Wiki as a collaborative writing tool in teacher education: Evaluation and suggestions for effective use

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Abstract

Wiki technology provides new opportunities to foster collaborative writing in teacher education. To empirically evaluate the level of collaborative writing in a wiki-based environment, this article used three methods and their combination. The first method was the history function that records all students’ actions, enabling to trace all changes made in the wikis. The actions were analyzed in terms of number and percentage of contribution using a taxonomy categorized by 10 editorial types. The second method examined comments posted on the wiki discussion page to evaluate the level of collaboration. The third method provided feedback on the level of collaboration by means of peer assessment. The results show important differences in the types of contributions across the categories investigated. The results also reveal that the level of collaborative writing was lower than expected. Possible factors that may influence wiki-based collaborative writing are discussed. Finally, suggestions for effective use of wikis as collaborative writing tools in teacher education conclude the article.

1. Introduction

Wikis are seen as potentially powerful tools to foster collaborative writing. They provide opportunities for students to collaborate on joint assignments and group writing tasks. According to Parker and Chao (2007), wikis may serve various educational purposes, such as presenting class materials, keeping a log for knowledge, storing documentation for a research project, or supporting collaborative writing projects. The research literature provides many other examples of wikis in education (Caple & Bogle, 2013; Grant, 2009; Li & Zhu, 2013; Mak & Coniam, 2008; Tetard, Patokorpi, & Packalen, 2009; Thomas, King, & Minocha, 2009; Wichmann & Rummel, 2013). Whilst wiki use is becoming more and more common, its use in education is still under explored (Davidson, 2012). In addition, there is relatively little research on successful implementations of wikis supporting collaborative writing (Pifarré & Fisher, 2011). Research studies on wiki are mostly perception-based, such that it is not straightforward to determine who contributed to the wiki, how students collaborated, the extent to which they collaborated, and what types of activities were performed (Judd, Kennedy, & Cropper, 2010). Recently, a small but growing number of studies have drawn on the data log generated by the history function of wikis. This function enables retrieval of number and percentage of contribution from each student. The data log is considered as inherently more reliable than perception-based studies to explore collaborative writing activities. However, statistical data alone do not necessarily give a complete picture of students’ contributions to the wiki. Supplementary methods are needed to explore the level of collaborative writing. This work aims at investigating students’ collaborative writing activities in a wiki-based environment in teacher education. The activities were analyzed using three methods. First, the data log of the history function categorized by 10 editorial types of actions. Second, students’ comments posted on the wiki discussion page, and categorized by increased level of collaboration. Third, peer assessment to provide feedback to each other’s wiki, and highlight the level of collaboration. A cross-checking of the findings is then performed to find whether the methods produced similar results regarding the level of collaborative writing. This is followed by a discussion of possible factors that may influence wiki-based collaborative writing. Finally, suggestions for effective implementation of wikis as collaborative writing tools in teacher education conclude the article.

2. Theoretical background

2.1. Wiki technology

Wikis are considered as a type of Web 2.0 technology that enables users to work together on the Web. In terms of collaborative writing, wikis allow participants to create a collective document by editing, discussing, and sharing information about a topic of common interest (Chao & Lo, 2011; Peled, Bar-Shalom, &
Sharon, 2012; Wichmann & Rummel, 2013). Wikis have three major functions to facilitate collaborative writing:

(a) Editing function that supports multiple users to create and modify articles, texts, or documents. This function provides navigation for non-linear organization of the wiki.

(b) History function that records all edits, by means of color coding, allowing users to trace all revisions being made. The history log enables edits to be traced to the users, and helps the teacher to monitor and assess students’ progress.

(c) Discussion page that enables asynchronous written communication between users by providing explanations and posting comments on various issues related to the wiki.

The advantages provided by wikis enable teachers to evaluate the level of contribution of each student and groups of students by looking at the history log and creating statistics on the basis of a set of given criteria. Similarly, comments posted on the discussion page may be analyzed quantitatively and qualitatively to evaluate the extent to which students discussed issues related to collaborative writing. Among a plethora of wiki tools, MediaWiki was chosen as a platform for collaborative writing tasks. MediaWiki incorporates all functionalities described above. In addition, it is restricted to university members, making it appropriate for education (Kasemvillas & Olffman, 2009). MediaWiki uses a simplified HTML language and provides an extensive functionality for user authentication (Su & Beaumont, 2010). MediaWiki has a history log that keeps track of students’ edits by name, date, and color coding (Lund & Smedral, 2006). Using this function, it is possible to rollback to earlier versions of the wiki. MediaWiki also provides a discussion page that serves as a place for reflections for the wiki (Ibid).

2.2. Wiki-based collaborative writing

To examine the level of wiki-based collaborative writing in teacher education, it is important to distinguish between cooperation and collaboration. According to Witney and Smallbone (2011, p.102-103), cooperation is defined as an activity, “where participants divide the task among themselves and work independently”, whereas collaboration is an activity that enables participants to “coordinate their efforts to solve a problem or accomplish a task collectively”. Collaborative learning is then described as “the process of learning generated by small, interdependent groups of students (…), who work together as a team with shared problem solving” (Ibid, p. 103). In educational settings, collaborative learning involves collaborative writing, where “students produce a piece of text each by taking turns in contributing to the process of writing a join text” (Bradley, Lindström, Rystedt, & Vigno, 2010, p. 71). Collaborative writing consists of one or more participants clarifying, modifying, by editing, and/or revising the text of one or more participants (Witney & Smallbone, 2011).

Collaborative writing is underpinned by Vygotsky’s sociocultural learning theory (Kuteeva, 2011; Li, Chu, Kl, & Woo, 2012), which assumes that collaboration among participants can achieve more in terms of learning benefits than individuals. Particularly important for collaborative writing are language and social interactions, and the notion of Zone of Proximal Development (ZPD), defined as the “distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). Although ZPD originally refers to expert-novice or teacher-student interactions, it has been found that “students can reach high levels of performance than they might achieve by working on their own” (Li & Zhu, 2013, p. 2). Nevertheless, Mindel and Verma (2006) argued that the wiki model provides instructors with the ability to monitor students’ collaborations and group work. Hence, interactions between students and teacher are mutually supportive to reach the potential of ZPD.

While collaborative writing is not new in educational settings, wikis offer new opportunities to work in groups, and as such, they facilitate collaborative writing and group discussion (Lundin, 2008). Alterations and changes are made directly in the text being written. Argumentations and critical reflections accompanying the revisions may be made in the discussion page. Wiki-based collaborative writing is a coordinated activity that enables participants to edit and revise each other’s contributions to the wiki (Chao & Lo, 2011; Meishar-Tal & Gorsky, 2010; Trentin, 2008; Witney & Smallbone, 2011). Hence, wiki-based collaborative writing is opposed to work that simply consists of splitting up the task, work independently of each other, and then assemble individual contributions to a final wiki. Most of the work is performed individually, by creating wiki pages, or portions of wiki pages, and editing only these pages, without any interference with peers’ pages.

2.3. Taxonomy for categorizing students’ actions carried out on wikis

Students can make various contributions to a wiki: add new information, remove content, restructure existing content, or rephrase the meaning of sentences, etc. Until recently, there have not been methods that would help in categorizing these various wiki editing types. Recent studies, however, have provided guidance to classify activities performed on wikis. Pfeil, Zaphiris, and Ang (2006) used a taxonomy to categorize editorial types in Wikipedia, which was later adapted to wikis by Meishar-Tal and Gorsky (2010). The taxonomy used in this paper draws on this research, which originally included 13 categories, of which the following 10 were identified as important to assess collaborative writing (Table 1). Three categories were not considered in this work. The first category was “Vandalism”, because MediaWiki, unlike Wikipedia, is restricted to university users, and, therefore, there is almost no risk to demolish pages. The second category was “Mark-up Language” that may change the appearance of pages. This was not included, because the HTML code being used is simplified and does not impact the content. The last category was “Reversion”, that is the reversion of a page to a former version in order to reverse vandalism or certain users’ activities. The reasons for not considering “Reversion” is that the risk for vandalism is minimal, and, in addition, reversing users’ activities was not recommended to avoid drastic changes of the wiki content.

These categories have not the same level of importance when it comes to assess collaborative writing as defined in Section 2.2. To examine the level of collaboration, these categories need to be divided into three main groups of actions:

(1) Actions associated with technical issues, such as presentation, appearance and structure of the wiki (format, style/typography)

(2) Actions on content, which do not change the meaning of sentences or links (add and delete information, add and delete link)

(3) Actions on content, which in contrast to the second group, alter the meaning of sentences or links (clarify information, fix link, grammar, and spelling)

These groups of actions can be further described by increased level of collaboration. The first group is characterized by a low level of collaboration, since the actions carried out on wikis focus mostly on technical issues, without reference to content. The second group emphasizes actions on content, such as add or delete information or links, without changing the meaning of sentences. These types
of actions can be considered more as cooperative than collaborative activities according to the distinction between cooperation and collaboration. But, it may happen that students make minor changes in sentences, or move sentences from one to another place in the wiki. Thus, this group of actions can be characterized by a middle level of collaboration. Finally the highest level of collaboration is achieved when students alter, rework or revise the meaning of sentences, fix links, and correct the grammar and spelling. This is the case of the third group.

2.4. Wiki-based collaborative writing environment

Fig. 1 describes the wiki-based writing environment used in this work. The environment is organized around MediaWiki as a platform for collaborative writing. It is supported by the sociocultural learning theory, which states that knowledge is the result of social interactions and the language being used. Another important component is the taxonomy used for analyzing students’ actions that are categorized by 10 editorial types. Students use the editing functions of the wiki to perform collaborative writing activities and the discussion page to post-comments. The groups evaluate each other’s wiki by means of peer assessment based on pre-defined criteria. The teacher uses the history function to create statistics and evaluate the level of collaboration achieved by the students. Likewise, the teacher analyses the comments posted on the discussion page and the results of peer assessment to evaluate the level of collaboration.

3. Literature review

The literature review suggests that there are three major issues that characterize current research on wikis in education. Firstly, although positive experiences with wiki-based collaborative writing exist, Pifarré and Fisher (2011) report that there is relatively little research on successful implementations of wikis supporting collaborative writing. Secondly, according to Judd et al. (2010), existing research studies on wiki focus mostly on participants’ perceptions of collaborative learning. Finally, a small but growing body of research has recently drawn on the data log of the history function of wikis.

3.1. Wiki use in education

The research literature reports on a number of positive experiences with wiki-based collaborative writing in education. For example, Thomas et al. (2009) concluded from the feedback received from students, taking a course in software engineering in a wiki-based environment, that collaboration, peer review and
reflections contributed to learning and understanding of the course concepts. In addition, they reported that the students felt that a wiki is a good medium for collaborative work in a distance-learning course, even though they noted a number of disadvantages of collaboration. Likewise, Minocha and Thomas (2007) reported that “the use of simple wiki (...) did support the socio-constructivist pedagogy”, and that “all the groups completed their collaborative activities (...)” (p. 310). Nevertheless, they suggested that wiki alone may not be sufficient “to be fully effective in realizing all the potential benefits of collaborative activities” (Ibid). Kuteeva (2011) explored the use of wikis in a course of communication in English, and reported that writing on the wiki made nearly 60% of the students consider their audience, develop their academic writing skills, access to others’ work, and learn others’ opinions. Yusoff, Nik Alwi, and Ibrahim (2012) reported that using wikis for group work encouraged group participation, but the students claimed that they preferred face-to-face discussion during collaborative writing. Likewise, Naismith et al. (2008) concluded that students were able to use the wiki to complete tasks, but collaboration was not as co-constructive as expected due to a number of factors, such as tensions between expectations of collaboration and assessment practices, differences between participants, degree of co-presence and familiarity with technology.

3.2. Critical issues of wiki

A number of researchers are more circumspect about the capabilities of wikis to support collaborative writing. Research findings suggest that wiki are not inherently collaborative, even though they possess features that can facilitate collaborative writing. Additional components are needed to promote participation and collaboration among students, such as a sound pedagogy (Judd et al., 2010; Karasavvidis, 2010). Several hypotheses have been raised to explain the low level of collaboration when using wikis: unfamiliarity with wikis, lack of experience, dominant learning paradigm, limited student contribution, reluctance and resistance to use wiki, lack of motivation and engagement, time management, problem of ownership, and lack of appropriate pedagogy.

3.2.1. Unfamiliarity, lack of experience and dominant learning paradigm

Karasavvidis (2010) argued that the reason why students did not collaborate is that they lacked skills, attitudes, and strategies to deal with wiki tasks. The dominant learning paradigm associated with the behaviorist epistemology was also a factor that prevents students from collaborating (Ibid). Likewise, Huang and Nakazawa (2010) indicated that teachers need to encourage learners’ activities because they may not be accustomed to wikis.

3.2.2. Limited student contribution

Mindel and Verma (2006) observed that students “tended to accumulate or aggregate content on wiki pages rather than truly collaborate” (p. 17). Similarly, Arnold, Docate, and Kost (2009) concluded that students rarely revise peers’ contributions even though these were part of the wiki assignments. Instead, they were more concerned with adding information to existing pages. Likewise, Ebner, Kikkmeier-Rust, and Holzinger (2008) indicated that none of the students created new pages, revised existing pages, or re-worked exiting content over an entire semester. Furthermore, Cole (2009) reported that students had not contributed to the wiki at all, after the first half of the semester. She concluded with the statement that “it is not enough to simply add a wiki into a course with a traditionally designed content and expect students to automatically participate. Rather, course content needs to be explicitly redesigned around wiki use” (p. 144).

3.2.3. Reluctance and resistance to use wikis

Wheeler and Wheeler (2009) reported that students’ collaborative writing was limited, because of their reluctance to edit each other’s work. Likewise, Lund and Smørdal (2006) found that students did not like to rewrite or modify their own work or peers’ contributions to the wiki. Similarly, Britcliffe and Walker (2007) highlighted the students’ unwillingness to engage effectively in collaboration because they did not like to change others’ work.

3.2.4. Lack of engagement and motivation

Carr, Morrison, Cox, and Deacon (2007) reported that some students were not motivated to use wikis in an online course. They pointed out that a minority of students performed much of the wiki activities, while other students in the same group did not contribute at all or contribute minimally. Some felt uncomfortable sharing their knowledge and drafts, because of fear of exposure.

3.2.5. Time management

Forte and Bruckman (2007) reported that students had the tendency to postpone important parts of the wiki as the deadline approached. Likewise, Allwardt (2011) indicated that “among discussion group participants, time management was the most problematic issue reported” (p. 600). In addition, “some students were frustrated that groups were inactive until just before the due date approached and that group members did not reply to their postings in a timely manner” (Ibid, p. 600).

3.2.6. Problem of ownership

Elgort, Smith, and Tolland (2008) pointed out that a significant number of students felt they could have done the assignment better on their own, without using wikis, in addition that some students preferred working alone rather than as part of a group. Similarly, Wheeler, Yeomans, and Wheeler (2009) indicated that “students tend to protect their ideas as their own work (...).”, and as a result, “they are resistant to having their contributions altered or deleted by other group members” (p. 992).

3.3. Research using the data log of history function

Besides perception-based studies, which are still predominant, a small but growing number of studies have recently drawn on the data log generated by the history function of wikis. Hadjerrouit (2013) reported that most students did not collaborate when they used wiki to edit collective documents. Instead, they focused mostly on adding information to existing pages and technical aspects. Similarly, Leung and Chu (2009) reported that students worked individually most of the time, and edited each other’s contributions if necessary. Likewise, Judd et al. (2010) provided evidence against a general tendency to collaborative writing. In some contrast, Meishar-Tal and Gorsky (2010) indicated that adding text was carried by a large majority of students, but the percentage of editorial changes was higher than adding sentences, because the students were required to edit each other’s work.

4. Methodology

4.1. Participants

Students from a Web 2.0 technology course participated in this study from January 12 to March 19, 2012. The participants were 16 students divided into 6 groups of 2–4. There were 9 (56.25%) full-time students, and 7 (43.75%) part-time students. All students had experience with working in groups, but none of them were familiar with wiki-based collaborative writing. All have been introduced to Web 2.0 technologies, such as blogs, Twitter, Google Docs, Face-
book, and Second Life. Some of the students possessed basic knowledge and skills in HTML coding and Web design, e.g. uploading files and images, using multimedia and animations. Most of them have background in teacher education.

4.2. Wiki tasks

The wiki tasks were specified in collaboration with the instructor. Each group investigated a specific topic and created a wiki from a teacher education perspective. Students were encouraged to coordinate their efforts and decide themselves whether one member of the groups could serve as manager who was responsible for coordinating group efforts. Two weeks before the deadline, the groups presented their tasks to peers and instructor, who provided constructive comments. Prior to the wiki tasks, the specificities and technical features of wikis were introduced to the students during the first week of the course. Lectures on collaborative writing were given in the following 2 weeks. The students were required to submit their wikis for continuous supervision. Two weeks before the deadline, the wikis were assessed by means of peer assessment using a set of pre-established criteria.

4.3. Assessment goals and requirements

The instructor provided a set of assessment goals and requirements. First, the wikis should follow general usability criteria such as technical layout, text organization, paragraph structure with heading and subheading. The wikis should contain links, images, tables, lists, and references. Second, the wiki should provide quality information, without linguistic, grammatical, and spelling errors. The content should draw on recent curricular development in teacher education, and include study material and topics that are of interest for students. Third, the wiki content should be self-explaining, and offer information that is relevant and adapted to the characteristics of users. Given these requirements, the students were encouraged to collaborate by editing each other’s work, and take actively part in discussions by arguing and reflecting on wiki-related issues. The student groups were required to deliver wikis with a minimum of 4000 words to ensure that a sufficient quantity of writing can be produced. Fourth, to enhance the quality of the wikis, the students were required to assess each other’s wikis by providing constructive feedback. Finally, the students were assessed as a group creating a collective wiki, and not individually according to the amount of work they produced.

4.4. Data collection and analysis methods

The work used three data collection and analysis methods and their combination. The first method was the taxonomy with 10 categories of actions. The total number of actions per group and category, including their frequencies and percentage of contribution were collected and analyzed, such as whether the action was an addition, deletion or clarification of information; addition, deletion, or fixation of links; formatting, spelling, style, or grammar. In addition, the actions were analyzed according to three main groups of actions and their level of collaboration. The second method aimed at evaluating the comments posted on the discussion page. These were categorized by technical issues, wiki content, and collaboration; and analyzed both quantitatively in terms of number of comments, and qualitatively in terms of their level of collaboration. The third method was peer assessment to provide constructive suggestions for improvement. This was based on a questionnaire with open-ended questions, and categorized by technical issues, wiki content, collaboration and discussion. The students were asked to indicate the level of agreement with the statements of the questionnaire based on a five-point Likert scale from 1 to 5 with, where 1 was coded “Very Low”; 2 as “Low”; 3 as “Middle”; 4 as “High”; and 5 as “Very High”. Peer assessment was mandatory, and performed 2 weeks before the delivery of the wikis. Finally, the findings resulting from the three methods were cross-checked to explore if similar results regarding collaborative writing are being found.

4.5. Purpose of the paper

This purpose of this paper is threefold. First, it aims at evaluating the level of students’ collaborative writing with wikis. The second purpose is to suggest factors that impact wiki-based collaborative writing. The third goal is to propose an approach to foster collaborative writing with wikis. Three methods were used to collect data on students’ actions: history log, comments on the discussion page, and peer assessment. Three levels of collaboration were defined to evaluate the extent to which students collaborated: low, middle, and high. Accordingly, the work aimed to address the following research questions:

(a) What is the level of collaboration of students’ actions carried out on the wikis in the history log?
(b) What is the level of collaboration of students’ comments posted on the discussion page?
(c) What level of collaboration characterizes the wikis when evaluated by peer assessment?
(d) What factors may influence students’ collaborative writing in teacher education?
(e) How to foster wiki-based collaborative writing in teacher education?

5. Results

This section describes the results achieved in terms of actions carried out on the wikis across the 10 categories investigated, students’ comments posted on the discussion page, and peer assessment.

5.1. Level of collaboration of students’ actions in the history log

Table 2 shows the frequency and distribution of actions that fell under each of the 10 categories investigated. The total number of actions was 2856, which means an average of 178.5 actions per student (n = 16). Note that a single edit may involve several actions, for example a student could add information and delete a link. In this case, both actions in the categories add information and delete link were recorded.

Table 2 reveals that the most important action performed on the wikis in terms of average frequency relative to the total number of actions was format, followed by addition of information and links, clarification of information and fixing of links, deletion of information, style/typography, deletion of links, spelling, and finally grammar. The category “clarify information” can be divided into two subcategories: a student clarifying his/her own information, on the one hand, and clarifying each other’s information, on the other hand. The statistics does not indicate the frequency of each subcategory. However, even if all actions associated with clarifying information fell under the second subcategory, which is the best possible scenario, the average frequency of 12.04% is low compared with those achieved for formatting, addition of information and links. More specifically, the frequency of the category “clarify information” was lower than 12.04% for four groups (1, 2, 5, and 6), 14.93% for group 4, and 23.79% for group 3. It can be inferred from this analysis that the level of collaborative writing in terms of clarifying each other’s contribution was low in comparison to the total number of actions.
Table 2
Distribution of actions in each group of students and category in ascending order.

<table>
<thead>
<tr>
<th>Category</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
<th>Group 6</th>
<th>No. of actions</th>
<th>Frequency of actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>155</td>
<td>113</td>
<td>80</td>
<td>163</td>
<td>109</td>
<td>48</td>
<td>668</td>
<td>23.39%</td>
</tr>
<tr>
<td>Add information</td>
<td>65</td>
<td>51</td>
<td>81</td>
<td>259</td>
<td>89</td>
<td>44</td>
<td>589</td>
<td>20.62%</td>
</tr>
<tr>
<td>Add link</td>
<td>79</td>
<td>36</td>
<td>136</td>
<td>119</td>
<td>82</td>
<td>53</td>
<td>505</td>
<td>17.68%</td>
</tr>
<tr>
<td>Clarify information</td>
<td>24</td>
<td>21</td>
<td>114</td>
<td>138</td>
<td>44</td>
<td>3</td>
<td>344</td>
<td>12.04%</td>
</tr>
<tr>
<td>Fix link</td>
<td>69</td>
<td>8</td>
<td>20</td>
<td>68</td>
<td>39</td>
<td>17</td>
<td>221</td>
<td>7.73%</td>
</tr>
<tr>
<td>Delete information</td>
<td>24</td>
<td>19</td>
<td>18</td>
<td>86</td>
<td>35</td>
<td>25</td>
<td>207</td>
<td>7.25%</td>
</tr>
<tr>
<td>Style/typography</td>
<td>33</td>
<td>9</td>
<td>6</td>
<td>19</td>
<td>38</td>
<td>29</td>
<td>134</td>
<td>4.69%</td>
</tr>
<tr>
<td>Delete link</td>
<td>23</td>
<td>0</td>
<td>5</td>
<td>29</td>
<td>14</td>
<td>6</td>
<td>77</td>
<td>2.70%</td>
</tr>
<tr>
<td>Spelling</td>
<td>13</td>
<td>7</td>
<td>8</td>
<td>29</td>
<td>6</td>
<td>5</td>
<td>68</td>
<td>2.39%</td>
</tr>
<tr>
<td>Grammar</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td>14</td>
<td>9</td>
<td>3</td>
<td>43</td>
<td>1.51%</td>
</tr>
<tr>
<td>No. of actions</td>
<td>448</td>
<td>260</td>
<td>479</td>
<td>924</td>
<td>465</td>
<td>233</td>
<td>2856</td>
<td>100%</td>
</tr>
<tr>
<td>No. of students</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An additional analysis was performed in terms of the three main groups of actions as described above: Actions associated with technical issues, actions on content without changing the meaning of sentences, and actions on content, which alter the meaning of sentences (Table 3). The results show that the amount of collaborative writing (20.97%) does not increase significantly in comparison to Table 2, even though the actions “fix link”, “grammar”, and “spelling” are considered as integral part of collaborative writing, in addition to clarifying information. Note that a statistical analysis does not necessarily give a complete picture of students’ collaborative writing in terms of quality of content being changed. As Meishar-Tal and Gorsky (2010) stated, certain categories in the taxonomy depend upon content analysis, such as clarifying information, which “can be differentiated only by someone familiar with the subject at hand” (p. 27).

5.2. Level of collaboration of students’ comments in the discussion page

A detailed analysis of the comments posted on the discussion page shows that the students made comments on a range of issues. Following (Su & Beaumont, 2010), the content of the comments were analyzed and categorized by increased level of collaboration:

- Comments on technical issues of the wiki (low level of collaboration).
- Comments on wiki content (middle level of collaboration).
- Comments on collaborative writing (high level of collaboration).

The lowest level of collaboration is when students discuss technical issues such as layout, structure, placement of images and figures, inserting tables and lists, format, and typography, with almost no reference to the wiki content. The middle level of collaboration is achieved when students discuss the wiki content in terms of addition/deletion of content, proof reading and grammar corrections, references, linking of key words, and wiki length. The highest level of collaboration is when students critically discuss the usefulness of the wiki content, and identify gaps in their knowledge. Equally important in this category are the review the literature, adaptation of language to the target audience, and clarification of content.

As Table 4 shows, most comments were those with a low level of collaboration (55.21%). These comments referred, in ascending order, to images (34 occurrences), format (25), tables (23), typography/style, pages, and subpages (15), and lists (7). Middle level collaboration comments (38.54%) related to addition of information (24), links (22), wiki length (13), references (5), proof reading and spelling errors (5), key words to be linked (3), and categories (2). High level collaboration comments (6.25%) referred mostly to wiki requirements (8), and collaboration (4). Issues such as usefulness of information sources, study material being used, literature review, adaptation of language to the target audience (or potential users of the wikis), clarification and revision of content were not addressed. Only one student emphasized the need to work collaboratively.

There were several comments with a low level of collaboration, of which the following are representative:

Now we have nice images and I think there are enough. We can probably insert a picture or two to the section on (...).

I fixed a positioning of images, but I am still not particularly happy (...). Need some more lists to meet the requirement. Suggestions would be appreciated.

The following were typical comments associated with a middle level of collaboration:

We must to at least make sure that none of the links are “empty”. We now have about 3000 words (...). Thus, 1000 words are still missing. Any suggestions on what we can write in more details?

I guess today we will deliver the wiki, so we have to get it done. Who takes care of creating tables? I thought I was writing the page about (...), and proofread the entire wiki. We also need to arrange the reference list.

There were few comments with a high level of collaboration. The following illustrates the type of students’ comment:

Table 3
Distribution and percentage of actions according to three main groups and their level of collaboration.

<table>
<thead>
<tr>
<th>Level of collaboration</th>
<th>Group of actions</th>
<th>Frequency of actions (%)</th>
<th>No. of actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Actions associated with technical issues, such as presentation, appearance and structure of the wiki (format, style/typography)</td>
<td>28.08</td>
<td>1378</td>
</tr>
<tr>
<td>Middle</td>
<td>Actions on content, which do not change the meaning of sentences or link (add and delete information, add and delete link)</td>
<td>50.95</td>
<td>802</td>
</tr>
<tr>
<td>High</td>
<td>Actions on content, which alter the meaning of sentences or links (clarify information, fix link, grammar, and spelling)</td>
<td>20.97</td>
<td>676</td>
</tr>
<tr>
<td>Total no. actions</td>
<td></td>
<td>100</td>
<td>2856</td>
</tr>
</tbody>
</table>
Table 4
Distribution of comments in each category posted on the wikis.

<table>
<thead>
<tr>
<th>Level of collaboration</th>
<th>Category</th>
<th>No. of comments</th>
<th>Frequency of comments (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Comments on technical layout, structure, navigation, format, images, tables, lists, paragraphs, headings, pages.</td>
<td>106</td>
<td>55.21</td>
</tr>
<tr>
<td>Middle</td>
<td>Comments on content, linking of key words, wiki length, proof reading, grammar and spelling errors, references.</td>
<td>74</td>
<td>38.54</td>
</tr>
<tr>
<td>High</td>
<td>Comments on usefulness of information, wiki requirements, literature review, adaption of language to target audience, clarification and revision of content.</td>
<td>12</td>
<td>6.25</td>
</tr>
<tr>
<td>Total no. of comments</td>
<td></td>
<td>192</td>
<td>100</td>
</tr>
</tbody>
</table>

The next will probably be that we meet and work collaboratively with the wiki, do you agree?

Considering that the category of comments with a high level of collaboration is the one that requires critical reflections and discussion, it can be asserted that the overall level of collaboration was rather low. In addition, the number of comments (192) is very low compared with the number of total actions (2856), which means an average score of only one comment per 14.87 actions. Finally, a closer look at the discussion dates and time show that most comments were posted the last 2–3 weeks before the delivery of the wikis. Otherwise, it was difficult to follow the discussion threads of the respective wikis, because the date of contribution or/and name of contributor were missing.

5.3. Peer assessment

As for the comments posted on the discussion page, peer assessment was categorized, with minor changes, by technical issues, wiki content, and collaboration. A survey questionnaire with 6 statements, resulting from 6 criteria, and open-ended questions was designed to address peer assessment (Table 5). Concerning technical issues, the students were asked to assess the level of technical design and navigation (statement 1 and 2). Wiki content was addressed by content understandability and adaptability to users’ characteristics (statement 3 and 4). Finally, peer assessment addressed the level of collaborative writing and discussion (statement 5 and 6). Table 5 shows the distribution of students’ responses.

5.3.1. Technical issues

Responses to the questionnaire revealed that 7 students considered the level of technical design as high, and one as very high, in terms of layout, inclusion of figures, images, lists, colors and tables. In contrast, only 5 students found the level of navigation high. Most responses to open-ended questions focused on problems associated with key words to be linked and navigation. Some of representative comments are as follows:

Some key words are obviously not properly linked (…). I would have tried to include some more links (…).

The links are empty and therefore they have no value: All links lead to pages without content. There are no links for keywords in Section 3. There are many keywords for 3 sections that should be explained.

Links need an appropriate description. Otherwise, there are many keywords that are linked up, and do not have content.

As previously mentioned, I think that the page can be improved by a little more variety of graphic illustrations, and change the sentence structure here and there.

5.3.2. Wiki content

Students’ responses indicate that half of the students believed that the wiki content is easy to understand. However, only 3 students agreed that the wikis were adapted to the users’ characteristics, and 8 felt that adaptability of content was of middle quality. Typical students’ responses to open-ended questions revealed the inadequacy of the language being used and characteristics of the target audience:

I think the language is a bit difficult considering that their target audience is 5–7th grade.

Not everything was easy to understand, thinking particularly of young students who will read this.

For me, the content is understandable and interesting, but for children of 5–7 age, there are maybe too many figures and dry facts that they can familiarize themselves with them.

The wiki lacks a defined purpose; it should come out more clearly who is the target group.

Maybe, it is not accurately adapted for children, since there are some concepts that can be difficult for them and young people.

The wiki should have been shortened down significantly, less text for several illustrations.

5.3.3. Collaboration and discussion

The results show that half of the students thought that the level of collaboration was high. In their responses to open-ended

<table>
<thead>
<tr>
<th>Statement</th>
<th>Very high</th>
<th>High</th>
<th>Middle</th>
<th>Low</th>
<th>Very low</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What do you think about the level of design/layout of wiki pages (Layout and structure of the pages, headings, tables, lists, images, choice of colors)?</td>
<td>1 (6.25%)</td>
<td>7 (43.75%)</td>
<td>7 (43.75%)</td>
<td>1 (6.25%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>2. What do you think about the ease of navigation and linking? Are the key words properly linked?</td>
<td>0 (0.00%)</td>
<td>5 (31.25%)</td>
<td>8 (50.00%)</td>
<td>2 (12.50%)</td>
<td>1 (6.25%)</td>
</tr>
<tr>
<td>3. What do you think about the level of content understandability? Is the content easy to understand?</td>
<td>0 (0.00%)</td>
<td>8 (50.00%)</td>
<td>3 (18.75%)</td>
<td>3 (18.75%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>4. What do you think about the level of content adaptability? Is the language suited to the users’ characteristics such as age and knowledge level?</td>
<td>0 (0.00%)</td>
<td>8 (50.00%)</td>
<td>3 (18.75%)</td>
<td>3 (18.75%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>5. Look at the history log, and assess the level of collaborative writing among students in the group.</td>
<td>0 (0.00%)</td>
<td>8 (50.00%)</td>
<td>3 (18.75%)</td>
<td>3 (18.75%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>6. Look at the discussion page and assess the level of discussion among students in the group.</td>
<td>0 (0.00%)</td>
<td>8 (50.00%)</td>
<td>3 (18.75%)</td>
<td>3 (18.75%)</td>
<td>0 (0.00%)</td>
</tr>
</tbody>
</table>
questions, 5 students referred to the history function to indicate that they collaborated with their peers, without giving any detailed explanation. Furthermore, only one student was aware of the fact that it was difficult to interpret the quality of collaboration based only on the history function. In stark contrast to collaboration, only 5 students indicated that the level of discussion was high, while 8 considered it as low. Some representative students’ responses are as follows:

Judging from the history function, it seems that everyone has contributed equally.

History shows that it has been working well.

The history function clearly shows that you have worked with each other.

The degree of collaboration is high. It seems that you have worked and contributed well.

It does not look like that all members of the groups contributed to the wiki according to the history function.

It is difficult to interpret the quality and extent of collaboration based only on the history function, but it seems that everyone has contributed and that the group has worked steadily.

There was not much discussion in the group (…), but it must have taken place outside the discussion page.

It does not look like there has been any written communication via the discussion page.

5.3.4. Level of collaboration

A statistical analysis was performed to assess the extent to which peer assessment addressed the level of collaboration among students (Table 6). As for the discussion page, the comments to open-ended questions addressed by peer assessment were categorized by increased level of collaboration. The lowest level of collaboration relates to technical aspects. Content is characterized by a high level of collaboration, whereas comments on history log, collaboration, and discussion reflect a high level of collaboration.

As Table 6 shows, most comments were those with a low level of collaboration (58.79%). These referred in ascending order to images (25 occurrences), navigation (23), technical design (17), page (10), tables (8), typography/style (6), color (5), and layout (3). Middle level collaboration comments (30.90%) related to content (19), target audience (16), linking of key words (8), language (6), and references (2). High level collaboration comments (10.30%) referred to discussion (10), history log (4), and collaboration (3).

6. Discussion

6.1. Summary of results related to research questions

6.1.1. What is the level of collaboration of students’ actions carried out on the wikis in the history log?

The most frequent action was formatting, followed by adding information and links. Clarifying information by modifying and revising each other’s edits were actions that the students did not carry out much (Table 2). As a result, the level of collaborative writing among students was rather low compared with the frequencies of other actions (Table 3).

6.1.2. What is the level of collaboration of students’ comments posted on the discussion page?

The results show that the level of collaboration of students’ comments was rather low compared with other issues (linking and navigation, proof reading and grammar corrections, references, wiki length, and technical issues). This means that the students did not critically reflect on issues pertinent to collaborative writing (Table 4). This is in accord with the results achieved for the categories of actions carried out on the wikis.

6.1.3. What level of collaboration characterizes the wikis when evaluated by peer assessment?

As Table 5 shows, the wikis were technically well designed, in contrast to the average quality of navigability and linking. The results also indicate that the students were globally satisfied with content understandability, in contrast to the low adaptability of content. Regarding collaboration, students’ responses do not provide clear evidence that they collaborated or just cooperated by adding or deleting information or links. The students also raised the difficulty of using the discussion page for written reflections, and that oral and face-to-face communication are still important.

A cross-checking of the results achieved by the three methods show some common tendencies. First, the results reveal that the students did not collaborate much by revising or clarifying each other’s work (Tables 2 and 3). This is confirmed by the students’ comments posted on the discussion page (Table 4). Peer assessment does not provide clear evidence of the level of collaboration, because students were not able to distinguish between cooperative and collaborative work, without a systematic analysis of the information found in the history log. However, the level of collaboration addressed by peer assessment by means of comments was low, which is an indication that collaborative writing was not regarded as important as technical issues and content (Table 6). Likewise, peer assessment reveals that the students did not use the discussion page to address critical reflections. Peer assessment also indicates that the content of the wikis was not well adapted to the characteristics of users.

Summarizing, it appears that students did not fully take advantage of MediaWiki functionality, or that the existing functionality does not fully support collaboration, discussion, and design of user-oriented content. Another explanation is that students lacked collaborative skills, and, as result, they were not able to fully use MediaWiki potentials to achieve a high level of collaboration, discussion, and content adaptation. It is also possible that additional factors may have influenced collaborative writing.

6.2. Factors influencing collaborative writing

The results achieved so far show that wiki-based collaborative writing might be regarded with some scepticism if the goal is to foster a high level of collaborative writing skills. Hence, one can
argue that wikis are perhaps better used to support brain-storming and similar activities, rather than high level collaborative writing. Furthermore, the empirical evidence that wiki-based collaborative writing resulted in lower quality - a finding reported in previous research, seems to indicate that the acquisition of collaborative writing skills is perhaps not so well supported using wikis. These are good reasons to be sceptical about wikis’ potentialities to support collaborative writing. These may turn out to be right when focusing exclusively on the technology being used, without taking into consideration a number of factors that may strongly impact wiki-based collaborative writing. Indeed, as Grant (2009) pointed out, collaboration is less a technological problem than a cultural and pedagogical issue. Focusing on removing technological barriers to realizing wiki potentialities is a “reductionist thinking equivalent to technological determinism” (Grant, 2009, p. 113). As a result, it appears that while wikis might potentially support group work, collaborative writing is not reducible to the technology. Rather the role of the teacher, the nature of the task, time management, motivation, assessment, pedagogy, learning issues, and technology integration are crucial elements in encouraging students to work more collaboratively (Allwardt, 2011; Caple & Bogle, 2013; Hadjerrouit, 2012a, 2012b; Lund & Smørdal, 2006; Tay & Allen, 2011). Some influencing factors are discussed in this section.

First, information found in the history log indicates that the students focused more on formatting, accumulation and deletion of content and links rather than collaborative work in terms of clarifying and revising each other’s contributions. Likewise, the history log shows that all group worked much as the submission deadline approached. This behavior is in accord with previous research indicating the students’ tendency to postpone much of their work until just before the deadline (Judd et al., 2010; Leung & Chu, 2009; Meishar-Tal & Gorsky, 2010; Tetard et al., 2009). This attitude somehow undermined the students’ opportunities to fully collaborate with peers. One possible explanation is that some students were more concerned about passing the course, while doing as little work as possible than writing collaboratively. Moreover, there is little evidence from the discussion page that the students identified gaps in their knowledge by reflecting on the wiki content and usefulness of information. In addition, most discussions happened the last 2–3 weeks before the submission deadline. As a result, it appears that the students did not fully take advantage of MediaWiki functionality, or that the existing functionality does not fully support collaboration and discussion. Likewise, the poor level of collaboration may be explained by the students’ lack of collaborative skills, given the fact most of them were not familiar with wiki-based collaborative writing.

Another explication raised by Grant (2009) is that students do not perceive their wiki tasks as authentic activities that require authentic audiences. They may think that their wikis will not continue after the end of the course. Combined with the importance of grades, it appears that the most important audience for them was their teacher, and not the target audience. This is confirmed by the final wiki products, which failed to thoroughly address this issue. Indeed, the analysis of the wikis shows that the students did not identify gaps in their knowledge in order to make the wikis more relevant and attractive to potential users. Rather, the students focused more on selecting content from Wikipedia and other Web sites than critically reflecting on their knowledge. According to Caple and Bogle (2013), adapting the content to the characteristics of the users is an important requirement for wikis, but it is a demanding task that requires reliable knowledge and information about central facts and concepts of the topic. A good level of language proficiency is also a pre-requisite to deal with this issue (Li & Zhu, 2013). Hence, the creation of user-oriented wikis requires drafting, rephrasing, and reworking the content recursively until it fits the characteristics of the target audience. In turn, drafting and reworking the wiki content cannot be done properly without collaborating and editing each other’s work.

Grant (2009) also suggests that students appear to use practices of individualized written work they were accustomed, rather than collaborating to realize shared knowledge, particularly in the absence of a pedagogical model to draw on. Similar findings are reported in the research literature (Elgøt et al., 2008; Forte & Bruckman, 2007; Lund & Smørdal, 2006). The wiki history log seems to confirm the view that students tended to approach the writing task more individually than collaboratively by splitting up the wiki task into subtasks throughout the entire wiki development period. This behavior may be explained by the fact that collaborative writing is more challenging in terms of cognitive efforts, active participation, group interactions, and time management than just splitting up the wiki task into subtasks, working individually without collaborating, and finally putting all the subtasks together to create a final wiki (Hadjerrouit, 2013).

Another possible explanation may be the assessment form being used to evaluate students’ contributions to the wikis (Harsell, 2010; Tetard et al., 2009). Since the students were not assessed individually, but as a group, they tended to focus more on the final wiki product rather than the collaborative process. It is then possible that they did not consider editing each other’s contributions as useful or desirable, and, as result, they preferred more individual work than collaboration. As Mindel and Verma (2006) stated, students are more inclined to collaborate when collaborative work is mandatory or assessed explicitly using a grading scheme. Teachers may use the history log of the wikis to assess individual contributions, since it records all students’ actions, particularly when they are required to demonstrate regular contributions (Grant, 2009; Harsell, 2010). However, being aware of the usefulness of the history log for individual assessment may not automatically facilitate collaboration, if students are not able to develop and apply effective collaborative writing strategies.

Finally, usability obstacles of wiki technologies may disrupt students’ collaborative learning experience (Minocha & Thomas, 2007). Likewise, the absence of a WYSIWYG editor may prevent students from fully using wiki for collaboration (Chao, 2007). As a consequence, although students may be positive when they use wikis, they may be reluctant to fully collaborate (Hughes & Narayan, 2009).

6.3. Suggestions to foster wiki-based collaborative writing

As Judd et al. (2010) indicated, wikis are not inherently collaborative, even though they possess features that can facilitate collaborative writing. With other words, collaboration is not automatically a direct influence of wiki technology, even though wikis may provide learning opportunities. Additional components such as a sound pedagogy are needed to foster collaborative writing using wikis. Given these considerations, suggestions for effective implementation of wiki-based collaborative writing are presented at three different levels:

- The individual student level, or student perspective
- The student group level, or student group perspective
- The teacher level, or teacher perspective

Suggestions at the student level aim at supporting students’ motivation, preparation, and ownership. Suggestions at the student group level emphasize familiarization activities in collaborative writing, social dynamics, discussion and communication with peers, user-orientation, and feedback provided by peers. Suggestions at the teacher level focus on pedagogical approaches to collaborative writing, time management, wiki development process, learning goals and assessment procedures. The acquisition
of collaborative writing skills does not need to occur in a linear fashion, starting from the student level, continuing with the student group, and finishing with the teacher level. Collaborative writing skills can be acquired in a variety of ways depending on teachers’ pedagogical strategy, classroom context, and students’ prerequisite knowledge.

6.3.1. Student level

From a technological point of view, wiki tools are supposed to be easy to use so that participants can quickly create wiki applications (Peled et al., 2012; Witney & Smallbone, 2011). However, Harsell (2010) indicated that students still stress the need for technical training, because not all students possess sufficient pre-requisite knowledge for using wikis, or are familiar with wiki technology. Similarly, Jones (2010) argued that technical problems still constitute sources of frustration for some students. Likewise, Wichmann and Rummel (2013) pointed out that wikis tools, such as MediaWiki, are not designed for educational purposes. Moreover, Chao (2007) indicated that wikis are missing a WISIWIG editor and additional features that facilitate collaborative writing. Hence, technical training is still needed to help students acquire the basic knowledge that is necessary to use wikis for collaborative writing. Furthermore, students should be made explicitly aware of the limitations and shortcomings of wiki technology, without neglecting their added value compared to other communication systems such as LMS.

Furthermore, student motivation is an essential component of collaborative writing with wikis. Ryan and Deci (2000) distinguish between intrinsic and extrinsic motivation. The former is a function of the value a student places on the wiki content, and the technology being used. It is enhanced when the content is inherently enjoyable and contains information that is highly relevant to the student. In turn, intrinsic motivation affects the amount of efforts and collaboration a student will be willing to invest in working together with peers in creating wikis. Basically, intrinsic motivation can be achieved through wikis that allow students to take control over their own learning (Olaniran, 2010) that provides opportunities for high level of activities, such as using and redesigning the discussion page to better communicate with peers. Extrinsic motivation can be achieved through performance goals, such as passing the course with a good grade. The results show that extrinsic motivation increased at the end of the course, because students worked much before delivering their work. This means that external rewards such as grades became more important as the deadline approached. Hence, collaborative writing throughout the course is highly dependent on intrinsic motivation from all participants, because it seems to be more effective than extrinsic motivation to foster collaborative writing and group interactions (Wesiak, Al-Smadi, & Gütl, 2012).

6.3.2. Student group level

A critical factor of success at this level is the students’ preparation, support in collaborative writing, and familiarization activities with wikis (Minocha & Thomas, 2007). At this level, students should develop a sense of how collaboration can be achieved by following a common goal and coordinating their efforts (Wichmann & Rummel, 2013). Basically, the acquisition of collaborative skills should not be restricted to wikis alone, but should be possible using useful means, such as allow students with different backgrounds come together to discuss a topic and add to each other’s knowledge. Another way to foster collaborative learning may be reflection of articles through students’ summaries of what they have learned (Tetard et al., 2009). These group-based tasks and other similar exercises may provide opportunities that facilitate familiarization activities with wikis.

Furthermore, the discussion page of the wiki is not powerful enough to support communication, because it is difficult to follow a discussion thread, without writing down the name of contributor and date of contributor. One way to communicate more effectively is to allow students to use the discussion page in conjunction with other Web 2.0 technologies, such as Google Talk and Twitter, but also other communication technologies such as mobile phone and emails. The use of alternative technologies may help students develop a sense of how the wiki task can be discussed using varied ways of communications, which in turn may stimulate students’ different learning styles, preferences, and approaches to learning and communication (Olaniran, 2010). For the decentralization process, face–face discussions are still important, even though it is difficulty to verify or trace the content of such discussions.

In terms of wiki content, student groups need to be knowledgeable in the topics being studied in order to create wikis that contain basic knowledge of central facts and concepts of the given topics. A comprehensive user-oriented wiki relies entirely on the quality of content and presentation of facts and central ideas, which in turn depends on the ability to report on relevant literature. One way to provide support for literature review is to assign articles to each student or groups of students that should be read, presented, and discussed within a short period of time. It may then be important to find out which concepts need to be discussed to address different aspects of the topic, and attract users’ attention (Mason & Rennie, 2007). Students lacking basic knowledge in the topic being studied will not be able to truly contribute to the wiki content.

Finally, collaborative writing needs to benefit from peer assessment. According to Topping (2009), a peer assessor with less skill, but more time “can produce an assessment of equal reliability to that of a teacher” (p. 20). Hence, this assessment form may help students to understand their own wiki by means of feedback they receive from their peers (Vu & Dall’Alba, 2007). It may enhance collaboration between students, “so that the feedback provided is appropriate and meaningful” (ibid, p. 542). In addition, peer assessment gives students an opportunity to look at the quality criteria being used to find out if they follow them, which, in turn, may help them revise and improve their wiki after the peer assessment process. To be effective, peer assessment should be mandatory, and based on pre-established quality criteria.

6.3.3. Teacher level

At this level, the importance of a sound pedagogy that fosters sociocultural learning cannot be underestimated, since putting students together does not automatically result in collaborative learning. Extending wiki to include a sociocultural approach to learning requires the integration of wikis into a pedagogical strategy that supports genuine collaborative writing. A suitable pedagogy should engage students in collaborative work and group dynamics to a greater benefit for the students, without penalizing weak members of the groups. The role of the teacher is to create an atmosphere of trust and confidence that stimulates students to change peers’ contributions and modify content created by others for the benefit of the group. Teachers should also provide specific guidance to assist students in the writing and peer-editing process. They should make students aware of the difference between cooperation and collaboration, and what genuine collaborative writing means. They should provide strategies that apply to large and small groups, and explain the various roles for the participants, as well as synthesize multiple points of views when discussing a wiki task. As facilitator of collaborative writing, the teacher is not supposed to restrictively control the learning materials and the writing methods the students prefer to adopt. Instead, students should feel confident with methods that suit their personal learning style.
Another task for the teacher is a careful planning of the wiki development process in order to minimize the barriers to successful collaborative writing (Witney & Smallbone, 2011). A planning that suits wiki requires a thoughtful interweaving of content, technology, and collaborative work. With other words, teachers need to engage students in design practices, inquiry, and research in collaborative groups (Mishra & Koehler, 2006). Likewise, the management of time is an important task both for the teacher and students, since collaborative writing is time intensive and cognitively demanding in terms of writing, revising, searching for information, reflecting on ideas, and structuring the information to an overall wiki. Hence, the development of wikis needs to be structured so that students are engaged in the process of collaborative writing. An approach similar to the one developed by Trentin (2008) may be used. The approach needs to incorporate structured stages (Hadjerrouit, 2013). It is centered on a group of collaborating students, because active participation of group members is given high priority. The approach may use rapid prototyping to produce a number of prototypes that can be quickly revised through feedback to ensure that group work is on the right track. The approach is incremental throughout the whole process, because a number of revisions are necessary to improve the quality of the wikis through a continuous cycle of gradual refinement.

Finally, the close integration of wiki tasks and assessment goals, and how students are assessed, individually or and/or in groups, may play an important role to effectively engage students in meaningful collaborative writing (Davidson, 2012). Both individual and group assessment may be used, but as Liu and Carless (2006) pointed out there is “a potential contradiction between a collaborative learning process and individual assessments which carry out a competitive favour” (p. 282). Unlike group assessment, which only evaluates the final product, individual assessment aims at rewarding each student for his or her contribution. It may enhance the students’ motivation to collaborate more closely, but it is dependent on the systematic use of the history function of the wiki to track students’ actions, and the way they are compiled statistically using an appropriate taxonomy. However, as Davidson (2012) indicated, care must be taken not to assess students on the percentage of contribution, because a “small contribution could be very well researched and written piece that provides far more valuable input than a larger contribution” (p. 44). Hence, there is a need for other assessment forms, since statistical data alone do not provide a full picture of students’ contributions in terms of collaboration. Additional assessment forms may be combined with individual assessment to enhance the motivation for collaborative writing, such as self-assessment and peer-assessment, on an individual basis or in groups.

6.4. Limitations

The work raises two validity issues: external and measurement validity (Bryman, 2008). The former addresses the issue of whether the results of the work can be generalized. The results may only be representative for small group learning settings, because this study was conducted with a small convenience sample (n = 16), with participants from one course only, and thus may not well cover a larger population of students in teacher education. Hence, the results need to be considered with caution, until future work with a larger population confirms the results. Another issue is measurement validity, which addresses the extent to which the data collection methods measure what they intend to measure (Bryman, 2008). This work used three methods and their combination. Hence, a good degree of measurement validity is ensured through the use of these methods and cross-checking of the results, but other methods such as focus groups, interviews, self-evaluation, observations, and control group may enhance measurement validity. In addition, the survey questionnaire used for peer assessment may be improved by asking more questions and using supplementary quality criteria.

7. Conclusions

Although this work has its limitations, because of the small sample size (n = 16) and short duration of the wiki tasks (8–9 weeks), it can serve as a basis for further explorations in wiki-based collaborative writing. Given these considerations, some conclusions can be drawn. Firstly, the results are generally in line with similar research work that specifically reports on students’ reluctance or resistance to edit each other’s contributions to the wikis. Secondly, the history function of the wiki provides an excellent research tool to analyze students’ contributions using an appropriate taxonomy of activity categories. Thirdly, factors influencing collaborative writing are identified, and suggestions at three different levels (student, student groups, and teacher) are presented to successfully exploit the potentialities of wikis for collaborative writing in teacher education. In future work, a longitudinal study will be undertaken to explore students’ collaborative writing activities over a period of 3 years to confirm the results. Future research will also be undertaken with a larger population of students to strengthen the validity of the results.

References
