Users' attitudes towards Web 2.0 communication tools in collaborative settings: A case study with early childhood education students

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Abstract. This paper examines the utilization of Computer Mediated Communication tools within collaborative learning activities. By examining the participants' attitudes and behavior, issues related to performance improvement are being discussed. Through a comparative study using a Blog, a Wiki and a Discussion Forum, students' perception of collaboration aspects ant the tools' effect are examined. Furthermore, common misconceptions are discussed, along with the difficulties the students face and the ways they invent in order to overcome them. The paper concludes in raising issues to be considered when designing similar collaborative activities, involving novice computer users with mediocre developed information literacy.

Keywords: Web2.0, Computer Supported Collaborative Learning, Computer Mediated Communication, user attitudes, collaborative design

Introduction

Computer Mediated Communication (CMC) tools are an integral part of distance learning approaches, especially web based ones. Often, communication is connected to students' improvement of critical thinking, problem solving and communication/argumentation skill (Kim, 2008). Such tools (e.g. email service) have been utilized within learning contexts for many years. Nowadays, Web 2.0 tools such as Blogs and wikis are increasingly coming to the forefront in educational research during the past few years. Several studies can be found in the literature, employing both traditional CMC tools (e.g. email, discussion forum) and Web 2.0 ones in educational settings (Kim, 2008). Within these studies, individual communication tools are being examined, highlighting their advantages and disadvantages as well as their drawbacks and limitations, when exploited educationally. Also, most of the related studies analyse collaborators' activity patterns in order to evaluate the collaborative process and/or the outcome, by examining issues such as collaboration scripting or facilitation, usability, learning design, participation, motivation, etc.

Nevertheless, there is a lack of comparative studies, involving more than one CMC tools (Kim, 2008), especially when the collaboration settings are the same. Furthermore, there are no studies focusing on recording the collaborators' perspectives on aspects related to the collaboration medium. According to contemporary research, learning design should consider how the learners actually learn. Thus, information on their insight of collaboration via CMC tools, focusing on the actual tools, may provide valuable information for improving the design of learning activities by better exploiting these tools, taking into account they are used widely nowadays.

This paper presents empirical data from a comparative study, involving three distinct CMC tools, namely a Blog, a Wiki and an Asynchronous Discussion Forum. The study focuses on the perspective of the tools' end user when attempting to collaborate in large groups, within

a learning context. In the case study discussed in this paper, the end users are university students, trained to become Kindergarten teachers. An important factor is that the corresponding students attended the 2nd year of their studies, having participated only one ICT related course. Considering that they had limited training in computer use in school, they can be categorised as novice users, with some of them not having any experience with computers at all, before attending the university courses. Furthermore, they all admitted not having participated collaborative activities in the past, especially forming large groups, thus being novice collaborators as well.

This study aims at recording the end users' perspective of collaboration via common CMC tools, in order to better understand factors that affect their evaluation of a good collaboration, in order to raise issues for better designing such learning activities. The paper is structured as follows: initially the field of Computer Supported Collaborative Learning (CSCL) is discussed upon, outlining the significance of communication within its settings. Then a brief overview of the educational uses of the three CMC tools is presented, followed by the research approach undertaken. Finally, the results are presented, before the concluding discussion

Computer Supported Collaborative Learning

Computer Supported Collaborative Learning (CSCL) is an intensively active research field for more than 20 years, related to Collaborative Learning with the help of computers (Stahl et al., 2006). According to Dillenbourg (1999), Collaborative Learning is a situation in which two or more people learn or attempt to learn something together. Within Collaborative Learning people capitalize on one another's resources and skills, by asking one another for information, evaluating one another's ideas, monitoring one another's work, etc while undertaking specific roles during the process (Chiu, 2000). Consequently, Collaborative Learning refers to methodologies and environments in which learners engage in a common task where each individual depends on and is accountable to each other.

Thus, CSCL is related to learning within a group. In an attempt to distinguish Collaborative from Cooperative Learning, Roschelle & Teasley (1995, p.8) defined collaboration as "… a process by which individuals negotiate and share meanings relevant to the problem-solving task at hand…. Collaboration is a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem". Thus, they examine collaboration as a social activity within a problem solving situation, actually describing the collaborative construction of new problem solving knowledge. Consequently, collaboration is not just about individuals working and sharing/combining results on a group level, but rather a process of socially co-constructed knowledge in order to establish a mutual benefit and advance the commonly shared knowledge at the same time (Bratitsis & Demetriades, 2012). Individuals' actions are examined not only as such, but as group interactions as well, usually within a social context, which lead to group learning. Thus, in CSCL learning is also analyzed as a group process; analysis of learning at both the individual and the group level is necessary (Stahl et al., 2006).

Within this context, the role of computers in collaboration shifted from the initial provision of assistance/guidance for learning to the facilitation of peer interaction. The most common form of collaboration support by computer systems is for them to operate as communication media. Ludvigsen & Mørch (2010) address these approaches with the term Dialogic Approaches. It is through talk and interaction with significant others that we can understand how participants use tools and resources in learning and cognition. Following

Vygkotsky's socio-cultural theory, they state that a basic premise is that both physical and abstract tools mediate human activities, and the main abstract tool is language.

Numerous applications can be utilized for that matter, such as email, chat, discussion forums, videoconferencing, instant messaging, social networking, etc. The main goal of CSCL computer systems is to create artifacts, activities and environments that enhance group meaning making and at extend, group well-being. The rapid expansion of Internet technologies has significantly contributed to CSCL systems' design, taking into account that it has altered the way people work, play and learn, in the first place. One of the most common approaches for facilitating the construction of common ground of understanding through negotiation is collaborative writing and/or computer mediated discourse. Through written communication, collaborators exchange ideas, information, comments and thus knowledge, while sometimes jointly constructing a final product in the process. Environments like shared documents editors, blogs, wikis, interactive whiteboards, mind map editors and discussion forums have been widely used for that matter. These communicational means have been utilized in multiple ways in CSCL approaches with the learning activity being entirely or partially implemented through the communication medium. Furthermore, many web based communication tools are available, most of which fall under the Web 2.0 technological category, mainly characterized by ease of use.

Summarizing, communication is a fundamental constituent of collaborative approaches and thus the corresponding tools need to be further researched upon. This paper focuses on three of the most commonly used Computer Mediated Communication (CMC) tools, namely blog, wiki and discussion forum, examining user experience and the facilitation of self- and group-level behavior and performance evaluation. The latter are key factors in defining the users' participation behavior and/or quality, as they are tightly connected to the understanding of the collaboration's goals and thus to the quality of the collaboration.

Educational uses of CMC tools

There is a wide range of technologies which support educational activities by facilitating communication and collaboration among students. CMC tools in particular, are utilized by instructors for supporting students in communicating and collaborating with other peers. This paper focuses on three CMC tools: Blogs, Wikis and Discussion Forums. In this section, a brief overview of their functionalities and the ways they are used in educational settings is attempted, allowing the understanding of the facilitation they offer to the students.

Blogs are easily updated personal web spaces for registering information in a multimedia and multimodal manner, following a chronological order and offering several interesting facilities (e.g. tagging). In educational settings, blogs can be used as communication media among collaborating students or between teacher and students (Sigala & Christou, 2007). Teachers, have used blogs for publishing announcements and/or information, thus provoking students' participation for publishing material (ideas, opinions, assignments, etc) in order to receive feedback from the teacher or other student peers. Regarding the teacher, blogs can be useful as a platform for sharing literature reviews and course material (Mejias, 2006), as well as a tool for investigating students' misconceptions and mistakes (Paulus & Spence, 2010). Students have used blogs for sharing learning experiences and expressing their thoughts (Maag, 2005). Also blogs have been utilized for discussing reflections on course materials, thus extending in-class discussions beyond class time and space limits (Betts & Glogoff, 2004).Furthermore, blogs have been used as personal journal by students, in which assignments, tasks and exercises are posted. In this case blogs are utilized as e-Portfolios, which can be mutually shared among students (Dippold, 2009). Finally, blog are

used as group collaboration platforms (Philip & Nicholls, 2009), through which content and ideas' sharing is feasible (Angelaina & Jimoyiannis, 2012). Research shows that blogs can encourage reflective learning, as the students may revise their activity at will (Farmer et al, 2008). Thus, they are facilitated in receiving information in a more sophisticated manner, allowing them to proceed to deeper understanding and knowledge construction Williams & Jacobs, 2004). Overall, the educational exploitation of blogs has been intensively researched throughout the entire range of education (Jimoyiannis & Angelaina, 2012), focusing on pursuing ways of better exploiting the educational affordances of such tools.

Wikis as web-based platforms which allow the collaborative construction of material by a group of people, who are not required to possess programming or other technical knowledge at all. Actually a wiki is an electronic version of a writing board, upon which every collaborating peer can write, delete or alter the content using their own "marker" and "sponge", with some significant features, such as versioning which allows rollback and the comparison of any two versions. The users' interventions are immediately visible to all the collaborating actors. Furthermore, wikis can incorporate multimedia content, thus being useful for creating digital content products. The most common task for which wikis are utilized is that of collaborative manuscript construction. The construction and interconnection of multiple articles-pages is possible, thus allowing a set of interconnected web pages to grow as collaboration among peers evolves (Sauer et al., 2005). Wikis have been used by educators for presenting course material (resources, external links, FAQs, etc) and creating interactive student activities (Schwartz et al., 2004). Typically, wikis are not the most appropriate tool to apply where quick answers are required. On the other hand, they are efficient tools for long term project or group activities, where a community space is required for virtual meetings, discussions, content sharing, and general course management (Roussinos & Jimoyiannis, 2011). In this vein, wikis have been used for extending in-class collaboration and exploited for sharing perspectives of research work, information and writing reviews or even evaluating and peer reviewing students' assignments (Bradley et al, 2010). In some cases, even group communication has been facilitated by the use of wikis, in a threaded-like form (Wheeler et al., 2008). The most important facility of is that of collaborative content construction. Utilizing this, a wiki can be used as a group authoring tool, thus strengthening the sense of community. Thus allowing students with similar or overlapping ideas to see and collaboratively build on each other's work (Sheely, 2008). In such approaches, academic writing skills and collaboration dexterities have been found to be developed (Wheeler & Wheeler, 2009). Furthermore, wikis can be used as content repositories, thus hosting FAQs, documents, links (as social bookmarking services), glossaries, etc. Regarding the use of wiki as a tool of reflection, namely as an e-Portfolio, they allow content organization in subjects and not chronologically, as opposed to blogs (Roussinos & Jimoyiannis, 2011). As in the case of Blogs, the educational benefits of Wikis have been well documented in the literature. For example in (Renee Fountain, 2005) a complete list of such benefits is presented.

Finally, Asynchronous Discussion Forums are eminently communication tools. They are the oldest of the three CMC examined in the current paper, having been used also for educational purposes for more than 30 years, whereas blogs and wikis exist for about 7 years. Since forums are being used for so many years, a great number of research studies have been conducted in order to examine ways of integrating them in educational approaches. They have been used as autonomous teaching tools, through properly designed activities (Paulsen, 1995), in various levels of education (Colins-Brown, 2001; Liu, 2007). As complementary tools to teaching, the have been used for as dialogical means in order for a group to reach consensus and/or a Common Ground of Understanding (Zumbach et al., 2005), or even for extending in-class discussion outside the class (Kear, 2002). Finally,

asynchronous discussions have also been used for assignments' reviewing and evaluation (Collins-Brown, 2001) of even for group assignments, as collaboration media, in several CSCL approaches. Thus a lot of work has been documented regarding the educational exploitation of Forums, including the development of collaborative scripts for dialogic activities, discussants' interaction analysis, development of critical thinking and metacognitive skills (Bratitsis, 2007).

In the above review of the literature, it is obvious that the three CMC tools under examination have been used for similar teaching approaches. They share similar characteristics, by being asynchronous in nature and allowing active group collaboration. The main difference among these tools is the organization of the content, with blogs following a chronological order, discussion forums a logical order, depicted by the threaded form of communication and wikis are more open-ended for the users, allowing them to decide upon the organizational approach. The importance of CMC tools for education has been highlighted by many researchers and can be concentrated in the statement that "asynchronous communication actually stimulates interactivity by extending the contact time for students, allowing them to respond when they choose" (Hiltz, 1994). Several studies explore the educational advantages, deriving from integrating such tools in teaching and learning. Most of them focus on how an individual tool is better exploited for a specific teaching approach, studying issues such as effectiveness, usability, appropriateness, etc. On the other hand, there are limited studies in the literature, comparing the three CMC tools under examination in similar educational settings (Kim, 2008). In a comparative study involving blogs and discussion forums for a whole semester, Diane Hall (2008) concluded that these tools are both appropriate for online teaching, but for different purposes. She found discussion forums to be considered simpler to use by the students, as it is easier to navigate through the discussions, offering a stronger learning experience. On the other hand, blogs were found to provide more understanding of the course material.

In any case, the claim of the current paper is that the choice of the actual communication tool is not the most important to consider. The literature provides enough evidence on how to exploit every one of these tools efficiently, considering the overall teaching approach to be implemented. This paper raises another significant issue, that of the students' perception of the overall collaboration and their individual activity as a part of the total activity. It is documented in the literature that students often face difficulties in understanding important aspects of collaboration, thus not performing adequately in such cases, as discussed in the following sections of the paper. The claim to be made is that whatever the communication tool is, the students will be able to use it efficiently, in the end. A deeper understanding of their perception, as these are formed through the CMC tools and their assessment of these tools under the exact same conditions is very important and should be taken into account in the instructional design process.

Research Approach

In the study presented in this paper, the three aforementioned CMC tools were used in a comparative study. The research took place during the Spring semester of 2011, with the participation of 113 second year undergraduate students of the Early Childhood Education Department of the University of Western Macedonia, in Greece. The activity took place within the context of the "Informatics' applications in Education" course and the duration was 8 weeks (between April and June). The students randomly formed three equally populated groups. To increase the randomness and split real-life friends into different groups, the instructor circulated three pieces of paper in class. He asked the students to

enlist their names, without explaining what the lists were for. He also requested that the three lists were circulated together, so that three students sitting next to each other would write their names on different lists. Consequently, real-life friends who usually sat together, as observed by the instructor, where separated during the collaborative tasks.

All three groups were assigned the exact same collaborative task. They were asked to function as an editorial board in order to create a book for the course syllabus. They had to decide upon the content of the book and its arrangement, while justifying their choices as well, not only for the material they decided to include, but also for the material they chose to omit. They had to decide what a novice, regarding Information & Communication Technologies (ICTs), Kindergarten teacher should read in order to understand the corresponding terminology and start using ICTs in his/her class. The material had to be organized in a way so that the target audience would be able to understand fundamental aspects of informatics, without going deep into technical information. Being novice users themselves, they were asked to provide their perspective on how such a book should be structured in order to make sense to similar types of ICT users. They were not required to write the actual book, but to provide an extensive and justified set of book contents, with chapters and their abstracts. Also they were asked to provide the resources they used while making their decisions. Throughout the semester significant issues related to the course syllabus were raised, during the lectures, thus providing hints on what the book should contain. In the end they were obliged to select one or more group members to present their "book" to the whole class.

No additional instructions were provided regarding the collaboration process. The groups had to initiate collaboration and proceed in any way they wanted to, in order to reach consensus. It was up to the group members to decide if they would work as equal peers, select leaders, spilt work and assign it to smaller sub-groups, etc. The only differentiation among them was the collaboration medium; Group A had to use a Blog, Group B a Wiki and Group C an Asynchronous Discussion Forum. Regarding the technological platforms, the Wordpress system was used by Group A, Mediawiki was used by Group B and the Discussion Interaction Analysis System (DIAS) system (Bratitsis & Dimitracopoulou, 2010) was used by Group C.

During the final presentations' session, a 4-section questionnaire was used. About 70% (73 students) of the total population were present at the time and filled in the questionnaires which aimed at recording the students' perspective on their collaboration and the product they submitted. Section A of the questionnaire was filled at the beginning of the session in order to capture the unbiased perspectives of the students. Then, the three groups proceeded with their presentations, followed by a short discussion with questions and comments by the students only (the lecturer was only coordinating). Afterwards, the students were asked to fill in Section B of the questionnaire. This section aimed at provoking students' reflection upon the tools they used, the way they used them and forced them to compare their tool with the other two and think about how they would function, both as individuals and as groups, if they were to use one of them. This reflective session led to the completion of Section C. Finally, a set of diagrams was presented to the students, depicting quantitative and qualitative aspects of their individual and group performance. All the diagrams were Interaction Analysis (IA) Indicators produced by the DIAS system (Bratitsis, 2007). For Groups A and B, data from the Blog and the Wiki were transferred in the DIAS system using XSLT transformation. The final section (D) of the questionnaire contained questions related to the diagrams and the possibility of them facilitating evaluation of the collaboration by the students and/or the instructor and was filled at the end of the session. The questionnaire is further explained in the next section.

Table 1. Number of students from each group who filled the questionnaires

Web 2.0 tool	Participated in the activity	Answered the questionnaire
Group A (Blog)	35	22
Group B (Wiki)	34	24
Group C (Forum)	34	27
Total	113	73

Research Methodology

As aforementioned, a questionnaire was the main research instrument. It was divided into four sections (A, B, C and D), as explained in the previous section. About 65% (73 students) of the total population were present at the time and filled in the questionnaires which aimed at recording the students' perspective on their collaboration and the product they submitted. Each section occupied one page. Table 1 shows the distribution of the students participated in both, the activity and the research.

Section A of the questionnaire included 12 questions which aimed at examining what the students' perspective and understanding of their collaboration, as well as their groups' performance and well-being. There were several types of questions. For example the questions: "*how many members of your group were active?*" "*Did you undertake any discrete role in your group?*", "*How many discrete roles were there in your group?*", requested a direct, numerical answer. Questions such as "*how active were the members of your group?*", "*evaluate the collaboration process within your group*", "*Are you satisfied with your performance within the role?*", "*where there discrete roles in your group?*", incorporated a 5-grade Likert scale for the answers. Finally, questions such as "*describe the collaboration process within your group*", "*describe the most significant positive an negative aspect of your group's functionality*", "*which discrete roles were there in your group?*", "*What would you change on an individual and group level?*", were open questions, which required literal types of answers in a free text format. Overall, this section aimed at recording if the students were able to understand and describe the collaboration process within their group as a whole, while understanding their positioning within the group collaboration scheme at the same time. This section of the questionnaire was filled at the beginning of the session in order to capture the unbiased perspectives of the students. The scope of this section was driven by the literature review which clearly indicates that students participating in online collaborative activities face significant difficulties in understanding complex aspects of collaboration, elaborating social queues and uploaded information, as well as assimilating tasks in order to improve their participation, both qualitatively and quantitatively (Dimitracopoulou, 2008; Bratitsis, 2007). The aim is to record the students' perception of the collaboration of their groups, as well as their estimation of their placement within the group activity.

Section B included 8 questions related to the collaboration platforms. The students were asked to evaluate their communication medium and compare it to the other two in matters of usability, collaboration and discussion facilitation. Their evaluation of the two CMC tools which they didn't use was based on the presentation of the corresponding group, as they were obliged to include a description of the collaboration procedure within the group and the utilization of their tool. This section aimed at provoking students' reflection upon the tools they used, the way they used them and forced them to compare their tool with the other two and think about how they would function, both as individuals and as groups, if they were to use one of them. Questions of this section were, for example: "*How do you*

evaluate the functionality of your tool?", *"How do you evaluate the functionality of the other tools?"*, *"How did your tool affect (positively and negatively) your functioning as a team?"*, *"Which do you think is the most important positive and negative characteristic and why?"*. Almost all of the questions were open-ended, except the ones which addressed a direct question, such as *"Would you had rather participated in another group?"*.

Section C included 6 questions related to the students' performance as individuals and as groups. They were asked *"did you find your participation satisfactory?"*, *"did you find your participation satisfactory in correlation to the others' participation?"*. A 5-grade Likert scale was used for the answers. Also, they were asked to, *"to describe their criteria of evaluating their performance and that of the others"*, by ranking 5 possible answers. The latter were : a) quantity of contributions, b) contributions' content, c) participation in organizational issues, d) fulfillment of independent tasks, and e) no criteria. A 6th option was available, namely "other", in which the students could provide any possible answer they wanted to, which was not included in the provided list. Finally, using open-ended questions, the were asked *"if they were able to quantify their collaborators' activity"*, *"how important are the qualitative over the quantitative criteria"*, etc. This part of the questionnaire aimed at recording the students' perception of their activity and that of their collaborators, correlated with the overall performance and well-being of their group. These questions constituted a separate section, as they were to be answered after Section B, which aimed and provoking the students' thinking, leading them to a reflective process. The aim was to force them to reconsider their actions and behavior, having acquired information from all three groups and discussed in class with their classmates, thus receiving differentiated perspectives.

Finally, Section D of the questionnaire contained questions related to the diagrams and the possibility of them facilitating evaluation of the collaboration by the students and/or the instructor. They were asked if *"they considered the indicators helpful for group organization and functionality"*, *"if they considered the indicators to be transparent and easy to understand"*, *"if they would like to have the indicators available during the collaboration"*, and *"if they thought that the indicators could assist the teacher to evaluate their performance and that of their collaborators"*. A 5-grade Likert scale was used in this case. Also, they were asked to enlist the indicators they found more useful and important to be available during collaboration (open-ended question). Finally, having seen the indicators, they were asked again *"if they were satisfied by their participation and their behavior within their groups"*, *"if they would change their activity patterns if they knew that the instructor could review the indicators"*, and *"if they would act in the same manner if the indicators had been available during collaboration"*. In this case, a 5-grade Likert scale was used too.

Overall, the students were forced to evaluate themselves and their fellow students, while reflecting upon their perspective on what makes a good collaboration, while evaluating and becoming familiar with three widely used CMC tools.

Furthermore, the collaborative products and the students' behavior during the collaborative process, as well as the presentations' section was observed and evaluated by the instructor. The content of the CMC platforms was examined and correlated with the students' answers to the questionnaires. This paper presents a brief analysis of the questionnaires and further discusses the students' behavior. The core aim was to record the students' attitudes towards the three CMC tools, taking into account that they never had used any of them in the past. Their preferences on communication media, as well as the ways they used in order to overcome any possible problems are discussed, indicating the perspective of the novice user and a possible user model. Overall, this paper tries to raise issues for better designing similar collaborative activities, by considering the novice end users' perspectives.

Findings

Overall, Group A produced 290 posts and comments in the Blog, Group B created 23 articles and a total of 130 web pages through 937 edits in the Wiki and Group C wrote 676 messages in the Discussion Forum, divided in 13 topics. As stated in the previous section, 73 out of 110 students attended the presentations' session, thus filling the questionnaires. Except from a few students who were excused, the rest had extremely low or no participation at all during the collaborative activity, so the collected answers represent almost all the active population. The students who answered the questionnaires were almost equally distributed to the three groups, thus the answers are comparable.

Questionnaire - Section A

The initial set of questions aimed at investigating if the students could understand the group activity and project their own activity within the group. Question No 1 requested that the students estimated how many (number) of their group-mates were active and how much (a 5-grade scale was provided). Overall, 16 distinct values for the number of active participants were provided, varying from 5 to 35. The distinct values per group can be seen in Table 1. The mean values were 14.68 (SD 5.86) for Group A, 19.63 (SD 6.59) for Group B and 21.67 (SD 7.43) for Group C. Examining the actual data, the correct values were 22, 28 and 27 accordingly, indicating that the students' estimation was erroneous (Table 2). Moreover, the SD values and the number of distinct values indicate that there is no norm in the students' estimations, but they rather guess, based on the "feeling" they had from the overall performance of their groups.

Regarding the estimation of their group-mates' activity, there were too many combinations in the answers. Some provided an answer for the whole group while others attempted to group their collaborators' activity using characterizations. For example: "5 - very active", "10 - inactive", "6 - moderately active", etc. Consequently, the students seem to have an increased difficulty in understanding the participation extend and activity within their group as a total, but also in distinguishing the variety of participation patterns among their collaborators.

Also, the students were asked to describe how their group organized their collaboration and all the intermediate steps and milestones until the completion of their task. Interestingly enough, 85% of the students (62 of 73 in all three groups) described the process, exactly as their representatives did during their presentations. The instructor noticed that this was actually an active discussion topic among the students on their way to the final meeting, when entering the classroom. Thus, it is difficult to distinguish if the answers actually depict their own perspective or if they are a result of the pre-class discussions. Of course, it is possible that the students followed the description appearing in the presentations, understanding that they could not come up with an answer on their own. In any case, the claim that they face difficulties in understanding the group activity is strengthened.

Table 2. Students' estimation of the group activity

	Group A	Group B	Group C
Mean Value	14.68	19.63	21.67
SD	5.86	6.59	7.43
Actual Value	22	28	27
Distinct values	7	9	10

Table 3. Students' evaluation of the collaboration

Collaboration	Positive aspect	Negative aspect
85% positive	Managed to collaborate (80%)	Participation (32.3%)
		Poor collaboration (12.3%)
		Lack of democracy (12.3%)

When asked to grade their collaboration with a 5-grade scale, 85% of the students (62 out of 73) used the positive grades (averaging to 5-excellent). This complies with their answers to the question "*what was the most significant positive aspect of your collaboration?*", in which 80% (59 of 73) of them stated that they were actually able to collaborate by distance and directly communicate with each other. It is important to mention that they had no prior experiences of working via computers in group assignments, especially with groups of these sizes (about 35 members each). On the other hand, the most negative aspects of their collaboration were the fact that not everybody participated (32.8% - 24 students), poor collaboration (12.3% - 9 students) and lack of democracy (12.3% - 9 students). The latter refers to their impression that a small sub-group made all the decisions and they felt that they were obliged to follow up on them, regardless of them concurring to these decisions or not. Also, these answers were costly related to Group B (wiki), in which the coordinators presented a more dynamic and strict personality. These answers (positive and negative aspects) are rather contradictory, thus enhancing the conclusion that the students experience difficulties in understanding the group activity, both quantitatively and qualitatively (Table 3).

The questions discussed at this point were examined for the whole population and not for every group separately, as the scope of the questions is to record the students' perception of online collaboration, having in mind that this was a new experience for them, regardless of the collaboration platform they used. The results comply with the literature (Dimitracopoulou, 2008). Moreover, when the students were asked "*what would they change on a group level*", half of them (50.68% - 37 students) replied "the collaboration and coordination process" and 15% (11 students) replied that they "would like to see more active participation by more students". Thus, a total of about 65% would like to see better collaboration, although they stated that they were happy with what they accomplished up to that point.

When asked if they held a distinct role within their groups, 76.7% (56 students) of the students answered yes and 23.3% (17 students) answered no. Most of them (79.45% - 58 students) stated that they nominated themselves for undertaking their role and the group agreed. Also, 89% (65 of the students) considered that they met the demands of their role, as they understood them. On the other hand, only 58.9% (43 students) stated that they wouldn't want to undertake another role. Consequently, a significant percentage of the students thought that their performance was satisfactory, but they would like to have contributed to the group on another level. Since most of the students stated that they volunteered for their roles, it becomes more evident that their understanding of the group activity is rather problematic.

Also, the students were asked to enumerate and describe the distinct roles within their groups. Although almost all of the students (93.15% - 68 students) admitted that there were such roles, most of them (80% - 59 students) recognized 2-4 roles (Word file preparing, Powerpoint file preparing, Presenters, Information contributors). Actually, there were more abstract roles within the groups, like group leaders, coordinators, editing teams and decision makers, but the students failed to recognize them (with minor exceptions). They considered

as a role the undertaking of a task that was visible and connected to a tangible artifact, such as the preparation of the final manuscript or the presentation.

Questionnaire - Section B

In Section B of the questionnaire, students were asked to evaluate the CMC tools. In the literature, most of the papers related to the educational use of CMC tools (see Section "Educational uses of CMC tools"), examine the collaboration processes, learning outcomes, learners' interactivity, design and implementation of collaborative strategies, etc, focusing on one CMC tool. There is not much comparative work on several CMC tools (e.g. Kim, 2008), used for the exact same purpose. In this study, the CMC tool is the main variable. When asked to grade the functionality of their assigned tool, most of the students (95.89% - 70 students) replied that it was very easy, easy or not difficult to use. The term functionality in this question referred to the set of functions provided by the tool and how easy it was for the students to utilize them and collaborate. The students perceived this question as related to ease of use.

Closely examining their replies, per group (Table 4), an interesting observation is that the Wiki was the tool that most students claimed to have adapted to, very fast. The fact is that the most difficult function to learn in the MediaWiki environment is how to create new pages. Other than that, the users simply login and write. With this in mind, the aforementioned claim is not very unexpected. Summing up the numbers of the two columns on the right in Table 4, the conclusion is that students found the Wiki and the Forum equally easy to work with (70.68% and 77.77% respectively). Regarding the Blog, the occurrence "*I adapted fast*" is similar to the one of the Forum. In these cases, the fact that the threaded form of the comments of a blog post and the asynchronous discussions are similar, along with the use of a form in order to create a new post, can explain the similar numbers. On the other hand, the Forum clearly was found "*easy to use*" (22.22% as opposed to 4% for the other two tools). This can be explained by the threaded form of the asynchronous discussions which makes it easy for a user to follow dialogues, as explained further bellow.

An interesting observation is that a significant percentage of Group A members (40.9% - 9 students) claim to have faced some difficulties with the Blog environment. The number seems quite big, having in mind that contemporary internet users are more familiar with blogs and blog like information presentation. A possible explanation is the fact that only up to 10 posts partially appear per page and the user has to "open" a post in order to see the complete content and the corresponding comments. This was perceived as a drawback, making it difficult for the students to follow up on dialogues, as explained further bellow.

Regarding the CMC tools of the other groups, 70% (32/46) of the students found the Discussion Forum and 71.73% (33/46) found the Blog easy. Regarding the Wiki, 57.14% (28/49) of the students found it to be rather difficult and 22.4% (11/49) easy to use. It is obvious that the students' perception on the tool functionality changes when they are required to use it. Thus, the wiki users worked easily with it and the other students considered it to be difficult to use.

Table 4. Students' evaluation of their assigned CMC tools' functionality

Web 2.0 tool	"Minor difficulties"	"I adapted fast"	"It was easy"
Blog	40.9% (9/22)	50% (11/22)	4.5% (1/22)
Wiki	25% (6/24)	66.67% (16/24)	4.1% (1/24)
Forum	18.5% (5/27)	55.55% (15/27)	22.22% (6/27)

Table 5. Students' evaluation of their assigned CMC tools' effect on the collaboration

Web 2.0 tool	Group A	Group B	Group C	Total
Blog	8	5	16	29
Wiki	12	13	9	34
Forum	12	6	21	39

Also, students were asked "*what was the effect of the technological tool on the group's collaboration*". Most of them (42 students, 8-GroupA, 13-GroupB, 21 GroupC) replied that their assigned tool had a positive effect on their collaboration, whereas similar percentages were recorded in total when the students expressed their estimation for the tools of the other groups (46.15% Forum, 48.83% Wiki, 52.5% Blog). Closely examining the numbers (Table 5), reveals that actually blog users found the other tools better, whereas wiki and forum users found their tool to be better. In fact, wiki users found their tool much better that the others, whereas forum users find the blog almost as good as the forum. The latter can be explained by the threaded form of communication that both tools support.

Then the students were asked to describe the most important positive and negative aspect of the three CMC tools. For this question, the answers of all students are being considered. Regarding the Blog, the commenting facility which allows dialogic discussion was the most important positive aspect (35.6% - 26 students), followed by its usability (27.39% - 20 students). As aforementioned, most of the students are more familiar with blogs through their occasional use of internet, while reading information (e.g. news). Thus, the aspects, characterized as positive, are rather expected. On the other hand, the chronological order of the posts and consequently the organization of the discussions and dialogues were recognized as a negative aspect (32.87% - 24 students). Being influenced by the Discussion Forum, students mentioned that they wanted to organize their discussions in a more logical way, namely the threaded form which visualizes turn-taking within a dialogue-discussion.

Regarding the Wiki, the main positive aspect was that the students were able to directly manipulate the manuscript through the editing page (21.9% - 16 students), followed by the versioning (17.85%- 13 students) and the editing facility (16.43% - 12 students). The manuscript manipulation and the editing facility are differentiated, as the former refers to the students being able to directly work on the final product and the latter refers to the editing of their contributions in order to improve or correct them. The fact that they could create more than one page, thus allowing them to split into subgroups was recognized as an important facility as well (16.43% - 12 students). It is interesting that the first positive aspect was recognized as the most negative one too (61.64% - 45 students), as it was harder to distinguish each participant's contribution on the final product.

Finally, the separate topics facility was the most important positive aspect (58.9%- 43 srudents) of the Discussion Forum, allowing Group C to better organize their discussions and split into independent subgroups. Overall, the students seemed to prefer the discussion splitting of the Forum, the ease of use of the Blog and the fact that they didn't have to go through all the information exchange in order to produce the final manuscript in the Wiki. On the other hand, they found the Wiki to be more difficult to use and monitor (as the discussions are not actually visible), the Blog harder when trying to produce the final manuscript (they had to go over all the posts and comments) and the Forum more difficult for handling collaboration. These answers, correlated with an in-class discussion, revealed that they preferred Blogs for information exchange, Wikis for producing collaborative texts and Forums for dialogues (Table 6).

Table 6. Students' overall evaluation of the CMC tools

	Collaboration	Positive aspect	Negative aspect
Advantage	Discussion handling Easy to use	Editing	Discussion splitting
Disadvantage	Summing up	More difficult	Handling collaboration

Some other interesting observations were also made. For example, Group B did not use the discussion page on the Wiki system. For each page (called *article* in a wiki), there is a discussion tab/page in which the collaborating actors can discuss upon the article content are reach consensus. Instead, they wrote at the bottom of each article page and annotated their texts with their name and a timestamp. This way they created a chat-like communication queue within each article, which they deleted after completing the negotiations. For example they wrote:

> "*John – Wednesday 10:30 am: I think that we should split this article into two subsections*"

An important issue for the students, in all groups, was that they wanted to know who made each contribution. As CMC tool users, their account names were created by combining their initials and their registration number at the university. For example a username looked like *tb2534*. This way, it was not obvious who was the student assigned with such a username, although it was done in purpose, in order to have some anonymity on the contributions and reduce phenomena like friends collaborating intensively and independently from the rest of the group. Nevertheless, the students sought to acquire this information by asking each other during the activity. Also, this seems to be a factor that influenced the wiki users in providing positive claims for the system's functionality and the rest to provide reduced positive claims for their assigned tools. The account name appeared automatically in the blog and the forum post. The only way to overcome this was for the user to clearly write his/her name in the post content, which the students didn't think of doing.

Questionnaire - Section C

Section C of the questionnaire aimed at examining the understanding of the group activity by the students and the projection of their individual activity within the group performance. The corresponding questions were the same, regardless of the group membership. Most of the students were satisfied with their performance, both individually (84.93% - 62 student's) and compared with their collaborators (78.08% - 57 students). The following questions aimed at recording the criteria the students used in order to evaluate their participation and that of their collaborators. They had to prioritize: a) contribution quantity, b) contribution content, c) participation in organizational negotiations, d) completion of autonomous tasks, e) I used no criteria, and f) Other. None of the students included choices e and f in their priority lists. The results can be seen in Tables 7 and 8.

Table 7. Criteria order for evaluating personal performance

	1st place	2nd place	3rd place	4th place
Contribution Quantity	0%	38%	50%	17%
Contribution content	10%	33%	32%	20%
Organizational negotiations	30%	21%	13%	36%
Autonomous tasks	50%	8%	4%	27%

Table 8. Criteria order for evaluating collaborators' performance

	1st place	2nd place	3rd place	4th place
Contribution Quantity	20%	36%	36%	19%
Contribution content	10%	33%	36%	19%
Organizational negotiations	30%	23%	22%	28%
Autonomous tasks	40%	8%	6%	34%

Interesting observations can be made. None of the students claimed to have used contribution quantity as a criterion for evaluating their individual performance, whereas 20% used it as the primary criterion (1st place) for evaluating their collaborators' performance. Equally interesting is the percent of the students who placed quantity as a criterion in the 3rd place for individual performance evaluation (50%). The completion of autonomous tasks is highly appreciated in both lists (50% and 40% respectively). In this case study, the students considered as autonomous tasks the creation of the PPT file for the final presentation, the conduction of the presentation, the creation of the word file deliverable, etc. An explanation for the high numbers for this criterion is that when carrying out such tasks, it is easy to stand out among a group and present activity that can be considered as significant. On the other hand, this approach neglects the fact that the person who conducted the final presentation may have not contributed at all to the production of the material, whereas several students who might have worked intensively and effectively towards meeting the activity goals do not stand out equally. It is obvious that the performance of the latter could be considered as better, as their contributions are fundamental for the success of the group, whereas a slightly better or worse presentation does not affect group success as much.

The students considered the quality of participation as the most important evaluation factor (82.2% - 60 students), overall. It was interesting to see that the rest (17.8% - 13 students) considered both quantity and quality as equally significant factors of evaluation. None of the students considered only quantity of the contributions as the crucial factor, although 20% (15 students) indicated this as the most significant criterion for evaluating their collaborators' performance (Table 8).

When asked to describe criteria that they considered to be qualitative or quantitative, they failed to do so in either case, although some insight of what constitutes a criterion was provided in the previous questions (Tables 7 and 8). They all wrote nothing to answer this question, expect 2-3 students. For example, one student considered the amount and size of contributions as quantitative criteria. For her, qualitative criteria were: a) initiation of communication queues/discussions, b) the content of the contributions, c) comments and changes to already formulated proposals, and d) participation in the organization process of the group collaboration. Furthermore, half of the students claimed to be unable to quantify their collaborators contribution, when asked. This complies with the results in Section A of the questionnaire, in which the students were asked to estimate how many of their collaborators were active and how much. The variety of answers indicated that they were unable to quantify their collaborators' activity. An interesting observation is that although they easily provided numbers in Section A (e.g. 7 members were very active, 10 were completely inactive, etc), they answered no to the last question in Section C, "*Can you quantify the participation of the others?*".
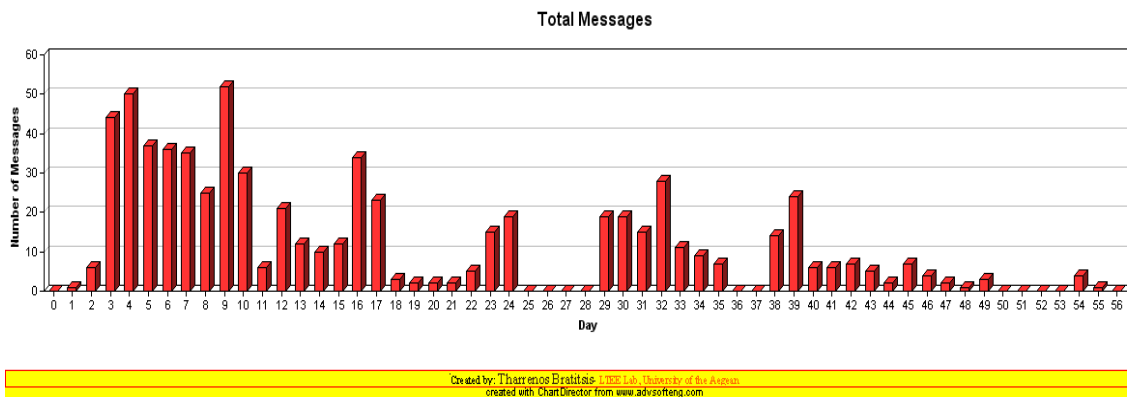
Total Messages

Figure 1. Total messages indicator
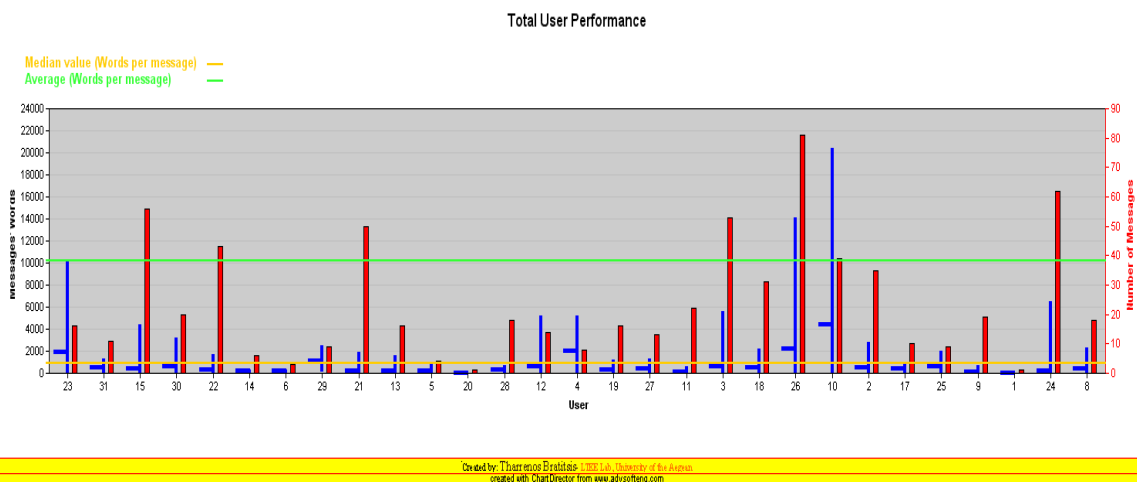
Total User Performance

Figure 2. Total user performance indicator

Questionnaire - Section D

Before completing Section D, they were introduced to Interaction Analysis indicators, some of which visualized qualitative aspects of collaboration. Detailed information on these indicators can be found in (Bratitsis, 2007; Bratitsis & Dimitracopoulou 2008; 2010). For facilitating the reader, two indicative examples are shown in Figures 1 and 2. The bar-chart in Figure 1 shows the number of messages posted in the discussion forum per day. Many variations of this indicator can be produced, for different time frames and different topics. The chart in Figure 2 presents 2 bars (blue and red) for each forum participant. The blue bar shows the largest and the smallest message in matters of words, as well as the mean number of words per message (horizontal blue line segment). The red bar shows the number of messages by the corresponding user. Also, the chart shows the average and mean values (words per message) for the whole discussion forum. Thus, this chart provides a quick overview of the students' performance within the communication based activity, in correlation to each other and the overall performance. It can be considered as a qualitative indicator, by providing insights of the students' activity patterns.

For this section, the answers provided by all the students are considered, as they are not directly related to the communication medium. The majority of the students admitted that the indicators were transparent and easy to understand (93.15% - 68 students). Almost 2 out of 3 (64.38% - 47 students) claimed that the indicators could assist the groups in better organizing their task and collaboration, to their understanding. On the contrary, 23.82% (17 students) thought that the indicators would not facilitate the organizational part of the collaboration process. The percentages are similar (67.14% - 49 students and 23.82% - 17

students respectively) in respect to the groups' functionality and well-being. The conclusion is that the students found the indicators to be useful for them as individuals, but as groups too. When asked "*who should see the indicators*", the majority of the students considered the instructor (76.81% - 56 students) as the main addressee of the corresponding information. Almost 1/3 of the students (34.24% - 25 students) thought that also the students should be able to see the indicators, during the collaborative process, whereas an additional 16.43% (12 students) asserted that some of the collaborators, based on their distinct roles, should be able to see some of the indicators. Summing up, about half of the students thought that they should be able to see the indicators.

Almost all the students were positive that the indicators would assist the instructor in properly evaluating their performance as individuals and as groups, as well as to assess the collaboration process and the "functionality «of the groups. Imprinting this attitude, the students were asked if they still were satisfied with their performance and behavior. Most of them (83.56% - 61 students) provided positive answers. Regarding their behavior within their group, the positive answers were almost identical (83.56% - 61 students). In the question "*If you knew that the instructor can review the indicators would your behavior be the same?*", 60.27% (44 students) of the students provided affirmative and 24.65% (18 students) negative answers. Regarding the latter, most of them (80.82% - 59 students) stated that in this case they would be more active. Furthermore, in the question "*If you could see the indicators during the collaborative activity, would your behavior be the same?*", 58.9% (43 students) provided affirmative and 21.91% (16 students) negative answers. In this case, almost all the students (94.52% - 69 students) who claimed that they would act differently stated that they would be more active. The answers are similar for these two sets of questions.

A contradictory observation was that although all the students claimed, in Section C, that the qualitative aspects are more important in collaboration, most of them preferred to have quantitative indicators available during the collaborative process, especially those that visualize individual performance (e.g. number of messages/postings per day). Also, in the final question "what would you do differently if you and/or the instructor could see the Indicators", almost all of the students who answered stated that they would be more active, quantitatively (participate and write more).

Discussion

This paper attempted to address the issue of the attitudes and problems of novice collaborating users via CMC tools. Most of these can be drawn by examining the users' ability to evaluate themselves and their collaborators. It is documented in the literature that often students have significant difficulties in understanding complex aspects of collaboration, elaborating social queues and uploaded information, as well as assimilating tasks in order to improve their participation, both qualitatively and quantitatively (Dimitracopoulou, 2008; Bratitsis, 2007). This is confirmed by the findings in the current research too. Indeed, students failed to distinguish roles within collaboration, by considering as such only those which lead to something tangible (e.g. a Word or a PowerPoint file), or those which can be undoubtedly recognized by the instructor, (e.g. the person who makes the final presentation). The majority of the students failed to recognize the information provider or a simple peer, as a legitimate role. Furthermore, students faced problems in understanding how their group-mates activity and how was their own participation and performance in comparison with the group's overall activity.

This project aimed at provoking students to reflect upon their activity and behavior through guided questions. Students were forced to consider their actions in order to better

understand the concept of collaboration, within a CSCL context. Overall the data indicates that this approach can be very useful, as students were introduced to aspects they obviously never considered. Nevertheless, more work is needed, as it was obvious that their misconceptions were not corrected through the project. Students did not use the proper criteria for evaluating individual and group performance and participation. Moreover they could not distinguish roles and tasks within the overall collaboration. Although they came to realize that this was a problem, they failed to realize what the proper evaluation criteria should be and exactly what undertaking a role means, within a collaborative activity, especially a non-structured one. Similar research projects should focus on finding ways of facilitating the understanding of such concepts by students, thus improving and enhancing collaboration, at extend. For example, collaboration scripting approaches may need to focus more on distinguishing goals and providing distinctive milestones for the students, thus enhancing their sense of completing a task and meeting the requirements of a specific role, rather than structuring the collaboration process in a step sequence matter or in a more abstract level.

On the other hand, it was obvious that although totally inexperienced, all the active students managed to adapt to the CMC platform they were assigned to and collaborate. One way or another, they found ways of overcoming technical and other issues among themselves. For example, the wiki users simulated a chat in order to contextualize their communication. Also, all the technical issues were resolved totally within the groups. Thus, the concrete conclusion is that students will find ways to collaborate through Web 2.0 technologies, regardless of how correct and precise the collaborative process will be. Approaches, such as scripting collaboration or utilizing IA indicators may facilitate collaboration. Nevertheless, more work seems to be necessary in building the proper "collaborative culture" among the students. What this study confirmed and highlighted is the type of misconceptions that the students have and the difficulties they face when using Web 2.0 CMC tools. Also, the study provided evidence of how novice users manage to overcome problems when asked to collaborate, although their initial perception of the matter makes them feel overwhelmed.

Also, when evaluating CMC tools, students preferred Blogs slightly more, mainly because they were more familiar to them. On the other hand, their evaluations indicate that they preferred different tools for different tasks. It became obvious they liked the Blog's usability and discussion facilitation, but found it to be very difficult in summing up a communication cue. They liked the topic separation in the Discussion Forum and the dialogic visualization of the threaded discussions, but found it more difficult to understand as a concept. Finally, the fact that all the information is on one page in the Wiki, was considered both an advantage (for collaborative text construction) and a disadvantage (regarding communication).

Another significant finding of this study is the students' perception of the CMC tools' functionality. As stated through Section B of the questionnaire, the students found the Wiki to be more difficult to use and monitor (as the discussions are not actually visible), the Blog harder when trying to produce the final manuscript (they had to go over all the posts and comments) and the Forum more difficult for handling collaboration. These answers, correlated with an in-class discussion, revealed that they preferred Blogs for information exchange, Wikis for producing collaborative texts and Forums for dialogues. This information is significant for instructional design, as end user satisfaction within a structured activity is important for maintaining one's motivation. The latter is fundamental to increased and refined participation, thus increasing the prerequisites for a successful collaborative activity.

Concluding, proper initial training of the novice users seem to be necessary. This training should focus mainly on building the proper culture. Of course, the ongoing research on approaches that facilitate collaboration and support end users is equally significant. In this vein, supporting the end user's satisfaction through the collaborative process and creating a sense of happiness is significant. This study provides valuable information towards this goal, by highlighting aspects of users' satisfaction elements, which need to be addressed properly when designing collaborative learning activities.

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