

# Students' uses of Wiki in Teacher Education: A Statistical Analysis

Said Hadjerrouit

**Abstract**—Wikis are considered to be part of Web 2.0 technologies that potentially support collaborative learning and writing. Wikis provide opportunities for multiple users to work on the same document simultaneously. Most wikis have also a page for written group discussion. Nevertheless, wikis may be used in different ways depending on the pedagogy being used, and the constraints imposed by the course design. This work explores students' uses of wiki in teacher education. The analysis is based on a taxonomy for classifying students' activities and actions carried out on the wiki. The article also discusses the implications for using wikis as collaborative writing tools in teacher education.

**Keywords**—Behaviorism, collaborative writing, socio-constructivism, taxonomy, web 2.0 technology, wiki

## I. INTRODUCTION

**R**EFLECTING the paradigm shift from behaviorism based on teacher-directed instruction to socio-constructivism relying on information sharing, group working, discussion, collaborative learning is becoming increasingly more and more important in education [1], [2], [3]. Virtual learning environments and web-based technologies provide a suitable context for collaborative learning [4], [5]. Recently, wikis have emerged as a new tool that supports collaborative learning. Wikis have been used in almost all academic fields to support educational tasks such as collaborative writing, course content authoring, teacher evaluation, group project, etc. [6].

However, despite its potentialities, wiki technology is still confronted with a number of problems such as students' dissatisfaction with the use of wiki for collaborative writing [7], student's preferences to do the task on their own without wiki technology [8], limited student contribution to the wiki [9], students' reluctance to use wiki for online course work [10], and resistance to have their own contributions changed or deleted by other group members [11], [12]. In fact, students' uses of wiki are context-dependent and may take different forms depending on the pedagogy being used and students' experiences and familiarity with the technology.

The main goal of this work is to examine students' uses of wiki in teacher education. Data collection and analysis methods use a taxonomy for classifying students' actions carried out on the wiki. The article also discusses the implications of the findings for using wikis as collaborative writing tools in teacher education.

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The paper is structured as follows. First, wikis as collaborative writing tools are described. Second, a taxonomy for classifying students' actions carried out on the wiki is suggested. This is followed by the research questions and methodology. Then, the findings are presented. Finally, the paper ends with a discussion of the findings, and some concluding remarks.

## II. WIKIS AS COLLABORATIVE WRITING TOOLS

Basically, collaborative writing is defined as a joint activity that gradually transforms a text by multiple contributors into a collective document [13], [14], [15], [16]. It involves writing strategies, document control modes, roles and work modes.

Collaborative writing is also characterized by a number of different activities, such as editing, reviewing, providing feedback and comments, discussing, peer-assessment, drafting, brainstorming, etc. The collective production of documents involves all aspects of writing such as content editing and formatting, style, document structure, layout, typography, grammar, etc. [17].

Genuine collaborative writing is primarily a matter of changing and improving each other's contributions to the collective document, and not just adding content or deleting portions of the document [13]. Currently, word processing and email are the most common information technologies used for collaborative writing [14].

A newer information technology for collaborative writing is wiki. Most existing wikis provide functionality to carry out collaborative writing activities, such as immediate access to the document, easy editing of content, tracking students' contributions, access to all previous versions of the document, comparing the differences between two versions of the document, including communication and discussion modes.

Teachers can use these features to investigate the distribution of work among students, the time needed to carry out actions, work intervals, and types of activities performed by the students. One of the most known wiki technologies is MediaWiki, originally developed for use on Wikipedia [18]. MediaWiki is the underlying platform used in the work to create wikis.

Although wikis are considered as tools that foster collaborative writing, there are a number of problems that still need to be solved:

- Need to support the wiki discussion page with more appropriate tools to follow a discussion thread or a topic under discussion by a group, and to avoid the problem of concurrent updating [19].
- Questions of copyright, because students may use others' work, e.g. articles taken from Wikipedia, as their own [20].
- Students' preferences of individual work over collaboration [8]. Many reasons may explain students' preferences, e.g. students' lack of collaborative writing skills.

- Students' limited contributions to the wiki [7], [9], [21]. This behavior does not foster collaborative writing and involvement with the subject being studied.
- Students' unwillingness and reluctance to use wikis for online course work, project work, or other educational purposes [10].
- Students' tendency to protect their writings and ideas. This raises the problem of ownership [12].
- Students' resistance to have their contributions to the wiki changed by other group members [22], [23], [24]. Adding content to existing pages is still one of the most common activities associated with wikis.
- Critical peer reviews and assessment are not perceived as being positive [19], even though students did not mind critiquing others' work.
- Students' tendency to postpone important parts of the wiki close to the project deadline [25, cited in [1]]. This behavior does not promote further collaboration.
- Work among students is not evenly distributed. As a result, much of the work is still done by a few students [10].

The research literature clearly shows that the use of wiki in education does not automatically guarantee collaboration, and that a careful consideration of a new and sound pedagogy is required to promote collaborative writing [26]. According to Karasavvidis [27], the most difficult problem with wikis hints at a "fundamental problem, namely the dominant traditional practices and the associated learning epistemology which is compatible by such practices" (p. 226).

### III. A TAXONOMY FOR CLASSIFYING STUDENTS' ACTIONS CARRIED OUT ON WIKIS

Taxonomies for analyzing students' actions carried out on the wiki have been reported by a number of researchers [14], [23],[28],[29]. This work used the following categories to analyze the students' actions:

- Add content to existing pages
- Modify and rephrase content
- Delete existing content
- Add link to exiting content
- Delete existing link
- Fix and correct existing link
- Format pages or sections of pages
- Grammar, style, and spelling

These categories can be divided into two main groups: actions on sentences and actions within sentences [13]. Actions in the former group are: add content, delete content, add link, and delete link. Actions in the latter group are: modify content, fix link, format, and grammar/style/spelling (Figure 1).

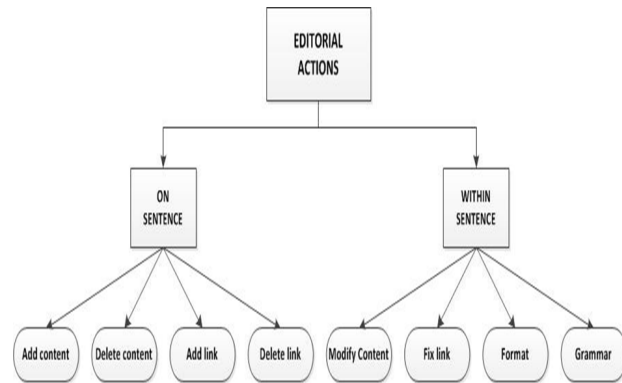


Fig. 1 Actions carried out on wikis

These categories are not equivalent in terms of importance in wiki research. Their importance depends on the context of use and nature of the topic. It is thus important to classify these categories according to the very nature of collaborative writing. Since this work is oriented towards writing a collective document, it follows that "modify content", "delete content", "add content", as well as "fix link", "delete link", and "add link" are more important than issues related to grammar, style, spelling and formatting [28],[29].

However, this classification does not mean that formatting, grammar, style, and spelling are not important regarding the quality of collaborative writing. It only states that this work focuses first of all on the transformation of an initial text into a collective document by modifying, deleting, and adding content and links. Hence, even though deep content analysis is missing, this taxonomy is consistent enough to produce objective and reliable statistics about students' contributions and the types of actions carried out on the wiki.

### IV. RESEARCH QUESTIONS AND METHODOLOGY

This study took place at the Faculty of Technology and Science. It was performed during the study year of 2010-2011. Three wiki projects were carried out in the spring semester of 2010, and the three other wikis in the spring semester of 2011. The course design and requirements did not change during this period of time. Eighteen students were assigned to perform wiki projects associated with a teacher education course in Web 2.0 technologies over a span of 6-8 weeks. All participating students were using wiki for the first time. None of them were involved in wiki or had pre-requisite knowledge in collaborative writing. The students were divided into six groups based on their choice of the wiki subject. The groups were then involved in six wikis associated with collaborative writing projects. The students were specifically instructed to perform in accordance with guidelines for writing good articles, layout, editing, style, and use of references. Students should acquire basic knowledge about wiki functions such as changing, adding, deleting, and developing content collaboratively using MediaWiki, as well as discussing issues related to the wikis. The subjects of the wiki projects were chosen by the students in collaboration with the teacher. However, the students' contributions to the wiki projects were not assessed individually, but as a group work.

Central element for data collection and analysis was the data log generated by MediaWiki. The log recorded and saved all actions carried out on the wikis. These are chronologically listed, with date and authors' names, including changes made in the text using color coding. The data log is particularly useful to support data collection and analysis, because it kept track of all students' contributions made to the wiki [28], [29].

In order to determine how students used the wikis for collaborative writing, the following research questions were asked:

- 1) What was the work distribution among students in each group?
- 2) How many actions were carried out on the wiki by each group?
- 3) To what extent did the students perform actions on entire sentences?
- 4) To what extent did the students perform actions within sentences?

Data analysis consisted in classifying the information provided by the data logs in three categories:

- Distribution of work and number of contributions made by each student
- Type of actions carried out by each group of students
- Time needed to accomplish wiki actions associated with each group of students

Once the data were structured according to the three categories, statistics was then created to assess the extent to which the students worked collaboratively. A crucial category in data analysis is the type of actions the students carried out on the wikis.

V.FINDINGS

A. Distribution of Work

The findings show that all students participated in the development of the wikis. However, the analysis of the students' work distribution provides clear evidence that some students were more productive than others in their own group. This is the case of student 1 in group 1, 2, 3, and 5, who contributed the most. In contrast, it appears that some students (student 2 in group 2 and 3, and student 3 and 4 in group 6) made minimal contribution to the wikis. The only group, where the work was almost equally distributed, was group 4 in terms of number of actions, which in itself is not an indicator for the quality of the contributions (Figure 2, Table 1). Thus, further analysis is required to study in depth the types of actions carried out by the students.

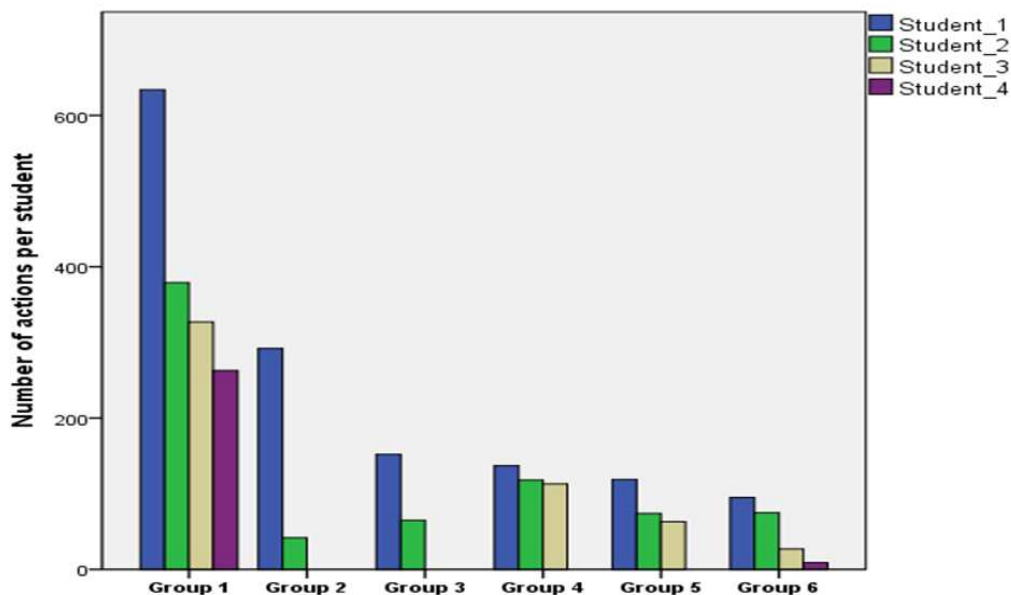


Fig. 2 Distribution of work

TABLE I  
DISTRIBUTION OF WORK

	Stud 1	Stud 2	Stud 3	Stud 4
Group 1	634	379	327	263
Group 2	292	42	---	---
Group 3	152	65	---	---
Group 4	137	118	113	---
Group 5	119	74	63	---
Group 6	95	75	27	9

B. Actions Performed

A total of 4318 actions were performed (Table 2). The most frequent action was formatting (38.25%), followed by add content (21.02%), modify content (11.78%), add link (11.62%), and delete content (8.36%). Otherwise, the other actions were more or less insignificant. Looking closely to the actions carried out on the wikis, it appears that 1011, that is to say 44.26% of all actions, were carried out as actions within sentences, and 2407 (55.74%) as actions on sentences. Figure 3 shows the distributions of the actions in both categories. The most frequent action within sentences was add content (50%),

followed by add link (28%). The most frequent action on sentences was formatting (66%), followed by modify content (20%). A closer look at the distribution of the actions within the groups reveals that formatting in group 1 was nearly 29% of all actions (Figure 4). Furthermore, formatting is one of the most frequent actions within almost all groups, followed by add content, add link, and modify content.

TABLE II  
TYPES OF ACTIONS PERFORMED ON THE WIKIS BY EACH GROUP

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total actions per category	Percent (%)
Modify content	352	38	28	55	31	5	509	11,78 %
Delete content	216	31	18	66	9	21	361	8,36 %
Add content	426	105	68	147	95	67	908	21,02 %
Fix link	67	21	12	1	13	19	133	3,08 %
Delete link	19	0	2	15	5	1	42	0,97 %
Add link	141	52	131	36	96	46	502	11,62 %
Grammar/style	73	17	2	29	50	40	211	4,88 %
Formatting	1242	55	127	122	53	53	1652	38,25 %
<b>Total actions per group</b>	<b>2536</b>	<b>319</b>	<b>388</b>	<b>471</b>	<b>352</b>	<b>252</b>	<b>4318</b>	<b>100 %</b>

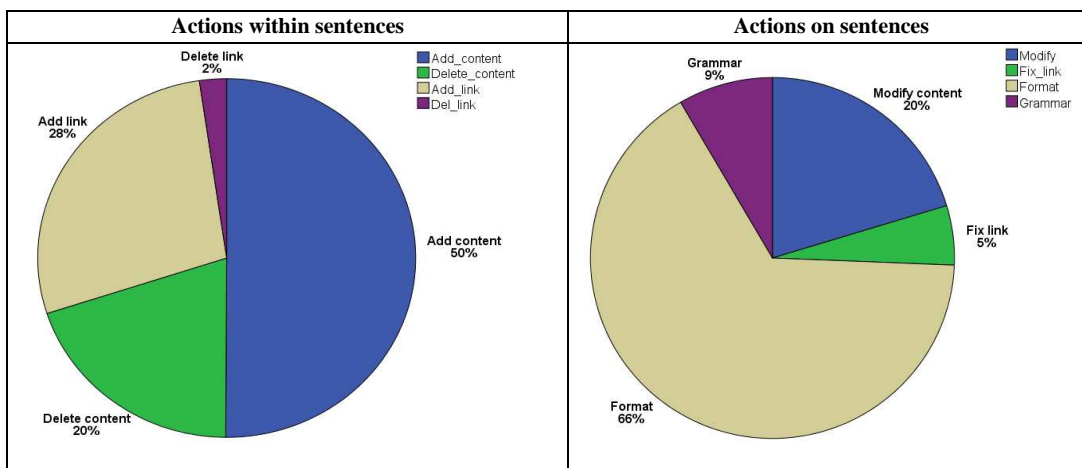


Fig. 3 Actions carried out within and on sentences

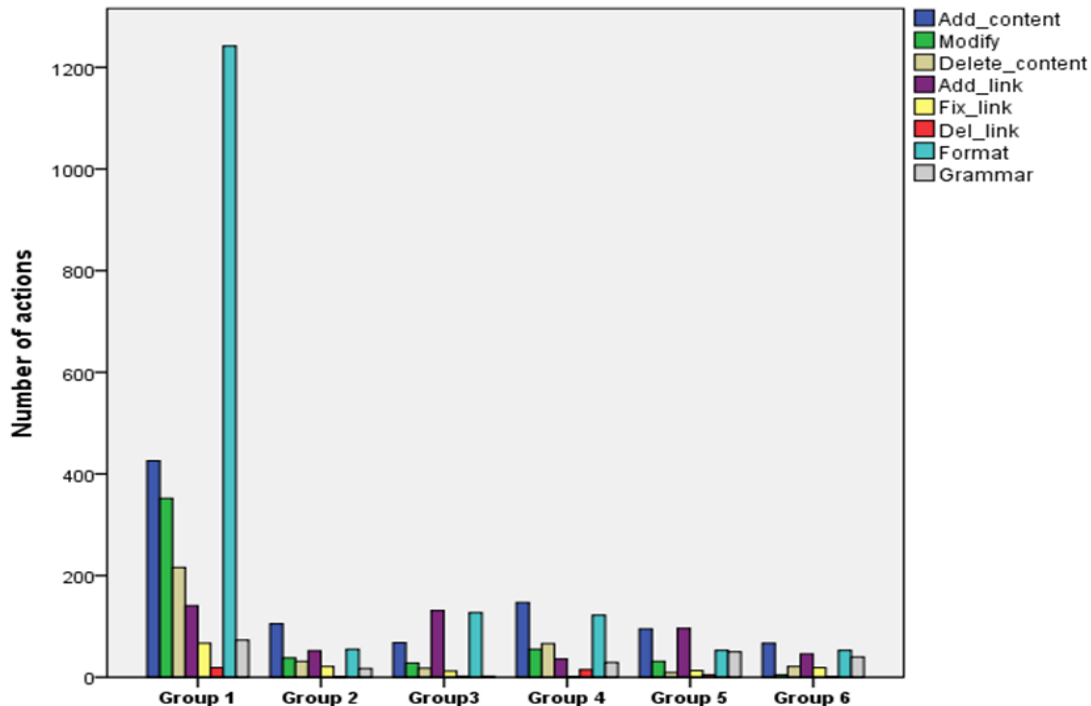


Fig. 4 Actions performed by each group

## VI. DISCUSSION

While the literature asserts that wikis are potentially powerful to support collaborative learning and writing, wikis in teacher education do not need to be used collaboratively, despite a number of difficulties that remain to be solved. Other ways of using wikis for learning are potentially possible [30], as this work clearly shows. From these considerations, a number of implications can be drawn from the findings.

First, this study demonstrates that a number of different actions can be carried out to construct wikis, which may not involve a high degree of collaboration. Indeed, this work shows that formatting was the most performed activity (38.25%), followed by add content (21.02%), modify content (11.78%), add link (11.62%), delete content (8.36%), grammar (4.88%), fix link (3.08%), and delete link (0.97%). These findings reinforce qualitative research, one implying that students are resistant to have their contributions to the wiki changed by other group members. Indeed, students were more concerned with adding content to the wiki than revising others' writings, editing, or rephrasing peers' contributions to the wiki.

Second, the findings also indicate the students' unwillingness to engage in genuine collaborative writing, because they do not want to edit others' work, since the total number of actions related to modifying content is only 11.78%, lesser than content addition (21.02%). This finding is clearly reflected by the amount of work in terms of actions performed on sentences, which is lower than the one done within sentences.

Third, adding content to existing pages can be considered as cooperative work rather than collaborative activity, since

students completed their wiki tasks more individually rather than collectively [31]. However, the findings must be viewed within the situation and specificities of the study, where the students were not assessed individually, but as a group. In the absence of a requirement based on individual assessment, the findings would probably have been different.

Fourth, the lack of familiarity with wikis and collaborative skills would also have influenced the students' behavior not to engage in genuine collaborative writing by editing each other's contributions. In any case, the findings reveal the potential impact of a pedagogical strategy, based on a socio-constructivist and collaborative learning paradigm.

Then, the findings reflect the tendency to postpone the work at the very last moment, since the majority of students' contributions to the wikis were made during the last period of the projects. The findings thus reinforce existing research, one implying that students postpone their work [23]. The completion of work until the last minute may have undermined collaboration and the students' opportunities to interact with their peers, and eventually members of other groups. The timing and distribution of students' work clearly reveal a great deal about the students' capacity and willingness to change and modify each other's work in their group.

Moreover, even though students were able to cooperate by splitting the wiki task in subtasks, and adding gradually content to the wiki, the findings reveal that genuine collaborative writing cannot develop successfully, unless students are given more time and training to experiment and familiarize with collaborative learning and group discussion, and what it means to be actively engaged in collaborative work [22].

Finally, an important result of this work is that the analysis of students' activities by means of the data logs, which are automatically generated by wikis, represents a research area of considerable potential, because it facilitates the analysis of performed actions, timing, work intervals, frequency of students' contributions, even though an automated content analysis is still beyond the capabilities of current wiki technologies [1]. The taxonomy is however a good starting point to create a reliable statistics of students' actions carried out on the wikis. Supplementary data collection and analysis methods, both qualitative and quantitative, would be used in addition to the statistics to obtain an overall picture of what happens when students work collaboratively to produce a collective document.

Due to the small sample size, the findings cannot be extrapolated widely to other educational situations, which may be different to the one presented in this work, even though the findings are in line with some research work. More research on wikis by means of data logs is encouraged in order to build a reliable knowledge base.

## VII. CONCLUSION

Summarizing, there is a need for an epistemological shift from individual work to collaborative learning and socio-cultural practices in order to use wikis as collaborative writing tools [32]. According to Lund and Smørdal [25], students need to engage in "collective cognition" to acquire the necessary skills (teamwork, communication, collaboration, group discussion) to develop collective documents. Such skills become necessary to foster collaborative writing. To be successful, the acquisition of such skills should not be restricted to wikis alone, but should be possible using appropriate means, such as allowing students with different knowledge backgrounds to discuss topics of common interest, co-write summaries of knowledge that students have acquired and learned, etc. [33].

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