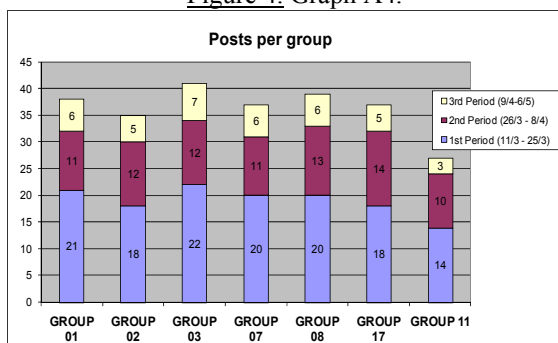


Figure 6. Graph B1.

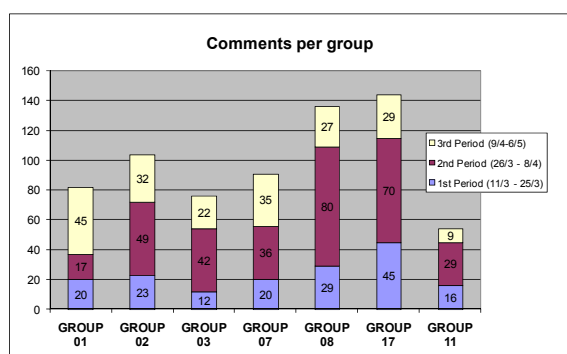


Figure 7. Graph B2.

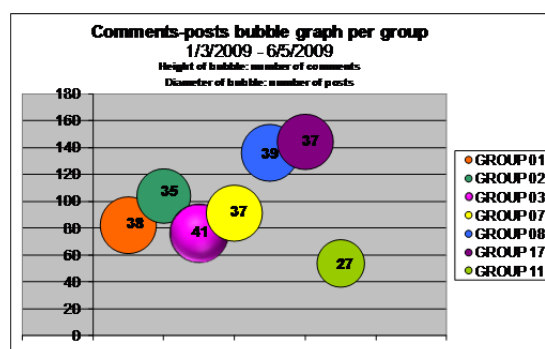


Figure 8. Graph B3.

Research Data Collection and Analysis

The raw data about the students' actions to the blogs were collected and analyzed. These data were used for the production of the interaction analysis graphs by a semi-automatic process. The students of the category K1 and K2 groups were asked to comment the posts with the graphs on their blogs in order to a) make sure that they had noticed the graphs and b) collect evidence about what information they decode from them. The analysis of the data is following.

RQ. *To what extent the interaction analysis graphs affects self-regulation of the group blog members? Are there any significant differences for impact among the different kinds of graphs?*

For this main research question we explore the impact of IA graphs to the groups of students collaborating through the blogs. For the comparison of the group categories we use: a) the mean number of posts and b) the mean number of comments published, per group for each category. The data collected from the blogs shows that the total number of actions for the 147 students was greater than 2095 (817 posts and 1278 comments). The comments of students to the graphs posts are not included in the calculation. Tables 1 and 2 summarize a separate variable for comments and posts for each group category. There are six variables of the form: KXC for comments and KXP for posts where X denotes the category of group (X in {1,2,3}). K1 and K2 categories are similar except to the kind of graphs they had available consequently any significant differences to the control groups' category K3 and among K1 and K2 could be related to the impact of the interaction analysis graphs.

In order to explore if there is any significant difference among the groups of the different categories we could apply ANOVA using the category (K) as a factor variable and the Comments (C) and Posts (P) variables as depended. For the ANOVA to be applicable there are specific prerequisites: the samples should be random and independent and the variances of the populations should be equal. In our case the samples are fairly random because of the use of alphabetical ordered surname list for the group formulation and in addition the samples are also independent because they have not common students.

Table 1. Basic statistics for the comments variables per groups category

Var	N	Min	Max	μ	σ
K1C	6	72	173	111.83	38.52
K2C	3	56	74	66.33	9.29
K3C	12	10	69	34.00	18.85

Table 2. Basic statistics for the posts variables per groups category

Var	N	Min	Max	μ	σ
K1P	6	40	57	49.33	6.41
K2P	3	39	53	45.33	7.09
K3P	12	0	47	32.08	8.68

Furthermore the distribution of the general populations are probably normal as the Shapiro-Wilk (S-W) normality suggests: (S-W_{K1C}=0.927; p=0.554, a=0.05), (S-W_{K3C}=0.937; p=0.461, a=0.05), (S-W_{K1P}=0.953; p=0.762, a=0.05) and (S-W_{K3P}=0.963; p=0.831, a=0.05). For the K2C and K2P normality it is not possible to apply a formal test because of the small number of groups (N<4) but we can hypothesise this taking a reasonable risk or override it using non parametric tests. The last prerequisite of ANOVA for the variance equality is checked using Levene's test. More specifically for the comments variables we have Levene's test (Median) (K1C-K3C)=4.141, df1=2, df2=18, p=0.033, a=0.05 thereafter the hypothesis *H0: The variances are identical* is rejected and the prerequisite is not fulfilled. In contrast, for the case of posts variables using the same test we have Levene's test (Median) (K1P-K3P)=0.411, df1=2, df2=18, p=0.669, a=0.05, consequently we have to accept hypothesis *H0: The variances are identical*. This is quite reasonable since the minimum number of posts was defined by the learning scenario and the students were not significantly differentiated. The above mean that for the case of comments variables we should use a non parametric test like Kruskal-Wallis while for the post variables it is possible to use ANOVA. So we have Kruskal-Wallis (K1C-K3C)=14.628, df=2, p=0.001, a=0.05 which means that we should reject *H0: The samples come from the same population*, and Kruskal-Wallis (K1P-K3P)=11.433, df=2, p=0.003, a=0.05 as well as for ANOVA(K1P-K3P) where F=10.586, sign.=0.001 < 0.05. All the tests show significant differences among comments and posts variables mean according to the group category factor.

At this point we will explore which pairs of variables have significant variables. We see that the groups of K1 category produce on average more posts and comments than the control groups of category K3 as well as from the groups of category K2 (significant differences on mean according to Mann-Whitney test for a=0.05). Furthermore groups of category K2 produced also more comments and posts on average than the control groups. Especially for the mean number of posts we have significant differences according to t-test only among K1P-K3P and K2P-K3P. The evidence of the research support the hypotheses that interaction analysis graphs had a positive impact to the intensity of group collaboration in terms of the number of posts and comments they produced. In addition the graphs for the category K1 (intragroup analysis) seem to have a stronger impact in terms of mean number of comments than those of category K2 (inter-group analysis). This could be happened because intragroup interaction analysis graphs compare the collaborators' contributions and increase the competition among the students in this way. The following excerpt from the comments of a member from group 8 for the graph A4 is revealing:

K.E. said: This graph constituted by circles showing how much a student deal with the group. And it seems that I am the least working member!!! I will agree with the other members of the group that this graph as well as the previous provides an incentive for me to try harder. 08 Apr 2009 10:19

Taking into account all the above we could hypothesize that the combined supply to the students with graphs of the both categories could be even more efficient in helping them to engage in collaboration and self regulate.

Discussion-Conclusion

The continuously increasing use of blogs in education and especially in the context of Computer Supported Collaborative Learning scenarios makes their systematic educational study more and more interesting. Blogs are quite easy to use by Students while they fulfill at a satisfactory level the communication and information management requirements of online collaborative learning by design scenario. The interaction analysis graphs of collaborating students could help teachers to monitor, moderate, coordinate, assess etc and students to increase their awareness and self regulate during their participation. The interaction analysis is also interesting for education researchers. The present research explores the impact of interaction analysis graphs organized in two categories. The first category includes: a) bar graphs and a bubble chart that summarize the evolution of the contribution in posts and comments for each group member separately, and b) a Social Network Analysis diagram with one node per students and arcs showing who was commenting whom. For each group the SNA depicts how extended and intensive was the communication (in term of comments) developed during collaboration, permitting the analysis of this communication for each pair of students. The graphs of the first category concern intra-group interaction analysis and aim to facilitate competition among the group members. The second category of graphs includes bar graphs and bubble chart summarizing the volume of posts and comments of whole groups permitting the comparison among groups. The graphs of the second category concern intergroup interaction analysis and aim to facilitate competition among the groups. From the experiment presented in the paper there is evidence for statistically significant differences among groups posts and comments production depending to the presence and the category of graphs. This means that interaction analysis graphs used has a significant impact on collaborative groups helping them to self-regulate during the learning scenario implementation. As far as the different categories of graphs is concerned (intra vs. inter group analysis), in this study the intra-group analysis graphs had a significantly stronger impact resulting in more active, productive and engaged groups with extensive commenting among their members. Interaction Analysis Graphs seem to give the students the feeling that teachers are monitoring their participation in the groups and this facilitates students to contribute and collaborate more.

The main weakness of this research is the small sample for the groups of category K2 which do not permits the secure generalization of the results for the graphs of the specific category. In contrast, the results for the comparison of interaction analysis graphs of category K1 to the control groups are fairly strong. Future directions of the research include the automatic production of the graphs and their smooth integration in the learning environment in order to give continuous access for the users and to be possible to collect interaction data of the students to the graphs.

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