

PRE-SERVICE TEACHERS IDEAS OF COLLABORATIVE WORK WHEN USING A WIKI TO CONSTRUCT A LAB NOTEBOOK

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Abstract

Due to the potential benefits of the wikis, they are increasingly gaining popularity in educational settings. In the educational context they have been used for various purposes such as managing research projects, publishing course materials and completing writing assignments. This type of Web 2.0 tool provides a number of useful functions, such as creation of content by multiple users, tracking history of users' actions, comparison between different editions and roll-back to earlier versions of the wiki, allowing teachers to monitor learners' co-authoring process. Because of these functions, wikis have been claimed as facilitators of collaborative writing, group discussion and interaction. However, wikis are not inherently collaborative.

After a brief review of the relevant literature on the importance of interaction in the learning process this communication presents some preliminary results on the use of wikis by pre-service elementary school teachers. The implementation of virtual lab notebooks hosted within a wiki environment in the scope of a course on biology is described. Students' perceptions regarding the implementation of the wiki are explored, namely its challenges and potential benefits. In order to achieve this goal, participants were asked to write a reflexive essay about their use of the wiki. A content analysis on this data followed. An additional goal is to understand the kind of interaction promoted by the wiki. For this purpose, the individual contributions to the wiki that occurred during the learning process were analyzed and categorized. Follow-up interviews were conducted to gain insight into students' decision-making process. The results are discussed in view of identifying factors that may lead to a more successful integration of the wikis in science lessons and to improve pre-service teachers' confidence in using Web 2.0 tools for pedagogical purposes.

Keywords: wiki, collaborative teaching & learning, lab notebook, students' interaction, pre-service teachers.

1 INTRODUCTION

Wiki is a web-based software that allows users to create and modify page content [1, 2] without the need of programming or HTML knowledge [3, 4]. This type of Web 2.0 tool commonly provides a number of useful functions, such as creation of content by multiple users, tracking history of users' actions, comparison between different editions and roll-back to earlier versions of the wiki [2]. Because of these features, "groups can collaboratively work on the content of the site without constantly emailing Word documents and tracking revisions from multiple authors who can't see each others' changes" [5]. Therefore, with this type of social software it is possible to create a community using a many-to-many communication mode [6].

Nowadays, different fields are adopting wikis for a great variety of applications depending on the kind of purpose of the group that utilizes it [1]. In educational settings, wikis are increasingly gaining popularity [2] and they have been used for various purposes such as managing research projects, publishing course materials and completing writing assignments [5]. To improve and increase collaboration are reasons referred for the adoption of this tool in educational settings.

It is important to highlight the difference between cooperation and collaboration. Although cooperation can be achieved by the division of work among participants, collaboration requires the "mutual engagement of participants in a coordinated effort" [7]. The "mutual engagement" is only accomplished through interaction and share among individuals.

A large body of research work has explored the introduction of wikis in educational settings. Students' and teachers' perceptions are one of the main areas of study. Positive perceptions about the value of wikis in fostering collaborative work have been documented in a number of studies [8, 9, 10].

Some other investigations utilize the records of user activity of the wiki to draw conclusions on the impact of this tool to foster the level of collaboration. Grant [2] found out that the creation of written content in a wiki, by secondary students, was an individual process. Students did not review each other's work because they did not perceived it as useful or desirable. Collaborative evidences were only present in terms of visual design and technical skills comments. Judd, Kennedy and Cropper also found similar results because although the wiki participation was high, "a relatively small proportion of students did the bulk of the work and many students' contributions were superficial" [11]. Similar results were found by Hadjerrouit [12] when analyzing a wiki application associated with 3 collaborative writing projects in a faculty of Technology and Science. In his opinion students cooperated rather than collaborated because they contributed to the wiki "mostly by adding and formatting content to existing pages, sometimes deleting small portions of the text, discussing superficially, or suggesting improvements to the technical design, rather than substantially changing, modifying, and critically reflecting on others writing" [12] and that the peer-review comments although valuable were "focused mostly on editing, formatting, and technical aspects" [12]. This investigation also indicates that the selected wiki did not facilitate discussion and collaboration since students "felt the need to engage in some form of synchronous communication to exchange their ideas and share their concerns" [12]. The importance of wikis technical features was also referred by Forte and Bruckman [13]. These authors, after studying the construction of science articles in a wiki, by two classes of high school science students, found "evidence that not only did cultural and institutional barriers stymie collaboration, but the design of the collaborative tool itself contributed to resistance among students and from the teacher" [13].

However, other empirical investigations reported more evidence of collaboration. For instance, Aharony [14], after studying the level and type of interaction that took place, between engineering students in the wiki comments section, concluded that they were essentially centred on content, revelling collaboration and deep levels of cognition among students. Nevertheless students did not change other students' work. So, the comments section was the only place where the contribution occurred. Meishar-Tal and Gorsky, after analyzing the construction of a wiki glossary of key course concepts by Israel graduate students, reported that modification of existing texts was done in a greater extent than previously reported [15].

Consequently research literature indicates that, although wikis have many technical features that can facilitate collaborative writing, group discussion and interaction, their educational use does not "dictate or impose any meaningful level of collaboration between users" [11]. Since wikis are not inherently collaborative, these studies reinforce that, apart from the technical features, pedagogical aspects need to be taken in consideration during the design and implementation of the wikis. Because "the use of wikis in education is still a relatively recent development, and the formal research literature on this subject is limited" [2], we believe that research on this subject is of utmost importance.

In the present communication we account for some preliminary results on the use of wikis by pre-service elementary school teachers. We state the methodological framework, describe the implementation of the wiki for collaboratively building a lab notebook, identify the sample and research instruments, and present and discuss the results of the analysis of student's perceptions and patterns of interaction. The research was conducted at a public higher education institution, in Lisbon, with students attending a course on biology in the last year of a 1st Cycle of studies (3 years, 180 ECTS) for pre-service elementary school teachers and kindergarten educators.

2 METHODOLOGY

We chose to use the wiki available at the learning management system (LMS) installed in the school (Moodle 2.1). This software allows the creation of new pages and the edition of other users' pages (word processing, insertion of images, creation of tables, etc) and also the possibility for students and professors to comment on all pages. It also has the history section where all versions are stored. Our choice of this particular wiki was based on the following features: a) all communication, within the course, is done using this LMS and students are expected to be well familiarized with it. Being an environment that students recognize we believed that this would help students to feel more confident; b) to enter the learning management system it is necessary a user authentication which is important to

assure the desired privacy; c) the wiki is simple to use. This wiki has no alert update options for the activity of users.

2.1 Wiki-based collaborative writing design and implementation

This strategy was implemented in all the six classes attending *The Living world* course, which comprises 141 students, divided into 63 groups. One of the classes, with 21 students and 10 groups, was randomly selected for this study.

The implementation strategy was fairly similar in all classes. In the first lesson, in order to explain the technical features of the wiki, the teacher simulated all the necessary steps to create the front page, new pages and hyperlinks. Other editing features were also discussed like insertion of images and modification of text properties. Additionally, there was a reference to the comments and history functionalities of the wiki. The teacher also encouraged students to explore the wiki editing facilities in a wiki that was built for that purpose. It was also created a forum to discuss eventual problems.

The class was then divided into groups of two or three elements based on students' preferences. The teacher has indicated the number, type and application date of the different tasks that students should report in the wiki (general characteristics of optical instruments commonly used in biology; image orientation obtained from the microscope, stereomicroscope and magnifying glass; observation of animal and vegetable cells; factors that influence the germination of seeds). In order to respect the individual style of each group, teachers did not make any kind of impositions on the wiki structure. The evaluation strategies were explained: after each application date, the teacher would comment on the work and based on those comments students were expected to reformulate it; the level of participation and reformulations would be taken into consideration for the assessment. After all these explanations the teacher asked students to choose between a private wiki for each group or a private wiki for each class in the laboratory sessions. Since the topics were the same for each group (except for one activity) they expressed many concerns about the possibility of seeing others' work. Because of that we chose to make it private, in other words, students did not have access to the wiki pages of other groups. Teachers organized password dependent small groups in the LMS in order for students to be able to work in their own group private wiki.

2.2 Data collection and analysis

At the beginning of the course a closed questionnaire was given to all students in order to diagnose their digital competence, namely their experience in social software, and their expectations towards using ICT tools.

At the end of the semester, after being graded in the course, students in all classes were asked to write a reflexive essay about their experience with the wiki. Students' perceptions of wiki as a lab notebook were studied using a qualitative content analysis on the data gathered by their reflections [16]. The analysis was done on the basis of both our aims (study of perceptions) and the text written by students. The context of the production of the essays was taken into account. Moreover we followed the 'fishing expedition' process [16].

Based on the wiki tracking system we gathered information about the interaction that took place between students. All the comments were extracted from the wiki with information about the author. An analysis of the distribution of comments and of its contents was done. Page versions were also analyzed. Since many versions were done by the same student during a short period of time, all the successive versions created within one hour were "collapsed" and treated as a single editing session. To assess the type of edition, successive page versions were compared. The answers to the questionnaire, the reflexive essays and the use of comments made by the selected class are evaluated.

In order to foster a better understanding of the results a focus group interview was carried out with one group of students from the class. The interview was sound recorded and transcribed.

3 RESULTS AND DISCUSSION

3.1 Questionnaire (students' previous experience and expectations)

Seventeen students (81% of class) responded to the questionnaire. Table 1 shows students' reported use of information and communication technologies (ICT) tools. Of the tools considered, internet browsing, research, preparation of presentations, text edition and live conversational tools were the technologies which the majority of students reported having used with great confidence. Conversely, more than 50% of the students do not know the following type of tools/software: visualization of models, semantic organization and construction of hypertext/hypermedia. In addition, 58.8% of the students do not know, or do not know how to use tools that allow the construction of collaborative pages, such as blogs or wikis.

Table 1 - Students' reported use of information and communication technologies tools.

	knows the tool/software				
	unaware of the tool/software	does not know how to use	uses with difficulty	uses with some confidence	uses with great confidence
Text edition	0.0	0.0	5.9	29.4	64.7
Spreadsheet	0.0	0.0	35.3	52.9	11.8
Statistical analysis	0.0	5.9	70.6	23.5	0.0
Drawing	5.9	11.8	23.5	47.1	11.8
Image processing	0.0	29.4	35.3	35.3	0.0
Preparation of presentations	0.0	0.0	0.0	23.5	76.5
Internet browsing	0.0	0.0	0.0	5.9	94.1
Search engines	5.9	0.0	0.0	11.8	82.4
Live conversational	0.0	0.0	11.8	23.5	64.7
Deferred conversational	5.9	5.9	23.5	35.3	29.4
Visualization of models	82.4	11.8	5.9	0.0	0.0
Semantic organization	64.7	23.5	11.8	0.0	0.0
Learning management system	5.9	0.0	35.3	52.9	5.9
Creating hypertext/hypermedia	52.9	23.5	11.8	11.8	0.0
Building collaborative pages	23.5	35.3	29.4	11.8	0.0
Realization of videos	47.1	23.5	11.8	17.6	0.0
Sharing photos, audio or video	29.4	29.4	17.6	11.8	11.8
Social networks	0.0	5.9	70.6	23.5	0.0

In order to evaluate students' expectations regarding the use of ICT for collaborative work within the course, they were asked to indicate their level of agreement or disagreement with seven statements (1- a totally disagree; 4- a totally agree). Fig. 1 displays students' mean scores for each item.

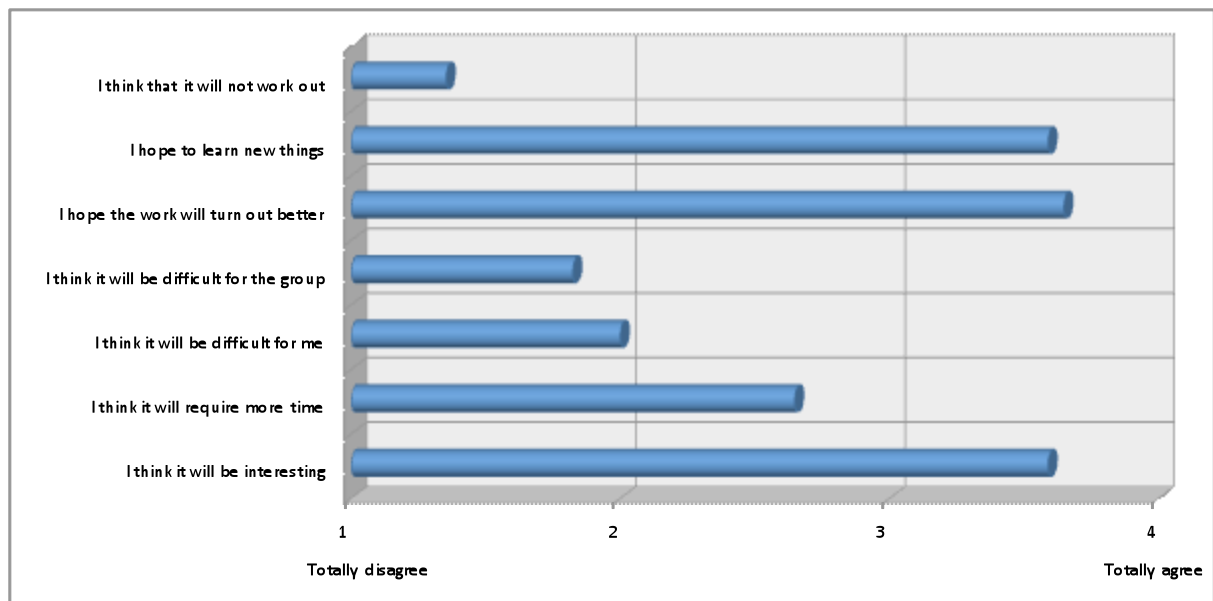


Figure 1- Students' mean scores about their expectations regarding the use of ICT for collaborative work in the course.

Fig. 1 shows that the students reported positive expectations, significantly agreeing with the positive statements and showing a trend of disagreement towards the negative statements. The introduction of these tools is significantly regarded by the students as an opportunity to learn new things and to improve the final product of their works as well as an interesting experience.

3.2 Students' perceptions

To analyze students' perceptions we made a content analysis on the essays that the students have written at the end of the semester. Our analysis is mainly qualitative, notwithstanding, as Bardin [16] said, that a qualitative analysis does not preclude some quantitative handling; but in doing that we have no other intention than to give an idea of global trends which could be somehow hidden in a textual description.

A set of categories emerged from the content analysis of the 13 (12 individual and one in group) essays produced. We sum up the categories obtained and examples of record units in Table 2 and in Table 3 respectively.

Three categories were defined in our procedure. For each one we address a negative, neutral and positive intention.

Table 2 - Categories resulting from content analysis of reflexive essays.

Categories	Perceptions			Sub-total
	Negative	Neutral	Positive	
Didactic	6	4	13	23
Practical	23	4	30	57
Learning	2	0	31	33

Table 3 - Examples of record units for each category.

Categories	Examples
Didactic	<i>may not be as easy to assess each student individually</i>
Practical	<i>Low cost in put materials [in wiki]</i>
Learning	<i>helps students to structure the work in a regular, methodic and continuous mode</i>

From the analysis we can see that the positive feelings and/or statements e.g. *bring multiple advantages* or *I consider that [the notebook] becomes an added value*, were far more common than the negative ones, e.g. *[as the work advanced] we came across some less positives situations*. Didactic category is expressed in the text both with a positive perception regarding a more up to date assessment, e.g. *get feedback on the work done without [the need of] physical presence or paper support* but, on the same theme, students also show some concerns, e.g. *the number of participations (...) in the notebook should not be distinguished in the information given by wiki records*.

On the other hand, the practical category is the most present perception in the texts. As expressed in Table 1 both positive, e.g. *there was no need to spend paper and ink in print documents* and negative statements, e.g. *placing photos [and] graphs is not practical*, are strongly present, although the positive perception carries a relevant advantage.

If we address the learning category, then we have a huge amount of positive perceptions, e.g. *get acquainted and use of new technologies*.

We think that the fact that students' perceptions about learning on a wiki environment had, in our analysis, such a high expression in the text is an interesting outcome of our research that we should investigate in a near future.

3.3 Teacher's and students' comments

A total of 48 comments were made in all the lab notebooks during the first three activities. However, the huge majority of them (83%) were posted by the teacher, especially after the task deadline. Analyzing teachers' comments made the following categorization emerge:

Table 4 - Categories and examples resulting from content analysis of teacher's comments.

Categories	Examples
Improvement suggestions	<i>Do you really think the table should be in the "procedure"?? I have many doubts about the image obtained in microscope present in the table – was that really observed???</i>
Congratulations	<i>Great job! You are clearly in the spirit of the book online!</i>
Deadline remarks	<i>We are already late! This entry should have been completed!!</i>

Eight comments were coded into the deadline category. Of those, 6 were done in the first activity (2 about the first draft deadline; 4 about reformulations deadlines) and only 2 in the second. For example, after the comments made to group number 1, on October 18th, no changes were visible until October 25th. Consequently the teacher wrote the following comment: "what about the reformulations? Where are they? The idea is to read my comments and to improve the lab notebook". On the third activity all the groups were respecting the schedule established and reformulation occurred without the necessity of teacher's promotion.

Moreover, the students' comments were always directed to the teacher. Some of them were student-teacher directed (2 comments), others were group-teacher directed (6 comments). The principal themes that emerged from those comments were:

Table 5 - Categories and examples resulting from content analysis of students' comments.

Categories	Examples
Apologize	<i>Hello teacher, we apologize but we have had quite a few busy weeks especially in other curricular units and that is why we did not yet made the reformulations.</i>
Ask for teacher advice/help	<i>By the way, we would ask the teacher to correct the "Labels" we used in the first activity.</i>
Inform teacher	<i>We have chosen to continue with the same numbers because we thought it would be interesting to do an index of all the images that we use in our notebook.</i>

In two of the comments posted, while informing the teacher about some technical problems, students showed real concerns about the assessment of collaboration:

"Hello teacher, our group has had some problems with the online notebook ... in this last entry it became red and asked for the creation of a new page. However, when we created it everything we had written was already there. As we did not know if the teacher would see it, we copied and pasted into a new page. I think now there is no problem, but it is just to give you knowledge that despite having only the name of E., the work was done together. Sincerely, E. "(group 9)

"well, the problem is that now, I am the only person that appears in the history (...) I don't want to cause no harm to my fellows (...)" (Group 7)

In conclusion, the comment feature was essentially used by the teacher and students did not use it to support the construction of the wiki. In part, the fact that our wiki did not provide email/or RSS alerts of activity, can explain this outcome. Additionally, informing students that the assessment would be done mainly upon the comments section may, somehow, have transmitted the idea that it was essentially a place for teacher-students communication instead of students-students communication. Interestingly, students have not used at all the forum created to discuss eventual problems, not even to ask for help in technical issues. All the communication done on line resumes to the comments analysed.

3.4 Page versions

Group number five comprised two students (A and B) and was one of the groups with the lower number of page versions (8 for the first activity; 4 for the second; and 3 for the third one) but equally divided between students. They have never used the comment section of the wiki.

In the first activity student A created the first page and introduced 566 words. After two days, B corrected two spelling errors and three days after added 595 words. Three days later A added a subtitle with 3 words and after 5 days introduced images. Then, the teacher made the following comments (quoting the notebook when needed and using a repeated question mark to induce the students to re-read and think about the text):

"From September 27 to" it is lacking the final date.

Images must be numbered and must be accompanied by a legend.

"We can still add that the magnifying glass has no resolution in its magnification." ???

"as the distance between the eye-object" what about the distance magnifying glass-object?

"Stereomicroscope - Similar to the above, just changing the light path: in this case, the light falls directly on the object" - the stereomicroscope can also have transmitted light.

Try to better organize the information.

"we noticed that the paper sheet was only visible with lens 4/0.1: we concluded that it was necessary to use a cover slip and a slide" ??? What do you mean by that?

In the images you should put the total magnification (and not only the magnification of the objective lens)

what about the records of observations with the stereomicroscope?

"And at the age of children, we integrate the instruments."??? Be careful... language must be clear and accurate

After teacher's comments A reorganized some ideas, corrected one spelling error and added legends to all the images. Then student B formatted the text. Although, some reorganization took place after the comments, all the reformulations were strictly in connection with the comments provided. This moment did not promote a re-overview of the text. Students' eyes only saw what teacher had pointed out.

In the second activity, A wrote 107 words and then B added 107 words. After that, A added images and 167 words and also modified one sentence. The formatting of images was done by B.

In the third activity, B started with 526 words and then A added more information and modified some sentences. The teacher made the following comment:

"in which the lesser the cell is the easier it is to trade with the outside world." - Lesser? Or smaller?

I think your observations of Elodea are a bit incomplete – you certainly saw more structures than just the chloroplasts

"Observations over Elodea" - the title is a little strange - observations over Elodea

Image 1 – wouldn't it be better to decrease slightly the picture???

"There are as we change the objective?"???

I believe you can still improve the notebook organization

After teachers' comments, B made one semantic modification, corrected a spelling error and expanded one idea. Even with the topic emphasized on the last sentence, students have not made any reformulation to accomplish this suggestion.

Wiki constructed by this group reflects a small and superficial interaction. During the wiki construction, simple addition of information was the main action. Moreover, text modifications were almost inexistent. Deeper reformulation of text only took place especially after teachers comments and only if they were very precise. During the interview, student A recognized that "I am lazy on that...; because reviewing things is tricky; and I put the information and is ready; so I went there more to add something of a lesson or something from another topic".

Our analysis reveals that the wiki construction was a cooperative work rather than collaborative. Indeed, the decreasing number of page versions during the three activities supports this interpretation. Like the students said in the interview, after the first activity "B - (...) we divided the activities a little better (...) Well, [in first activity] each added a bit of information; A- and I think it was a phase of exploration ...B - (...) and then we organized ourselves a bit better".

During the interview, when asked if their wiki reflected a team work the group mentioned that

"A - Reflects, I mean, I think that it reflected in our case, but that may not reflect in the circumstances in which can often be the same person entering the data in the wiki and was not she doing the work behind; B - I think it sometimes happened that was not the person who did the work but which sometimes add information in order to have participation in the wiki, because that count, who entered"

This answer is extremely interesting because it denotes the importance of assessment to improve students' participation. However it simultaneously brings up potential problems associated with evaluation of students' contributions.

4 CONCLUSIONS

Given that students are in the third year of a 1st cycle of studies and based on the reported use of ICT tools, we suspect that blogs and wikis may not have been incorporated in courses of the first and second year of this study programme. It is also important to note that some other tools, with great educational potentialities, like concept maps organizers, appear to be even less familiar to these pre-service teachers. This is in accordance with Costa's opinion [17], that ICT use is not being carefully accomplished by the institutions that are responsible for the initial training of teachers. However, initial preparation of teachers in this area is extremely important, not only for the teachers' professional development, but also to help them use these technologies with their pupils [17].

Our preliminary research indicates that the implementation of the wiki is, generally, regarded as positive. Students make reference to didactic, practical and learning positive aspects of the wikis. Students' positive perceptions about learning on a wiki environment have a high expression in their texts. We think that this fact is an interesting outcome of our research that we should investigate in a near future. Students identified both benefits and challenges posed by the use and implementation of wikis in their essays. Issues connected with the assessment were in the core of the challenges reported. However, negative aspects were also referred, especially practical ones. Some technical difficulties, such as uploading and formatting images, were reported. Nevertheless, similarly to the results of the study of Forte and Bruckman [13] at the end of the semester, students had resolved many of those issues. In some cases they arranged "intelligent" solutions in order to manage the image.

In our study the students were extremely worried about the assessment of the sharing of the tasks by the teacher because they did not want to cause any harm to their colleagues. It is possible that this concern promoted a more detailed division of the work to guarantee that all students had the some number of entries in the wiki. It was also reported that, in some cases, the history section did not reflect the work done by the students. These possibilities rose by students need to be addressed more carefully. Students' ideas about the meaning of collaboration may be an explanation for this behaviour.

Students regarded collaborative work mainly as a kind of work where the tasks are properly divided between them. So, although using the word collaborative the description made by the group interviewed agrees more with the definition of cooperation. Based on these results and in accordance with Hadjerrouit [18] we believe that a previous explanation about the difference between cooperation and collaboration may benefit students' achievement.

Another point to consider is the teacher's role during the wiki construction. The intermediate assessment provided good encouragement for participation in the wiki. Reformulations occurred with a higher frequency after teacher's comment, but indeed these comments did not promote a depth reformulation. Revision was essentially done using teachers' view and did not increment group reflection and understandings. Although teacher orientation is important it need to be perceived by students not as the "correct" or to be "done" but as aspects to re-think about it. Therefore, pedagogical considerations, about strategies to improve revision process, need to be taken accounted for during the wiki implementation. Other forms of assessment can be precious, namely self and peer assessment, because they foster interaction between the groups [12].

Summarizing, wiki implementation did not dictate a true collaboration between students, which is in accordance with the research literature. Probably one of the main reasons for this low collaboration relies in the lack of collaborative skills. In the future, it is quite important to explore pedagogical aspects that need to be present during wikis implementation in order to improve students' learning.

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