

Wiki-mediated Collaborative Writing in Teacher Education

Assessing Three Years of Experiences and Influencing Factors

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Keywords: Action Category, Collaborative Learning, Collaborative Writing, MediaWiki, Taxonomy, Wiki.

Abstract: Wikis have been reported as tools that promote collaborative writing in educational settings. Examples of wikis in teacher education are group projects, glossary creation, teacher evaluation, and document review. However, in spite of studies that report on successful stories, the claim that wikis support collaborative writing has not yet been firmly confirmed in real educational settings. Most studies are limited to participants' subjective perceptions, and do not take into account influencing factors, or the relationships between wikis and the learning environment. In this paper, students' collaborative writing activities over a period of three years are investigated using a taxonomy of action categories and the wiki data log that tracks all students' actions. The paper analyses the level of contribution of each member of student groups, the types of actions that the groups carried out on the wikis, and the timing of contribution. The article also discusses personal and contextual factors that may influence collaborative writing activities in teacher education, and recommendations for students as well.

1 INTRODUCTION

Wikis have been used in teacher education to achieve varied educational goals, such as teacher evaluation, document assessment, or student projects. Research studies point out to the potentialities of wikis to support collaborative work (Minocha and Thomas, 2007; Thomas et al., 2009). However, in spite of positive experiences that have been reported in the literature (Kuteeva, 2011; Naismith et al., 2011), a number of researchers are more circumspect about the potentialities of wikis to support collaborative learning and writing. 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 (Cole, 2009; Grant, 2009; Elgort et al., 2008; Judd et al., 2010; Karasavvidis, 2010).

To further explore these hypotheses, this article reports on a small-scale empirical study in teacher education that examined the extent to which students collaborated to perform wiki-based tasks associated with collaborative writing over a period of three years. The work uses the wiki data log (or history

log), and a taxonomy of action categories to investigate the value of wiki-mediated collaborative writing. In addition, influencing factors that may impact collaborative writing with wikis are discussed, including some recommendations to help students engage in collaboration.

The article is structured as follows. First, the relationship between wiki technology and collaborative writing is clarified. Second, related research work is reported. The next section describes the theoretical framework, followed by the methodology of the work. Then, the results and discussion are presented. Finally, some remarks conclude the article.

2 WIKI-MEDIATED COLLABORATIVE WRITING

2.1 Wiki Technology

This work used one of the most popular wiki platforms – MediaWiki - to perform collaborative writing activities (Kasemvilas and Olfman, 2009). MediaWiki uses a simplified HTML language and provides an extensive functionality for user authentication, making it appropriate for educational

purposes (Su and Beaumont, 2010). Another important functionality of MediaWiki is the history log that keeps track of students' actions by name, date, and colour coding (Lund and Smørdal, 2006). In addition, MediaWiki provides a discussion page for communication, reflections and negotiations.

2.2 Wiki and Collaborative Writing

Collaborative writing is an activity that enables participants to produce a text collectively (Witney and Smallbone, 2011). It is grounded in the social-constructivist learning theory (Vygotsky, 1978), and assumes that participants can achieve more in terms of learning benefits than individuals. Collaborative writing is opposed to simply splitting up the task, work independently of each other, and then assemble individual contributions to a final product. This activity is called cooperation rather than collaboration (Scanlon, 2000, cited in Judd, Kennedy and Cropper, 2010).

Wikis provide a space for collaborative writing by means of a simple interface allowing students to share information, discuss, negotiate, and produce a text by more than one author. Wiki-mediated collaborative writing is a coordinated activity that enables students to edit and revise each other's contribution to the wiki task (Chao and Lo, 2011; Meishar-Tal and Gorsky, 2010; Trentin, 2009; Witney and Smallbone, 2011).

3 THEORETICAL PERSPECTIVE

The underlying theoretical perspective of this research relies on a taxonomy developed by Pfeil, Zaphiris and Ang (2006). It is used to classify and analyse students' actions carried on the wiki. The taxonomy included originally 13 actions, of which the following 10 were identified as important for this work (Ibid, p. 101):

- *Add Information (or content)* - Addition of topic-related information
- *Add Link* - Addition of links or linking of a word within an existing sentence to a page
- *Clarify Information (or content)* - Rewording of existing information without adding new information. Rewording done in order to clarify the content
- *Delete Information (or content)* - Deletion of topic-related information.
- *Delete Link* - Deletion of links or removal of the linking function from a word within a sentence
- *Fix Link* - Modification of an existing link

- *Format* - Changes that affect the appearance or structure of the page
- *Grammar* - Alterations of the grammar
- *Spelling* - Correction of spelling mistakes
- *Style/typography* - Activities that affect the presentation of the text

To measure the degree of collaboration, these actions can be classified from the lowest level of collaboration (that is cooperation as defined above) to the highest level of collaboration. Between these levels, a wide range of actions can be stated. The lowest level of collaboration is performed when students only add content/link, delete content/link within their own subtask. A high level of collaboration is achieved when students rephrase each other's work, clarify and modify the content of the wiki, and correct the grammar and spelling. In addition to rewording and clarifying content as defined in the taxonomy, students can make peers aware of changes and ask them to react to them. These activities can provide a high level of collaborative writing. Between these forms, varied level of collaboration can be achieved, for example when students clarify the meaning of other's work, add content and links to already existing pages, structure some other's work by moving sentences. As a result, some actions may be considered as more cooperative than collaborative activities, while other activities may be classified as more collaborative than cooperative, as defined above.

4 RELATED WORK

Wiki-mediated collaborative writing can be studied from different perspectives and methods. A literature review reveals that most studies use qualitative methods such as interviews and quantitative methods such as survey questionnaires to investigate participants' perceptions of collaborative writing.

In recent years, a growing number of studies have drawn on the wiki data log, also called history function that tracks all students' actions being made on the wiki. The history log is inherently more reliable to analyse students' collaborative writing activities than perceptions-based studies. This work is a continuation and a synthesis of a research that started in 2010 in the field of wiki-mediated collaborative writing over a period of three years (Hadjerrouit, 2011; Hadjerrouit, 2012a, Hadjerrouit, 2012b; Hadjerrouit, 2013a, Hadjerrouit, 2013b). This previous work used both the wiki data log and the taxonomy described in the theoretical perspective. A similar work was done by Judd,

Kennedy, and Cropper (2010), who analysed data that are automatically recorded in the history log to assess the nature and scope of users' contributions. They found little evidence of collaborative writing among participants, and that many students' contributions were superficial. Likewise, Leung and Chu (2009) reported that students worked individually most of the time, and edited each other's contributions if necessary. 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. Nevertheless, most of the work based on the wiki data log pointed out that wikis do not automatically make collaboration happen due to a number of influencing factors in the teaching and learning environment.

5 METHODOLOGY

5.1 Research Goal and Questions

This work aims at exploring the extent to which students collaborated to perform wiki-based tasks associated with collaborative writing in teacher education. Relying on the taxonomy described in the theoretical perspective and the history log that tracks all students' contributions to the wikis, this work attempts to address three questions:

1. What is the level of work contribution of each member of the student groups?
2. What are the types of actions that the groups carried out on the wikis?
3. What are the time intervals and timing of contributions of the groups?

5.2 Participants

The experiments over a three-year period were based on three cohorts of participants. The participative students were enrolled in a Web 2.0 technology course that was offered each year. None of the students experienced wiki-based collaborative writing before taking the course. Some students possessed good technical skills, while other had background in pedagogy and learning paradigms. The first experiment lasted for a whole semester from January to May 2010, while the following experiments in 2011 and 2012 lasted for eight weeks. The number of participants in 2010 was 8 students, divided into 3 groups of 2-4 students. In

2011, the number of participants was 10, divided into 3 groups of 3-4 students. The number of participants in 2012 increased in comparison with previous experiments. Sixteen students, divided into 6 groups of 2-4, were enrolled in 2012. Despite these differences, the conditions under which the experiments were carried out were basically similar. Each experiment started with new writing tasks, but the students were encouraged to study previous editions of the course.

5.3 Writing Tasks

The wiki writing tasks were situated within teacher education, including topics within mathematics, science, geography, history, and other subjects. 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 two weeks. The students were required to submit their wikis for continuous evaluation on the basis of the following criteria. First, the wikis should follow general usability criteria such as good technical layout, clear linking and navigation. Second, the wikis must contain information of good quality, without linguistic, grammar, and spelling errors. Third, the content of the wiki should draw on recent curricular development in teacher education, and include well-structured study material with images, figures, tables, lists, and references. Fourth, the wikis should be self-explaining, and provide information that is relevant to the target audience. Fifth, the wikis should contain a minimum of 4000 words to ensure that a sufficient quantity of writing is produced. Sixth, the students are required to edit each other's contributions, and take actively part in discussion of the wiki content and structure. Finally, in line with the wiki philosophy based on collaborations, the students were not assessed individually, but as a group working collaboratively. Nevertheless, the history log can be used to look at the students' individual contributions to the wikis.

5.4 Data Collection and Analysis Methods

In an attempt to provide a consistent evaluation of the experiments, this work used the wiki data log to collect three types of quantitative data. Firstly, the level of work distribution among members of the student groups to assess the amount of work and frequency produced by each student.

Secondly, the total number of actions per group

and category of the taxonomy described in the theoretical perspective, including their frequencies, were collected and analysed, such as whether an action was an addition, deletion or clarification of content, addition, deletion, or fixation of a link, formatting, spelling, style, or grammar.

Then, information on work intervals and timing of contribution were recorded to assess the amount of work produced by the students over a period of three years.

Finally, observations and informal discussions were used to gain supplementary information on students' collaborative writing activities.

6 RESULTS

The results are described with respect to the experiments that were carried out in 2010, 2011, and 2012. The results are reported in terms of level of distribution, types of actions, and time intervals.

6.1 Level of Work Distribution

Table 1 (Appendix) presents the distribution of work made by each member of the student groups over a period of three years (2010-2012).

In 2010, the percentage of contributions ranged from 39.56% to 16.40% of total activities. One student in group 1 contributed to almost 40% of the work, and the rest was distributed among the other students. In group 2, one student contributed to 87.43%. The same situation occurred in group 3, where one student contributed to 70.05%.

In 2011, two students in group 3 contributed to 82.53%. In group 2, one student made 46.48% of all contributions. In contrast, the work was more equally distributed in group 1 than in the other groups.

In 2012, a similar distribution of work can be observed. One student did most of the work in groups 4, 5, and 6. Two students in group 2 and 3 contributed to more than 80% of the work. The work contribution of group 1 was evenly distributed for three students, with the exception of one student (student 4).

Table 1 (Appendix) enables to see the level of contribution made by each student in the respective groups. The table does neither indicate the types of actions or activities performed by the students, nor show the level of collaboration among students. Thus, further analysis is required to gain more insight into the level of collaborative writing among

the students and the types of actions performed on the wikis.

6.2 Type of Actions

The analysis of the results shows that the students carried out all editing actions described in the taxonomy for collaborative writing (add, modify, and delete content; add, fix, and delete link; format, and grammar, style, and spelling) to a certain extent.

Table 2 (Appendix) shows all editing actions over a period of three years (2010-2012). Note that grammar, style, and spelling are put together, because these actions are somehow similar. They aim at correcting grammar mistakes and spelling, changing the style, typography, and presentation of the wiki content. These actions may then be considered as collaborative actions, though to a lesser degree than clarifying content, especially when students contribute to each other's work.

The most frequent action in 2010 was formatting (43.90%), followed by add content (18.47%), clarify content (12.89%), add link (9.99%), delete content (8.17%), fix link (3.09%), grammar/style/spelling (2.84%), and delete link (0.65%).

In 2011, the most frequent action was add content (28.27%), followed by formatting (20.66%), add link (17.72%), grammar/style/spelling (12.08%), delete content (8.30%), clarify content (7.49%), fix link (3.81%), and delete link (1.67%).

In 2012, the most important action was formatting (23.39%), followed by add content (20.62%), add link (17.68%), clarify content (12.04%), grammar/style/spelling (8.59%), fix link (7.73%), delete content (7.25%), and delete link (2.70%).

The average result achieved for the three-year period was as follows. The most frequent action was formatting (29.32%), followed by add content (22.45%), add link (15.13%), clarify content (10.81%), delete content (7.91%), grammar/style/spelling (7.84%), fix link (4.87%), and delete link (1.67%). A total of 7304 actions were performed, and only 853 actions (10.81%) aimed at genuine collaboration (Table 2, Appendix). If grammar/style/spelling (456 actions, 7.84%) are considered as collaborative actions, then the total number of actions that aimed at collaboration is 1309, that is 18.65% of all actions.

Hence, it appears that cooperation is more evident that collaboration and that no significant progress has been made from 2010 to 2012 regarding the action "modify content" (average score 10.81%). The action started with 12.89%,

decreased in 2011 (7.49%), and increased in 2012 (12.04%). Formatting (29.32%) and add content (22.45%) were the most important activities over three years, in contrast to clarify content and grammar/style/spelling. The evolution of students groups' actions over three years confirms the results (See Figure 1 in the Appendix).

Summarizing, it is obvious that students were more apt to engage in cooperation rather than collaboration. Group members mostly worked on individual sections of the wikis. This reduced their ability to produce shared knowledge and collective documents of the wiki tasks. There were few occasions when the groups worked on the same section of the wiki by revising substantially each other's work. Clearly, this cannot be considered as genuine collaborative writing, since students rarely revised or modified each other's content. Instead, students were more concerned with formatting, adding content, formatting the text, and adding links.

6.3 Timing of Contribution

Table 3 (Appendix) shows the timing of contributions and work intervals over a period of three years, including the average number of actions per week. Note that in 2011 and 2012, the workload for the month of March was distributed over two weeks, which means that the average number of actions per week must be divided by 2, and not by 4 as it is the case for the month of May in 2010.

In 2010, Table 3 shows that all groups worked much as the last deadline approached, and did not follow the schedule assigned throughout the experiment period from January, 19 to May, 14. This was particularly true for group 1 (G1) and group 3 (G3).

In 2011, a similar tendency was observed, particularly for group 2 (G2) and group 3 (G3), in stark contrast to group 1 (G1). Also here the average number of actions performed in March was much higher than in February and January. This was also the case in 2012, though to a lesser degree.

As a result, it seems that a slight progression has occurred from 2010 to 2012 since the amount of work has not increased drastically the last month in 2012 in comparison to 2011, which itself achieved a better result than 2010. This, however, does not automatically mean that students collaborated. It is more likely that they cooperated as a triangulation of the timing of contribution seems to indicate.

7 DISCUSSION

A cross-checking of the results shows that the students did not collaborate much in their attempt to perform writing tasks. A number of influencing factors may explain the low level of collaboration. These may be classified in two broad categories: Contextual and personal factors.

Contextual factors are those related to the teacher, technology, assessment procedures, and learning paradigm.

Personal factors are students' motivation, prior knowledge in collaborative writing, and familiarity with wiki technology.

In addition to influencing factors, some recommendations are suggested to improve collaborative writing with wikis.

7.1 Contextual Factors

According to Karasavvidis (2010), the learning paradigm in higher education is based more on the behaviourist paradigm than collaborative learning. Hence, wiki-mediated collaborative writing may be inhibited when it is introduced into educational settings where traditional views of learning such as behaviouristic practices are actually predominant. As a result, students without sufficient collaborative skills may be disadvantaged even though collaborative writing is potentially possible with wiki technology.

Another factor that may have influenced students' collaborative writing activities is the assessment procedure used to evaluate students' contributions to the wikis. Since students were assessed as groups, and not according to their individual contributions, it is not surprising that some students did not fully engage in collaborative writing. As a result, most of the work was done by some students as the distribution of work clearly reveals. It is also possible that some students were more dominant than others (Meishar-Tal & Gorsky, 2010). Clearly, collaborative writing requires more group assessment, because it may be necessary to judge individual contributions, which in turn, may influence positively students' contributions to collaborative writing.

The third factor is the wiki technology being used, that is MediaWiki. While the technology is based on an interface with a simplified HTML language, it does not offer an advanced WYSIWYG editor, which may facilitate the use of wikis. In addition, the discussion page is not good enough to promote reflections on collaborative writing,

influencing thereby students' activities performed on the wikis.

7.2 Personal Factors

The first category of personal factors comprises perceptions that students hold about wikis, familiarity with the tool being used, its limitations and potentialities for collaborative writing (Caple and Bogle, 2013; Minocha and Thomas, 2007). Informal discussions and observations revealed that some students without technical background were not always comfortable with wikis. On the other hand, students with solid background in information technologies were more confident with using wikis. While students did not feel that they had to know everything about wikis, they did not deny the importance of the need to familiarize themselves with wikis to the extent of knowing what their functionalities and features are and how to use them for developing wikis. Some students believed that pre-work and preparation for wiki use before entering collaborative writing would have helped them to tackle some technical problems.

The second personal factor is the students' lack of collaborative skills and experience in collaborative learning. Such skills are indeed necessary to foster collaborative learning, which is a prerequisite for collaborative writing. Hence, collaborative learning should not be limited to wikis alone but should be possible using any means found useful, for example let students work together and discuss a topic that can add to each other's knowledge (Tetard et al., 2009).

Another critical factor of success is the students' motivation to effectively engage in meaningful collaborative writing (Hadjerrout, 2013a). Motivation - as a personal factor - is an essential component of collaborative writing with wikis. Observations and informal discussions revealed that motivated students edited more content and used more wiki features. It seems that motivation is closely related to the wiki task itself, whether it is relevant and meaningful to the student.

7.3 Recommendations

Based on the results and influencing factors, some recommendations are suggested to help students engage in genuine collaborative writing using wiki technology.

Firstly, students need to familiarize themselves with wiki technology, because not all students possess sufficient pre-requisite knowledge for using

wikis. Hence, technical training is still needed to help students acquire the basic knowledge that is necessary to use wikis for collaborative writing.

Secondly, wiki technology should be improved to include a WYSIWYG editor and additional features that facilitate collaborative writing. Likewise, the discussion page of existing wiki tools is not good enough to support genuine communication. It should be improved, and used in conjunction with other Web 2.0 technologies, such as Google Talk and Twitter, but also other communication technologies such as mobile phone, Skype, and emails.

Another recommendation that may foster collaborative writing is the students' preparation and prior acquisition of basic collaborative skills (Minocha and Thomas, 2007). Students should have a sense of how collaboration can be achieved by following a common goal and coordinating their efforts under the guidance of the teacher.

Then, in terms of wiki content, student groups need to be knowledgeable in the topics being studied in order to create wikis of good quality with relevant references, because those lacking basic knowledge in the topic being studied will not be able to truly contribute to the wiki content. In addition, students should possess some language proficiency to make the writing process easier, especially for those with technical background (Li and Zhu, 2013).

Furthermore, collaborative writing needs to benefit from clear assessment procedures and criteria. These may include both peer-assessment and self-assessment, on individual or group basis. To be effective, assessment of students' contributions to the wiki should be mandatory, and based on pre-established quality criteria.

Finally, the process of creating wikis needs to be carefully planned by teachers to guide and sustain students' collaborative writing activities. In addition, to management and planning activities, wiki-based collaborative writing cannot be successful without a sound pedagogy based on collaborative learning or similar learning paradigms such as the sociocultural approach to learning (Vygotsky, 1978). A pedagogical strategy that supports genuine collaborative writing should engage students in collaborative work and group dynamics to a greater benefit for the students.

8 CONCLUSIONS

Wikis have the potential to foster collaborative writing in teacher education, but wiki-mediated

collaborative writing is a demanding task that requires pedagogical changes. These are however difficult to achieve mainly because contextual and personal factors, which can act as barriers to learning, can prevent teacher students from collaborating. Even if it is impossible to draw any general conclusions from the experiments that were performed in 2010, 2011, and 2012, it can be ascertained that students did not make a real progress in their attempt to collaborate. To exploit the full potential of wikis in future experiments, it is important to guide students into all aspects of wiki-based collaboration. This entails taking into consideration both contextual and personal factors, affecting collaborative writing with wikis, and the suggested recommendations as well. Moreover, progress in wiki-based collaborative writing can be achieved through the iterative and continuous cycle of experimentations and evaluations in varied teacher education contexts.

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APPENDIX

Table 1: Students' work load and distribution (2010-2012).

<p>2010</p>	2010				
		Group 1	Group 2	Group 3	
	Student 1	634 (39.56%)	292 (87.43%)	152 (70.05%)	
	Student 2	379 (23.64%)	42 (12.57%)	65 (29.95%)	
	Student 3	327 (20.40%)	
	Student 4	263 (16.40%)	
	Total	1603 (100%)	334 (100%)	217 (100%)	
<p>2011</p>	2011				
		Group 1	Group 2	Group 3	
	Student 1	137 (37.23%)	119 (46.48%)	95 (46.12%)	
	Student 2	118 (32.07%)	74 (28.91%)	75 (36.41%)	
	Student 3	113 (30.70%)	63 (24.61%)	27 (13.10%)	
	Student 4	9 (4.37%)	
	Total	368 (100%)	256 (100%)	206 (100%)	
<p>2012</p>	2012				
		Group 1	Group 2	Group 3	
	Student 1	80 (31.25%)	121 (45.66%)	184 (46.58%)	
	Student 2	76 (29.68%)	107 (40.37%)	166 (42.02%)	
	Student 3	64 (25.00%)	37 (13.96%)	45 (11.39%)	
	Student 4	36 (14.06%)	
		Total	256 (100%)	265 (100%)	395 (100%)
		Group 4	Group 5	Group 6	
	Student 1	640 (68.37%)	209 (67.63%)	150 (61.47%)	
	Student 2	296 (32.95%)	100 (32.36%)	94 (38.52%)	
	Total	936 (100%)	309 (100%)	244 (100%)	

Table 2: Number and frequency of actions (2010-2012).

	Total 2010	Frequency 2010 (%)	Total 2011	Frequency 2011 (%)	Total 2012	Frequency 2012 (%)	Total 2010-2012	Frequency 2010-2012 (%)
Clarify content	418	12.89%	91	7.49%	344	12.04%	853	10.81%
Delete content	265	8.17%	96	8.30%	207	7.25%	568	7.91%
Add content	599	18.47%	309	28.27%	589	20.62%	1497	22.45%
Fix link	100	3.09%	33	3.81%	221	7.73%	354	4.87%
Delete link	21	0.65%	21	1.67%	207	2.70%	249	1.67%
Add link	324	9.99%	178	17.72%	505	17.68%	1007	15.13%
Grammar, style, spelling	92	2.84%	119	12.08%	245	8.59%	456	7.84%
Formatting	1424	43.90%	228	20.66%	668	23.39%	2320	29.32%
Total actions	3243	100%	1075	100%	2986	100%	7304	100%

Table 3: Average number of actions per week (2010-2012).

	2010						
	G 1	G 2	G 3	Average no. of actions per week			
January (2 weeks)	2	1	0	1.5			
February (4 weeks)	26	31	19	19			
March (4 weeks)	247	43	30	80			
April (4 weeks)	323	55	114	123			
May (4 weeks)	966	94	172	308			
Total	1564	224	335	106.3			
	2011						
	G1	G 2	G 3	Average no. of actions per week			
January (2 weeks)	91	30	4	62.5			
February (4 weeks)	187	97	62	86.5			
March (2 weeks)	87	129	140	178			
Total	365	256	206	109			
	2012						
	G 1	G 2	G 3	G 4	G 5	G 6	Average no. of actions per week
January (2 weeks)	155	11	0	3	0	1	85
February (4 weeks)	490	207	128	240	148	178	347.75
March (2 weeks)	291	173	116	21	156	79	418
Total	936	391	244	264	304	258	283.58

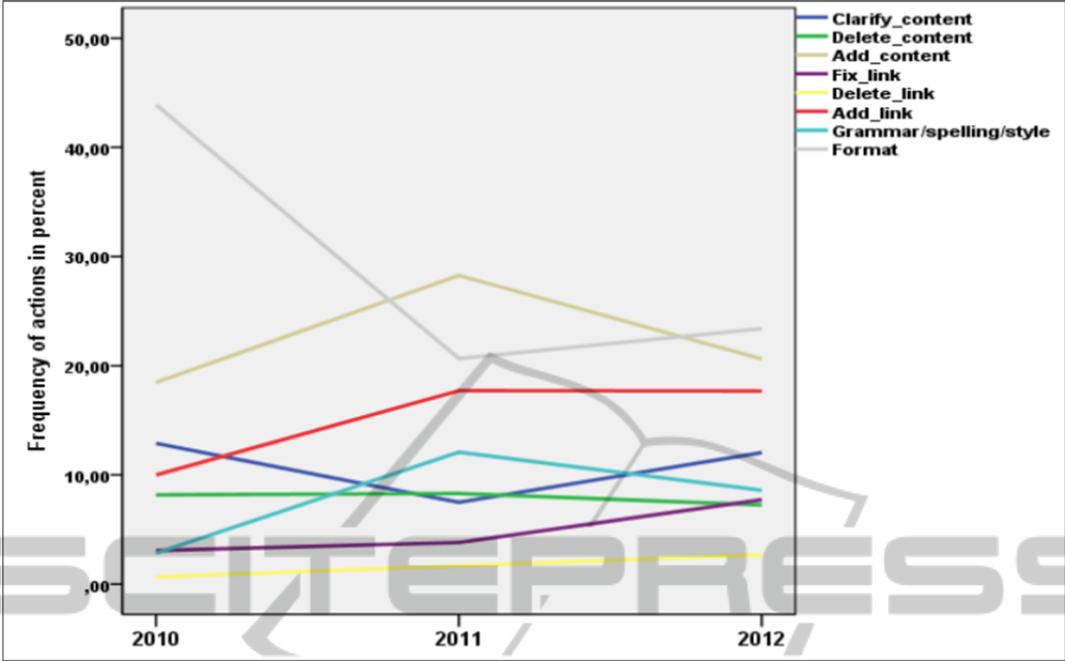


Figure 1: Evolution of student groups' actions (2010-2012).