

Assessing Virtual Collaborative Environment performance mediated by web-based conversational mechanisms

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ABSTRACT

The aim of this Work in Progress (WiP) is to assess the effect of using chat and thread discussion on effectiveness of collaboration through Web-Based Collaborative Environments (WBCEs), particularly platform wikis.

In order to prove that, this WiP will describe the experiment with four different scenarios that will be conducted in the following days. Each scenario is formed by 16 groups of three random students from Technical studies at the ETSEIAT, an UPC Engineering School, particularly candidates from Industrial and Aerospace Engineering. Some of the groups will work in face-to-face basis (control group) and the others will use the WBCEs. The groups that are using the WBCEs scenario will be using whether the wiki platform only or the wiki platform integrated with an online communication tool (chat or forum). In the last three scenarios, each member will have one computer and the communication among the members of the group will be made through the assigned WBCE. These groups have to deliver the final team collaboration report through the wiki space. On the other hand, the Face-to-Face group has to deliver the final collaboration report in a paper format.

We expect that this WiP would bring up new insights on WBCEs effectiveness. We expect that the groupware performance will improve by means of the online communication tools, because they promote social interaction, discussion and collaboration in online environments. However, we are dealing with students that are “*technology based learners*” and a preliminary results conducted in a pre-pilot experiment show that some of our assumptions differ from what we expected.



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Keywords

Wiki; Web-Based Collaborative Environment (WBCE); Computer-Supported Collaborative Learning (CSCL); online communication tools; effectiveness of collaboration.

1. INTRODUCTION

A new generation of web-based collaborative tools such as social networking sites, blogs, wikis, etc. has increased in popularity, availability, and performance in recent years. These web services are commonly referred in the Web2.0 technologies literature. Term officially coined by O'Reilly Media in 2007 [1]. The author emphasize that web-based tools facilitate a more socially connected web where everyone is able to communicate, participate, collaborate and add to and edit the information space [2, 3, 4]. We are going to refer to these tools as Web-Based Collaborative Environments (WBCEs) that allow asynchronous and synchronous Distributed Learning Groups (DLGs).

Particularly, this WiP is focused on wikis - simple websites that anyone can edit-, which we include in the WBCEs. Wiki enables groups to jointly coordinate their effort to solve, create and share content for ad-hoc problems [5] with decentralized knowledge sources [6]. This platform can house large and up-to-date knowledge repositories [7] and enhance the creation and transmission of knowledge among users by means of dynamic interactions [8].

Currently, an increasingly interest is growing in web-based environments for collaboration. For instance, the Information System (IS) community is paying considerable attention on how these new Web2.0 technologies can change business practices [9] and create new internal participation architecture at businesses [10]. However, there is a poor knowledge about the online communication tools (i.e. instant messaging) effectiveness on collaboration through WBCEs. According to previous [7,8] results, “*wikis should include some form of discussion board or instant messaging to make communication accessible and come to a consensus on a topic*”. Additionally, [11] since the authors said “*the lack of discussions tools within the wiki tool seemed to be another factor that hindered collaboration*”.

In sum, according to these authors, an additional web-based communication tool will be necessary to allow task coordination to distribute the group tasks. However, [12] said that Web2.0 technologies are changing the way students: learn and create new ideas; share and communicate their knowledge and findings; and, interact and collaborate among them. The preliminary results of our pre-pilot show results according to that author, as can be seen

in the result section. Students using wiki platform as unique WBCE and using wiki platform integrated with chat tool have similar performance results.

But a broad framework has yet to be developed identifying whether the best combination of web-based tools or not could help us to increase the groupware performance in WBCEs with a time constraint and defined goals. This context could be extrapolated in teaching workrooms and organizations.

Our WiP develops as follows. Firstly, we present the previous factors that influence the effectiveness on Virtual Learning Environments (VLEs). Secondly, we present the methodology we use to design the conducted experiment by explaining the context of the experiment and its description. Thirdly, we describe the variables used to collect the data through two questionnaires. Fourthly, we explain the preliminary results extracted by the pilot experiment conducted and what types of changes that make from the original experiment design. Finally, we briefly sum up our experiment design and highlight the expected results. Also, we point out the limitations of our work.

2. Factor of effectiveness on VLEs

Drawing on previous research in technology-mediated education an initial factors of effectiveness on Virtual Learning Environments (VLEs) are provided [13]. These determinants come from human and design dimensions.

The human dimension is related to social interactions. Factors like group size, group composition, nature of task, among others influence the effectiveness of collaborative learning. It is reinforced when is applied to ill-structure or complex task, because these situations increase the effectiveness of social construction of knowledge [14, 15]. Regarding on the design dimension is related to the group structure that encourages elaboration, questioning and rehearsal.

According to [16], three approaches result in group members socially interacting: 1) cognitive by including describing, explaining, predicting, arguing, critiquing, evaluating, explaining and defining within the group learning tasks; 2) direct by using specific collaborative techniques that structure a task specific learning activity; and 3) conceptual by applying a set of conditions (positive interdependence, enhanced interaction, individual accountability, interpersonal and small-group skills and group processing) to stimulate/stress collaboration.

Additionally, according to [17], there are four key factor of participation in Web 2.0 platform: trust (trust is referred to interpersonal trust that promote knowledge sharing in the aforementioned context: benevolence and competence [18]), history (history is referred to the organization inertia imposed by previous experience), outcomes expectations (outcomes expectations is referred to the expected consequences of one's own behaviour [19]) and organizational or management support (organization or management support is referred to provide the necessary training and reward participation). The former three are related to the social interactions while the last one is related to the group structure.

These previous detected factors drive us to think about a number of variables that assess these two dimensions. These dimensions are seen as individual patterns of behaviour (human dimension)

and a group performance by means of WBCEs (design dimension). On one hand, referring to human dimension eleven variables are considered: introversion, extroversion, teamwork, flexibility, experience with technology, experience with e-collaborative tools, self-monitoring, power, self-esteem, need to belong and community exchange orientation. On the other hand, referring to design variables eight variables are considered: partner's previous knowledge, preliminary group perception on results, team coordination effectiveness, team collaboration evaluation, web-based systems evaluation, activity complexity evaluation, group interpersonal skills and performance activity score.

3. METHODOLOGY

In order to achieve significant results, a large number of students will be involved (180 students). Currently, the pre-pilot experiment was conducted with 12 students (four groups of three students each). This pre-pilot attempts to test materials and evaluate procedures for the WBCEs activity design (wiki alone, wiki+email, wiki+thread discussion and wiki+chat). These preliminary results will help us to improve the number of online communication tools to use and the redefinition of the activity if it is necessary.

To conduct the pilot activity the following tasks have been designed:

- **Cooperative exercise design.** A two-part exercise has been developed. It has to be solved in groups of three students. The first part consists of the reconstruction of an original text about vacuum technology, which has been split into individual sentences randomly distributed among the three members of the group. After that, a 100 words summary of the text has also to be performed.
- **Personality survey design.** Mainly to evaluate participants social skills and attitudes in front of team work and collaborative work.
- **Activity evaluation survey.** Mainly to evaluate participants collaborative skills and attitudes in front of team work through WBCEs.
- **Reaction survey.** In order to get additional data to clarify the specific achieved results, that reaction survey helps us to evaluate both materials and procedures during the pre-pilot.
- **Performance evaluation rubric,** for an objective evaluation of the achieved results of each group and if the activity was well designed and which is the score performance in each group. The group performance will give an inside about which tool is not showing significance in our study.

Additionally, different materials to explain how does a wiki works and how to use each specific communication system were also developed in the form of educational videos. In this way, every student could see as many times as they want the different aspect of the activity.

The real experiment will be conducted with 180 students at the end of this month.

3.1 Experiment description

Our research question is to assess the effect of using online communication tools on effectiveness of collaboration through WBCEs (Web-Based Collaborative Environments), particularly platform wikis.

According to the previous question an experiment was designed and conducted in order to get valuable data around it.

3.1.1 Objectives

One main objective was set out at the definition phase of the experiment:

- Measuring the effectiveness of different communication tools (chat and thread discussion) in WBCEs, particularly wikis, to develop virtual work in groups.

In other words, the pre-pilot experiment is intended to measure the effect of using email, chat and thread discussion on the effectiveness of collaboration through wikis.

3.1.2 Preparation – Pre-pilot

To check and evaluate materials and procedures, a pre-pilot was conducted three weeks before the scheduled date for the formal experiment.

In this pre-pilot 12 students worked with the materials, forming four groups of three students each. Each group performed the two exercises (text reconstruction and summary) using one of the available tools:

- Wiki only tool (no communication besides wiki will be used).
- Wiki + email (considering that this is the most usual situation the students face every day when conducting a group task).
- Wiki + thread discussion (an alternative to email that allows a classification and categorization of discussions, producing in theory a better knowledge construction when working at an asynchronous mode).
- Wiki + chat (although a chat is less structured than a thread discussion, it is supposed that can produce better results in a synchronous activity as the one that has been designed).

Time schedule for this activity was:

- Initial presentation of the objectives of the activity and a brief presentation of the wiki and communication tools (around 30 minutes).
- Personality survey (10 minutes).
- Development of the two exercises (50 minutes).
- Activity survey (10 minutes).
- Reaction survey (10 minutes).
- Final, recorded group interview (20 minutes) in order to identify misunderstandings in any of the questions of the different surveys or in the exercises themselves.

A little more than two hours were used by this pre-pilot experiment. The students participating in it were economically rewarded and were students from a similar level than the students taking place in the final test (first year Engineering degree).

Three lecturers and two assistant students were in charge of the development and critical observation of this pre-pilot.

3.1.3 Pre-pilot validation – Test adaptation

After assessing the teamwork activity performance, having analyzed the different surveys and interviews and putting the observer observations altogether which were participating in the pre-pilot, some changes were decided to include before the final experiment in order to improve the performance of the achieved results. The main adopted changes were:

- Change some questions of the personality test that may lead to confusion when answering them.
- Include additional questions in the activity survey in order to take into consideration specific situations and problems detected at the pre-pilot level. Some other questions were included in order to let them explain the strategy they followed in arrange the group collaboration.
- Increase the level of difficulty of the first exercise. Initially this reconstruction exercise was based on a 13 sentences scientific text, randomly distributed in groups of 4 to 5 sentences to each student. At the final test 15 sentences were used (the initial 13 sentences plus 2 extra sentences that the group should discard). This increases the positive interdependencies, which is one of the key aspects of that kind of experiments.
- Eliminate one of the communication systems. After the evaluation and final interview it became clear that thread discussions and email can bring to very similar results and, eliminating one of the systems it would be possible to enhance the sample for each of the remaining communication systems. Additionally, email was not integrated into the wiki platform and this is one another factor that drive us to take that scenario out of our experiment.
- Include an additional observer in each face-to-face group (face-to-face groups will serve as control groups, in order to evaluate the performance in a traditional teamwork technique). The role for this observer is defined as taking the minutes of each face-to-face meeting, thus giving extra information when assessing the specific collaborative performance of each group.

These modifications were developed during the next days and prior to the test scheduled date.

3.1.4 The formal experiment

The experiment will be conducted by the end of May 2011 with all the students enrolled in the subject “Industrial Technologies” which is taught at the first year of the Industrial Engineering Degree.

A total of 180 students were split into 57 different groups:

- 16 groups working under the wiki only tool.

- 16 groups working under wiki + thread discussion.
- 16 groups working under wiki + chat.
- 9 groups working face-to-face.

So 144 students worked with WBCEs and 36 students worked under a traditional teamwork technique. Eight lecturers and three assistant students were acting as observers of the process.

At this time of the preparation of this paper, no numerical results are still available of this experiment, but by the oral presentation they already will be analyzed.

4. SURVEY DEFINITION

Two surveys have been implemented to help in the evaluation process of this experience:

- Personality survey.
- Activity survey.

The variables that have been measured at the personality survey are eleven: introversion, extroversion, teamwork, flexibility, experience with technology, experience with e-collaborative tools, self-monitoring, power, self-esteem, need to belong and community exchange orientation.

In total 76 specific questions were made at each personality survey to develop the previous factors. This survey was conducted just at the start of the activity, after a brief presentation on the exercise and the tools to be used.

The variables that have been measured at the activity survey are seven: partner's previous knowledge, preliminary group perception on results, team coordination effectiveness, team collaboration evaluation, web-based systems evaluation, activity complexity evaluation and group interpersonal skills.

In total 78 specific questions were made at each activity survey to develop the previous factors. This survey was conducted just at the end of the activity, after having solved the exercises.

Personality and activity variables, as well as, performance activity score will allow a better understanding of the effects of using chat and thread discussion on effectiveness of collaboration through WBCEs.

5. RESULTS

The performance of the exercise (scoring) will be measured through two different rubrics (one for each exercise). In the first one (to evaluate how close the reconstructed text to the original one is) four parameters will be identified:

- Number of sentences that match exactly in the exact order. It will be considered when groups of three or more sentences have been presented. One point will be given for each sentence performing like that.
- One extra point will be given for each group of at least three sentences in which there is only one change in the correct order of the sentences (for instance, if instead of identifying sentences 4, 5 and 6, the group identifies 4, 6 and 5, or other slight changes).

- Maximum number of sentences in one group of sentences that is well reconstructed. Two points if there are three sentences, three points if there are four sentences, four points if there are five sentences and six points if more than five sentences have been well reconstructed in a same group.
- Up to two additional points for each fake sentence that has been correctly identified.

For the second exercise (summarizing in no more than 100 words the previous text), 45 key words have been identified by one expert when analyzing the original reconstructed text. Assessing of this part will give one point for every two words in the summarized text that match any of the previous 45 key words. A penalty of one point will be applied for every two extra words in the summary surpassing the figure of 100.

Preliminary evaluation of the performance results of the pre-pilot show that using these evaluation rubrics, maximum scores of 30 were achieved and also the minimum score was 8. However, one group per online communication tool isn't enough to get specific results and pre-pilot activities will only serve as a test of materials and procedures, not as performance indicators.

When defining the formal experiment, it was thought that face-to-face groups (control groups) and wiki + chat groups will achieve similar performance results. Similarly it was thought that email and thread discussion would achieve lower performances than previous ones but similar between them. It was also thought that the wiki without additional online communication tools would deserve the worst results.

After the pre-pilot it became clear that email, as the most popular communication tool, would be less useful in a synchronous experiment that the one being described and, for this reason, was discarded.

Final evaluation of the factors identified in the personality and activity surveys will show if those factors are real dependent variables for the online communication tool effectiveness on collaboration on WBCEs. It is expected that significant differences will occur in the evaluation of the performances of the group activity using the different online communication tools and it would be relatively easy to identify which of the previous factors have a relatively low incidence in the overall performance of the group, as well as, the effectiveness of online communication tools in collaborative environments.

It is also expected that some of the factors may lead to controversial results (for instance, groups performing good (or bad) results and having very different perception in one or more factors). In this case further research would be necessary to clearly include or exclude such factors into the performance evaluation of the group's results.

It is also expected that some of the factors will clearly correlate, thus giving insights on their incidence in the global performance of the group, as well as, the level of effectiveness of the wiki + online communication tools being used.

6. CONCLUSIONS

In order to prove the expected results, two questionnaires have been conducted at the beginning and at the end of the experiment

to each student individually to test their personality and their web-based collaborative work performance perception. In order to encourage group performance this activity will be assessed as a relevant part of one Industrial Engineering subject. In sum, the expected results attempt to: 1) bring up new insights about WBCEs effectiveness; and 2) show which of the environment (with or without communication tools) brings a better effectiveness of collaboration through wikis in terms of collaboration. We have to consider, according to [20], that there are different approaches to the meaning of "*collaborative learning*". It has been studied from different points of view such as the number of subjects considered or the duration of the study. In our case the experiment matches with those described in bibliography.

Other indirect conclusions will be the recommendation to design specific activities to better understand the incidence of some of the factors that during this experiment have not been clearly categorized in the global group performance.

At this moment of the study it is unclear if a quantitative measurement of the communication performance will be possible. This is due to the fact that some groups faced initial problems when starting the activity (lack of knowledge of the tool or difficulties when filling in the personality survey that caused a delay in the starting point of the group exercises). A deep analysis of the results will indicate if this situation exists and, in this case, future development of more accurate experiments should be performed.

It would also be a further activity the need to increase the number of online communication tools being used. Webconferencing is one of the candidates that are under study at our school as far as an ever-growing demand of use of such technology has been detected in recent years.

The activity that has been developed and explained in this paper is a synchronous one (solving two medium complex exercises in a session of two hours in real time). It would be necessary to check if more complex activities or extended in time activities would lead to different conclusions.

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