Implementation of Online Collaborative Learning using Wiki

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ABSTRACT

Online Collaborative Learning is a powerful tool to help students acquire professional competences that will help them throughout their lives. This paper presents the results found at the first stage of the project of the same name: Online Collaborative Learning using Wiki. In this phase one hundred forty eight (148) students participated, with a diversity of majors and in different years of their undergraduate studies. Results show that in general there is a positive perception of the wiki activities during this academic term, additionally results revealed opportunities of improvement in the implementation of Wiki in the courses. Compared to other research carried out on single courses, this study is done on several courses (11) of the School of Engineering, with students with majors from every School on the university: Management and Medicine.

Keywords: Wiki, Collaborative Learning, Engineering Education

RESUMEN

El aprendizaje colaborativo en línea es una herramienta poderosa para ayudar a los estudiantes a adquirir competencias profesionales que les ayudará el resto de su vida. Este artículo muestra los resultados encontrados en la primera parte del projecto del mismo nombre: Aprendizaje Colaborativo en Línea Usando Wiki. En esta fase ciento cuarenta y ocho (148) estudiantes participaron, estos pertenecen a diferentes carreras y están cursando diferente año de sus carreras de pregrado. Los resultados muestran que en general hay una percepción positiva de las actividades del wiki durante este período académico. Adicionalmente los resultados revelan oportunidades de mejora en la implementación del wiki en las clases. Comparado como otras investigaciones similares que fueron desarrolladas en un solo curso, este projecto fue desarrollado en varios cursos (11) de la Facultad de Ingeniería, con estudiantes de carreras de todas las facultades de la universidad, incluyendo las Facultades de Administración y Medicina.

Palabras claves: Wiki, Aprendizaje Colaborativo, Educación de Ingeniería

1. INTRODUCTION

Michael Wesh presented in 2007 a video (Wesh, 2007) where he proposes several characteristics about the XXI Century student, in there students claimed to: be multitasking, be inherently collaborative, like to work online, and work asynchronously. This video arouse the question on whether our students in Honduras really present these characteristics, and if so how would be the best way to take advantage of these features to enhance the learning outcomes of the students. Research has shown that students have changed the way that they learn, and that they do so faster than the teachers adapt to these changes. This is furthermore supported by (Prensky, 2001) where it is stated that current generation of undergraduate students, are digital natives, thus they should easily get involved in online activities. Therefore this study would show if this is also our reality, if so the institution would have evidence to support the need to update the way that we teach, and if this is not our reality, the institution would have to further research on how to push the students to have these abilities needed to compete in the global market.

To be able to answer these issues the first step is to decide what is the most suitable method and technology that would enable a way to measure how much students adhere to Wesh pattern. For this purpose it was decided that implementing wiki in the classroom would give this study exactly what is needed. A wiki is a Web 2.0 space where many people can collaborate by adding, removing and editting content on it (Richardson, 2006). So using this technology we ensure that students will have a way to collaborate online in an asynchronous way.

The paper will describe the implemenatation process during the first quarter of 2013 in the Universidad Tecnologica Centroamericana (UNITEC), in addition the current qualitative results will be shared. After this introduction this paper is organized as follows: the background information will be presented where some details will be given about online collaborative learning, and wiki platform. Then the methodology used in this study will show the steps that have been done so far in this study, afterwards the current findings will be shared in the results sections. The paper finishes with the conclusions and future work.

2. BACKGROUND

In this section three issues will be presented, first a review on the importance of collaborative learning is exposed, followed by a brief presentation of the Wiki technology. Finally some previous research on the use of wiki will be discussed.

2.1 Collaborative Learning
This is the process where students are grouped together to carry out an activity that will produce a specified goal or product (Dooly, 2008). Collaborative learning has been found to be essential for the development of curricula independently of the subject area, as constructivist theory states, meaningful learning is achieved through: active learning, social interaction, and construction of knowledge (Bruner, 1990; Fink, 2003; Jonassen, Howland, Marra, & Crismond, 2007). Needless to say that collaborative learning heavily relies on the social interaction of the participants, providing a space where they can discuss and interact, granting themselves an additional level of mental abstraction that enforces the understanding of concepts. This social interaction, allows learning to actually happen, by suplying the students the opportunity to exercise, verify, solidify and improve their mental models through sharing of information and active discussion (O'Loughlin, 1992). Opposed to collaboration, individual work is found, where students working on their own will find difficulty to succeed, since collaboration is integral to their formation process (Lombardi, 2007), this becomes more true in the current globalized world. It is clear that individual work is still a useful kind of activity, however collaborative activities provide a richer experience for the students.

It is appropriate to mention the difference between collaborative activities and cooperative activities, where collaborative forces all involved parties to actively participate in the discussion, cooperative just splits the work, to be merged in a final phase. The merge process is merely the concatenation of the individual contributions. It should be clear that cooperative activities do not provide the advantages of collaborative ones. For instance collaborative activities bring an increased involvement of the student, enhances critical thought, promotes problem solving abilities, and encourages students to learn and achieve (Raman & Ryan, 2004).

In addition to collaborative learning, current technology allows for Online Collaborative Learning (OCL), where the participants can collaborate without the need to physically meet. OCL is particulary useful as a tool for distance education programs, where students are able to work and collaborate using online tools, thus providing an asynchronous way to work. Synchronous and asynchronous activities vary in the way that the response in the discourse is given. In synchronous communication, the response is immediate, as opposed to the asynchronous when the partipants respond in different times. (Ellis, 2001) found that only 33% of the students in her study found asynchronous activities to be disadvantageous, and that by using OCL tools an additional characteristic is met, where there is a permanency of the contributions of the students, as these contributions remain registered online. This permited the students further analysis and reflection with more time, than would have been possible in a synchronous activity, this is reflected in the study since 81% of the students expressed preference for this medium. Asynchronous activities are favorable since participants can contribute to the activities in their own time,

as long they remain within the stablished parameters of the activity, in addition to the time liberty it provides, online activities provide space freedom, where the student can participate from anyplace as long as it has an adequate internet connection. The nature of OCL is a reflection on the current trend of the world, where more work is being distributed among different geographical regions. Therefore applying activities using OCL, even in "sit in" courses, has come to be essential in the formation of new professionals, as it gives the student the ability to collaborate and to work on an online environment. These competences are becoming more and more important in the world today and in the world to come.

2.2 Wiki Technology

A wiki is a system that allows one or more people to construct a corpus of knowledge in an interlinked set of pages, using a process of creation and edition of web pages (Franklin & Harmelen, 2007). Some of the characteristics of a wiki are: a wiki does not require any add-ons on the browser, it promotes the association of concepts between different pages, creation and edition of pages is relatively easy, it is intended to involve visitors in the contribution and revision of content (Leuf & Cunningham, 2001).

The intrinsic characteristics of a wiki make it one suitable choice to implement OCL activities. Participants have, through the wiki, the opportunity to create documents related to their course, and to do so in a collaborative manner. Wiki allows students to become actively involved in the construction of their knowledge (Boulos, Maramba, & Wheeler, 2006), and by urging students to write for their academic activities, it improves their writing skills and their co-writing processes (Chao & Parker, 2007). In addition to helping students enhance their writing abilities, it also forces collaborative writing that wil transform the individual work of a student to a new dimension hreth social cognitive level I involved, thus enhancing the learning outcome of th participants.

There are several wiki services available, they can be classify according to features, ease of use, support and cost (West & West, 2009). One possible approach to select a wiki service is based on cost, where the implementation of the wiki must not represent an additional cost to the academic unit. When this is the case, usually the downside is that there would be less features and support would be limited. However, if there are people with the required technical skills, there is one service that would be perfect for implementation: MediaWiki (http://www.mediawiki.org). MediWiki is highly customizable, thanks to this characteristic the wiki site can be enriched with several third person extensions. Despite these advantages, MediaWiki requires that the institution implementing it to have a dedicated server, and at least one person with the expertise to install it, configure it and customize it for the specific needs of the institution.

To be fair, Wiki is not the solution for every OCL activity, some may adapt better to blogs, or to forums (West & West, 2009). Wiki presents clear advantages: the responsibility is redistributed between participants, it allows a dynamic organization of the group work, where collaboration can vary along various stages of the development of the activity, wiki stores a history of the revisions and permits to have a mechanism to do the discussions, the history and contribution of the participants can be traced. One major disadvantage of wiki is the difficulty it presents at assessment time, this happens due to the lack of automatic functions to extract information about the contribution of all participants in a way that is easy to digest for the evaluator (Trentin, 2008).

2.3 Previous Research

Successful application of wiki in OCL is in dispute according to the reviewed literature, some authors argue that students find wiki too complicated (Cole, 2009), while other express that the use of wiki actually improves learning in a class (Ben-Zvi, 2007), and the use of other online technology like podcasts is actually enjoyed by students (Lee, Chan, & McLoughlin, 2006).

Findings by (Cole, 2009) show that the perception of the student of online educational tools differs to their perception of other systems they employ for personal use. This difference in perception discourages the adoption of wikis. This is enforced by the experience in the classroom where more than 80% of the students that did not

use the wiki had one of the following reasons: confused about wiki, takes too much time, did not have any interest. On the other side (Ben-Zvi, 2007) had an outstanding success in the application of OCL using wiki in the course of Statistics, improving the learning outcomes of the students.

To achieve positive results both in perception from the students as in academic growth most studies agree that academic scaffolding needs to be properly in place, in such way that students receive all needed support during the wiki activities. Additionally wiki is not immune to be an academic activity, with the additional feature of usually being a new activity for the students; as such it requires additional effort on behalf of the teacher to motivate them accordingly (Hadjerrouit, 2012).

3. METHODS

To implement the wiki several steps were taken. In each of the next subsections these steps will be described.

3.1 Selection of Wiki

After reviewing the summary presented by (West & West, 2009), MediaWiki was selected for the development of the implementation of OCL. It is fortunate that in the project there is a person that can manage the server and update it if necessary, additionally we have access to a server with public access in the internet, and this grants all the necessities for the implementation of an in-house wiki server.

The wiki server is enriched with the extensions shown in Table 1.

Table 1: Extensions used in the Wiki Server

Extension	Description	Motivation
VideoFlash	These extensions help wiki editors to add video to the wiki page. The online video sites that can be used for this purpose are: Youtube, Google Video, DailyMotion, Vimeo, Sevenload, Revver, MetaCafe, Blip, Globo Videos	To have the ability to add videos to the developing page, this way it is expected that pages will be more alive and that students will be motivated to read and contribute to their wiki.
Math	The purpose of this extension is to add the functionality of mathematical formula writing in latex. By adding this extension wiki editors can now write formulas that "behind the scenes" are rendered to graphic format, this way the wiki obtains a better and more professional look and feel.	The wiki site is being used in math and math related courses. (See section 3.3 for a list of participating courses)
Cite	Adds the ability to cite in the text, and then generates the list of references in the position that the wiki editor desires. It works similarly to the reference tool in MS Word.	It is important that students acquire the ability to cite their references in their work. By correctly citing students recognize the source of their information.
SyntaxHighlight_GeSHi	It serves to highlight programming source code, it has the ability to recognize several languages, C++, C, Java, PHP, among others.	Since there are several computer science courses involved in this study, it is essential to have a way to highlight code in such a way to improve the readability of it.
Semantic MediaWiki	It is built to aid users to search, organize, tag, browse, evaluate, and share the content. Usually searching in wiki sites involves text-only queries, using semantic mediawiki users are allowed to add	Originally this extension was believed to be an aid for assessment, since it was similar to another one called

	semantic annotations to their wikis, thus enhancing the search power.	SemanticHistory. Currently this extension has not been exploited.

The current installation of MediaWiki has the following characteristics and specifications:
- MediaWiki version 1.19.2
- Ubuntu Server Edition 11.10

3.2 Induction to Teachers and Students

Once the installation of the server, the MediaWiki software and its required complements and extensions was done, the next step was to induce voluntary teachers in the use of wiki. For this purpose two 90 minutes sessions were prepared, where the pedagogical issues were presented to the teachers, and then a quick "how-to" was discussed in a "hands-on" workshop. In this first phase of the study only teachers from the School of Engineering participated in the implementation of wiki in their courses.

At the final stage of the induction workshop for teachers, there was a discussion on the type of activities that could be done using this technology. From this discussion there was found the following kind of activities:
- Exercise solution, students are presented with problems and groups of up to five students are assigned specific problems to be solved collaboratively on the wiki.
- Content Development, students are assigned topics on the course content, and then they research these topics and create a summary of their research on the wiki. This method of application is applied course-wide, in other words all student in the class collaborate in the development.
- Research Project Documentation, students do research on an additional topic of the course (not inside the official course contents).
- Project Development, the teacher assigns a project an integrative project to the students, and then they collaboratively develop the project showing the different stages of solution.
- Homework Solving, students are assigned homework and they solve it on the wiki in a collaborative manner, this can be done in small groups or course-wide group. The distinction with Exercise Solution is that the latter usually refers to mathematical exercise solution, where steps and justification must be shown.

Table 2: Courses Involved in Project Pilot

Course Name	Activity Kind	Year the course is usually taken
Sensors and Actuators	Content development	Senior
Thermodynamics	Research Project Documentation	Sophomore
Computer Networks	Research Project Documentation	Sophomore
Basic Mathematics	Exercise solution	Freshmen
Introduction to Algebra	Exercise solution	Freshmen
Environmental Engineering	Content Development	Senior
Ecology	Project Development	Freshmen
Differential Equations	Exercise solution	Junior
Engineering Statistics I, II	Project Development	Junior
File Structures	Content development, homework solving	Sophomore
C++ Programming	Homework solving	Freshmen

3.3 Implementation on Courses

Table 2 shows the courses involved in this stage of the study, eleven courses, covering students of every year in their studies, and covering courses with as few as six students and as much as forty students, students that ranged from a wide variety of majors. Additionally the table shows how the activities were implemented in each of the courses.

3.4 Assessment

This issue presented a real challenge. A rubric was created for this end; the rubric had different dimensions to allow for a comprehensive assessment of the activities done by the students. These dimensions included:
- Collective Assessment
  - Content, this verifies the accuracy of the content written by the students.
  - Presentation, assesses that the wiki page or pages have a professional and consistent presentation.
  - Collaboration, measures if every member of the group participated. Helps to motivate leadership.
  - Organization, checks that the content is logically organized.
  - Use of References, checks if the wiki text uses references in the appropriate format.
  - Language, verify the correct usage of language, by checking orthography and grammar.
- Individual Assessment
  - Consistency of Participation, this measure how consistent and constant was the participation of the student during the period of the activity.
  - Contribution, checks the student is making actual contributions to the assignment and not just minor revisions.

Current version of MediaWiki does not have an extension to permit for automatic mining of information to provide teachers with useful data to assess using the aforementioned indicators, this is further supported with research done by (Trentin, 2008), where he expresses that assessment is a time consuming activity and no tools are provided for automatic assessment. For these reasons the assessment currently does not use all dimensions effectively. Further interviews to the teachers will reveal their actual assessment tool needs.

3.5 Evaluation of the Wiki Activity

At the end of the academic period, ten week term in UNITEC, and evaluation instrument was given to all students participating in the project; this instrument included seventeen questions using the Likert scale, in addition to two open questions, and demographic information about the student. A summary of the results of this survey are presented in the next section.

4. CURRENT RESULTS

In this section some of the results are presented that showed how the wiki has performed during this phase. Table 3 shows a description of the figures representing the histograms that show the results of some of the questions in the survey instrument. One hundred and forty eight (148) students participated in this study.

Table 3: Summary of Histogram Results

| Figure	Question	Remarks
Figure 1:	Wiki activities helped my learning in this course	Approximately 45% of the students agreed to this statement, showing that they show a positive perception to the wiki.
Figure 2:	We need more help using the wiki	Students expressed that they do need more help, this is consistent with some of the open question comments, where they claim that they would like more in class support for the wiki activities.
Figure 3:	I worked on the wiki during all weeks of the course	There is no agreement for this statement, this is relatively in accordance to the observation of teachers that students tended to procrastinate their wiki activities.
Figure 4:	I worked in teams to do the wiki activities	65% agreed or completely agreed to this statement, thus exhibiting that some sort of collaboration took place.
Figure 5:	I met physically with my teammates to do my wiki assignments	On the other hand, students did not take advantage of the online nature of the wiki, since they agreed to this statement.
Figure 6:	I like to work online on my academic activities	Around 55% of the students manifested that they like to work online.
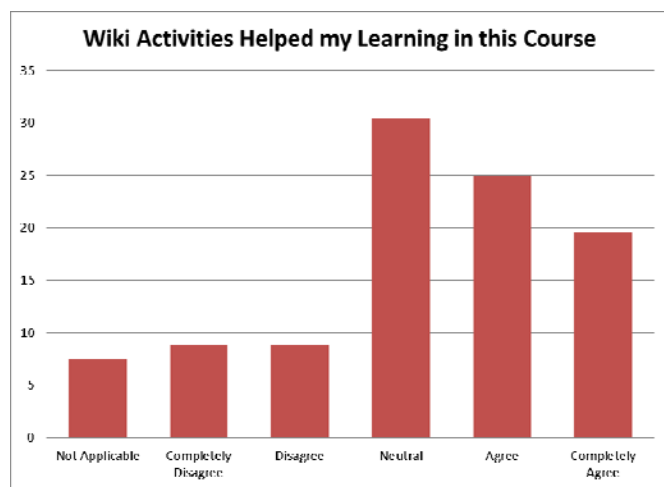
Figure 1: Question 1
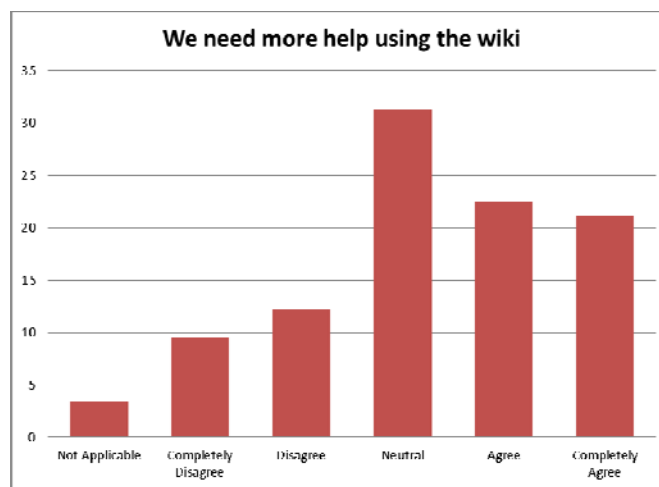
Figure 2: Question 4
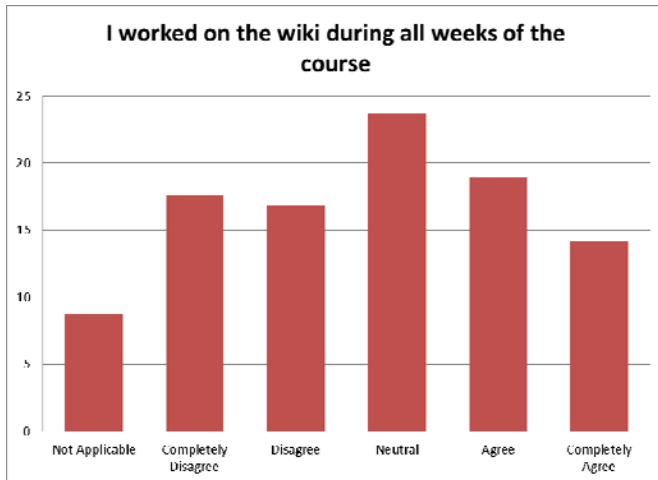
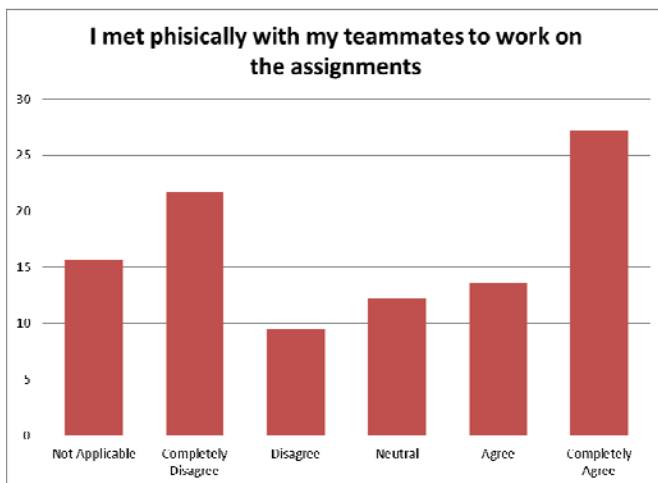**Figure 3: Question 5**
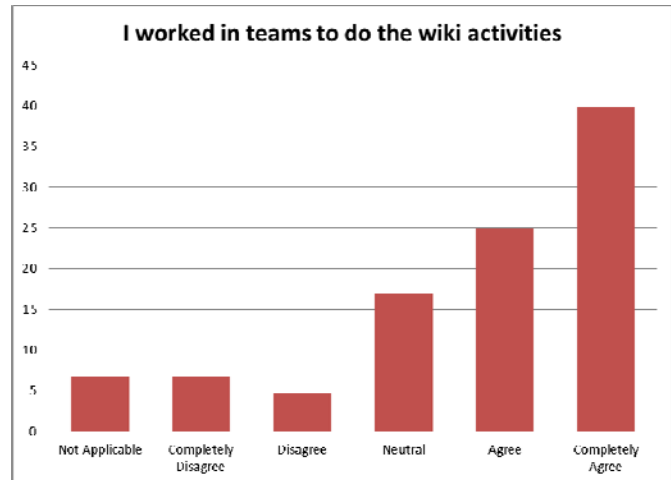
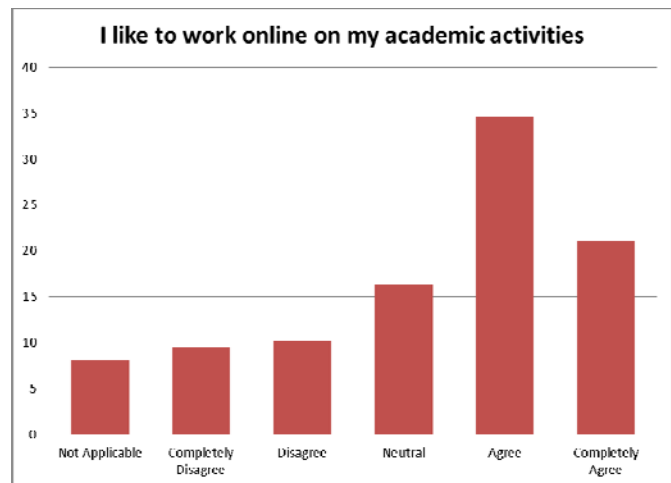**Figure 4: Question 7**

Figure 5: Question 9

Figure 6: Question 16

Cross tabulation of the Likert scale questions with the student major and the course where the wiki was used revealed that some of the answers are correlated with the major or the course. This can be seen in Figure 7, a Venn diagram that shows what questions are correlated with major and course. For instance Q9: I met physically with my teammates to work on the assignments, is correlated with major, checking closer the results it is found that non-technical majors do not tend to use the online advantage of the wiki, but rather like to physically meet to work on their assignments. Another result is that questions correlate more with the course taken than with the actual major, this may show a relation between the actual teacher and the attitude of the students, further research should enlighten this issue. This results were obtained using the p-value found applying a Chi-Square test on the data.
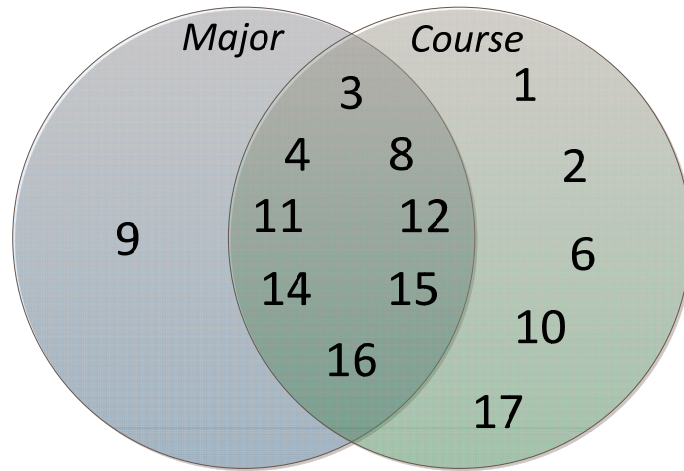
Figure 7: Venn Diagram of Correlated Questions with Major and Course Taken

Open question remarks presents another view of the perception of the students, 15% of the students wrote remarks on the "additional comments" and 25% wrote in the "recommendations for the future" question. On the additional comments there was a split perception where 34% of the students expressed themselves in a positive manner and 39% were negative in their remark, the rest provided neutral comments. Significant recommendations were that the teacher should have a closer supervision of the wiki activities and that the students would like to work on an activity on class time, basically to gain confidence in the system. Other comments revealed that some students did not understand the nature of the wiki activities, since they ask to avoid group work.

5. CONCLUSIONS

The most important conclusion found on this stage of the study is that the implementation of OCL using wiki needs to be pushed through, consistently in several courses, so that more and more students become familiar with the platform. In addition, all teachers agreed that motivation is key, it is of the upmost importance to keep motivating the students during the whole course term, this to help them achieve positive results in their learning outcome.

Our research has shown some consistency with previous research, for instance now it is proven that not because students love Facebook it means that they will love wiki or any other online learning tool (Cole, 2009). And by trying to provide the students with enough academic scaffolding better results can be acquired.

6. FUTURE WORK

During the next phase of the project it is planned to involve more courses, to develop a software online application to mine the history information of participants' contribution to the wiki. This tool will help teachers with the assessment of the activities developed on the wiki. Furthermore teachers' socialization of this results among the participating teachers will take place, and during this session teachers will be urged to encourage students about the importance of OCL in their education. It is planned to provide additional academic resources to the students, like videos and tutorials. Finally, the current survey will be updated to include questions to measure students overall motivation, internet facilities at home, and reasons for lack of participation.

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