WHAT KIND OF INTERACTION IS ACCOMPLISHED DURING THE CONSTRUCTION OF A WIKI?

Bianor Valente, Paulo Maurício, Ana Teodoro

Departamento de Educação em Matemática, Ciências e Tecnologia, Escola Superior de Educação de Lisboa, Instituto Politécnico de Lisboa, Centro Interdisciplinar de Estudos Educacionais, Escola Superior de Educação de Lisboa
bianorv@eselx.ipl.pt; paulom@eselx.ipl.pt; anat@eselx.ipl.pt

Resumo

Em educação, os wikis têm ganho uma crescente popularidade tendo vindo a ser usadas com diversos propósitos. No entanto a utilização desta ferramenta web 2.0 continua a ser relativamente recente.
A presente investigação pretende analisar a implementação e uso de cadernos de laboratório virtuais realizados com recurso a um wiki. Este trabalho foi desenvolvido numa instituição de ensino superior, no decurso de uma unidade curricular de biologia no âmbito da licenciatura em educação básica que visa a formação de professores do 1º e 2º ciclo do ensino básico e educadores de infância.
Nesta comunicação dirigimos a nossa atenção para o tipo de interação que se desenvolveu entre os alunos, em grupos de trabalho de 2 ou 3 elementos, aquando da elaboração do caderno de laboratório. Com esse objetivo, analisámos o tipo de edição e comparámos sucessivas versões de páginas de uma amostra de grupos que frequentaram a unidade curricular. Procedeu-se à categorização de contribuições individuais para o wiki e os dados obtidos do histórico do wiki foram analisados usando uma combinação de métodos qualitativos e quantitativos. Os resultados contribuem para enriquecer a compreensão acerca do uso dos wikis em projetos educacionais de cariz colaborativo.
Procede-se então a uma discussão dos resultados com o propósito de identificar fatores que possam levar a uma integração bem sucedida dos wikis no ensino das ciências, bem como a melhorar a confiança dos alunos futuros professores no uso de ferramentas web 2.0 com propósitos pedagógicos.

Palavras-chave: caderno de laboratório, ensino e aprendizagem colaborativa, interação de estudantes, formação de professores, wiki.

Abstract

In educational settings wikis are increasingly gaining popularity and they have been used for various purposes. However, the introduction of this web 2.0 tool in education is still a relatively recent development.
The current research aims to analyse the implementation and use of e-lab notebooks hosted within a wiki environment. This implementation was conducted at a state higher education institution, with students attending a course on biology in the last year of a 1st cycle of studies for pre-service elementary teachers and kindergarten educators.
In this study we focus on the kind of interaction that took place between the students, within the working groups of 2 or 3 members engaged in writing out the notebook. With that goal we analysed the type of edition and compared the successive page versions of a sample of groups drawn from the classes on the course. Individual contributions to the wiki were categorized.

Data obtained from the wiki logs were analysed using a combination of quantitative and qualitative methods. The findings provide a deeper understanding of the usability of wikis in collaborative group projects in education.
The results are discussed with the purpose of identifying factors that may lead to a more successful integration of the wikis in science lessons.

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

1. INTRODUCTION

The wiki in school learning management system (LMS) has several properties that are particularly suited to building support for online asynchronous collaborative learning activities. As Larusson and Alterman (2009) stated, these web 2.0 technologies require a 'modest level of skills' (idem, p.375) placing them within the technical reach of both science and non-science students and teachers. It is easy to co-edit and to preformat them in order to support a variety and broad range of learning activities. Moreover they exhibit a non-hierarchical control structure, enabling learners to feel as if they are working within a student-owned and centred workspace and enable tracking history of users' actions (Augar, Raitman & Zhou, 2004).

The use of information and communication technologies (ICT) in higher education requires a careful analysis of its implementation in order to realize its full potential (e.g. King 1998; Silva, Gomes, Oliveira & Blanco, 2003). The focus on a learner-centred curriculum favoured by educational research (e.g. Bonk & Cunningham, 1998) and the rapid growth of the internet in the 1990s have led to greater research on computer-mediated communication (CMC) (Romiszowski & Mason, 1996). However, ICT cannot be simply added to teaching and learning activities. Instead of following routines with ICT, students should be led to active learning and engage in collaboration. As a consequence it cannot be assumed that the use of ICT transforms science education in all cases for the better. Osborne and Hennessy (2003) emphasise the role of the teacher in creating the conditions for ICT use and for selecting and evaluating appropriate ICT tools and, moreover, in designing teaching and learning activities.

The intention of this study is to address the implementation of a wiki as an e-lab notebook at a state higher education institution in Lisbon, with students attending a course on biology in the last year of a 1st Cycle of studies (3 years, 180 ECTS) for pre-

service elementary school teachers and kindergarten educators. We conduct an analysis of the kind of interaction fostered in the learners who attended the course following our previous work (Valente, 2012). There, we had briefly outlined the difference between cooperation and collaboration. Based on the literature (Roschelle & Teasley, 1995) a link exists between learners' collaboration, their mutual engagement in a task, interaction and sharing. Here we proceed in the distinction between the two constructs, cooperation and collaboration, although most of the literature uses them interchangeably (Tu, 2004). The analysis carried out by Tu (2004) follows and develops that of Roshelle and Teasley (1995). According to Tu (2004), 'Collaborative learning uses small groups of learners (…) encouraging them to maximize their own, and each other's, learning' (p.12). Moreover, it 'engages learners in knowledge sharing, inspiring each other, depending upon each other, and applying active social interaction in a small group' (idem, p.12). Thus, the constructs presented in Roschelle and Teasley (1995) are found also in Tu (2004) and offer a solid basis for our analysis.

2. METHODOLOGY

We chose collaborative action-research as our methodological frame (Kemmis & Mctaggart, 2006) and to each research question we applied what we think to be the best technique. According to Kemmis and McTaggart (2006), action-research is linked to the research of concrete practices, not abstract ones. It differs from other research forms in its insistence on focusing on the research and reframing of 'particular practices, of particular people in particular places' (idem, p.564). Following these authors, 'what makes action-research 'research' is not the machinery of research techniques but an abiding concern with the relations between social and educational theories and practice' (idem, p. 574). Action-research is then put into effect in our study with a set of steps of reflection and observation, planning and acting. This study intends to report on the status of our research at the end of a cycle of action-research.

In order to explore the implementation of the wiki, the present study focuses on the following research questions:

- What was the nature of group participation in wiki collaborative writing?

- What can we do to foster collaboration?

2.1 Reasons for choosing the wiki

The *Living world* is a biology unit of a third year of a pre-service education cycle of studies. It has a theoretical and a practical component. During the practical lessons, students carry out different kind of activities such as observations, experiments and investigations, among others. Since 'learning the language of science is a major part (if not the major part) of science education' (Wellington & Osborne, 2001, p. 2) but also 'a major barrier (if not the major barrier) to most pupils in learning science' (idem, p.2), over 2 years (2009/2010 and 2010/2011) students were asked to construct a lab notebook to record all these activities.

One of the main goals of this lab notebook was not only to help students to recall what they saw, did and discussed, but also to structure their own thinking and promote reflection. Helping students to become conscious of the importance of recording in scientific activity was another purpose of this lab notebook. In addition, with this instrument we aimed to assess students' learning, and to identify their alternative conceptions, advances, retreats, and motivations.

However, after thorough reflection, we realized that one of the main objectives of this instrument was not being achieved: the formative evaluation. We decided to search for instruments that could fulfil our goals and, given the features of the wikis, we opted to construct the lab notebook using this tool.

Bearing in mind the variety of wikis, we chose to use the one available at the LMS of our school (Moodle). This software allows the creation of new pages and the edition of other users' pages (word processing, insertion of images, creation of tables, etc.) and also the possibility for both students and professors to comment on all editions. It also has the history section where all versions are recorded. Our choice was based on the following features: firstly, all communication within the course is done using this LMS and students are familiar with it. Therefore, an environment recognized by the students would help them to feel more confident. Secondly, to enter the LMS it is required a user's authentication, which is essential to assure the privacy we wanted. And finally, the wiki is simple to use. Nevertheless, it has an important shortcoming of

which we were not aware at the time: this wiki has no alert update options for the activity of users.

2.2 Wiki-based collaborative writing design and implementation

In the first lesson, in order to explain the technical features of the wiki, the teacher simulated all the necessary steps to create the front page, new pages and hyperlinks. Other editing actions were also discussed (image insertion and text modifications). There was also a reference to the comments and history functionalities of the wiki and the students were encouraged to explore the wiki's editing features in a wiki created for that purpose. A forum to discuss possible difficulties was also created.

After exploring the wikis, the class was divided into groups of two or three members, based on the students' preferences. The teacher listed the number, type and application date of the different tasks that students should record in the wiki: I) general characteristics of optical instruments; II) image orientation obtained from the microscope and glass magnifier; III) observation of animal and vegetable cells; IV) factors that influence germination of plants.

In order to respect the individual style of each group, no restriction on the wiki structure was imposed. The evaluation strategies were also explained: after each application date the teacher would comment on the work and, based on those comments, the students were expected to reformulate it. They were also informed that the level of collaboration and reformulations would be taken into consideration for the assessment. After these explanations the teacher asked students to choose between a private wiki for each group or a private group for each class. Since the topics were the same for each group, with the exception of one activity, students expressed many concerns about the possibility of seeing the work of others. For this reason, we chose to make private wikis, that is, students did not have access to the wiki pages of other groups.

2.3 Participants, data collection and analysis

This strategy was implemented in all the six classes attending the *Living world* unit, which comprises 141 students, divided into 63 groups. One of the classes, with 21

students, was randomly selected for this study. There were nine groups of two students and one group consisting of three students.

In order to establish the level of collaboration and cooperation that took place we gathered information from the wiki tracking system to develop a measure of students´ contributions. First we analysed the date, time and student identity of each version file. Since many versions were done by the same student during a short period of time, all the successive versions created within one hour were 'collapsed' and treated as a single editing session. We proceeded by computing the number of page versions within all wikis, within groups and by each student for each task before and after teachers' comments. To assess the type of edition, successive page versions were then compared and categorized using the following categories: 1) Adding new information; 2) Expanding ideas; 3) Reorganizing ideas; 4) Deleting ideas; 5) Replacing ideas; 6) Correcting error; 7) Correcting scientific concepts; 8) Formatting.

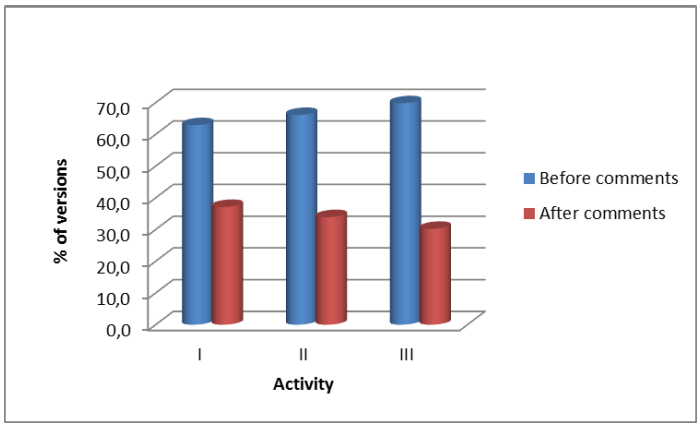
3. RESULTS AND INTERPRETATIONS

3.1 Page versions

The overall number of versions during the first three activities, for all students and across all groups, was 251. However, the number of versions was not equally distributed among the three tasks assigned: for the first task there were a total of 97 different versions, 59 for the second and 102 for the third. It should be noted that the nature of these three tasks was different, the second being considerably simpler than the others.

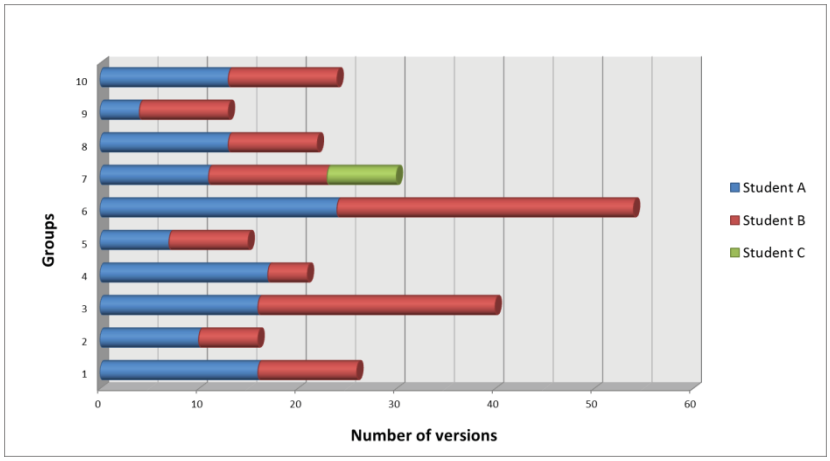
As we stated elsewhere (Valente 2012), the teacher made several comments for each task. Figure 1 displays the work distribution assessed by the number of versions before and after the teacher's comments. The percentage of page versions created after teachers' comments was approximately similar across the three activities (ca. 30%).

Figure 1- Percentage of page versions before and after teachers' comments (activities I, II, III)



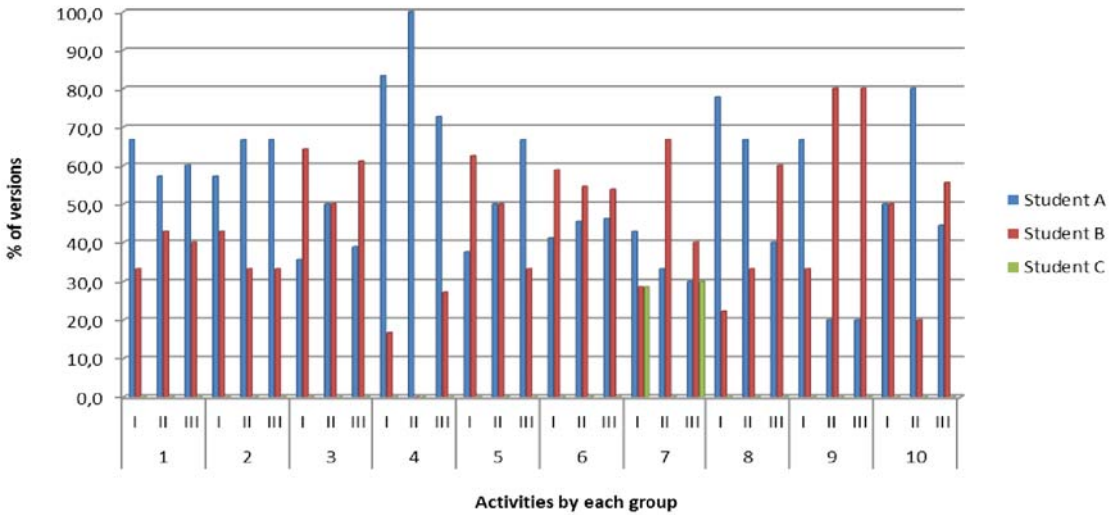
When considering the first three activities, the number of page versions varied considerably among groups, group 6 being the most active, with 54 versions and group 9 the least, with 13 versions. The degree to which students contributed to the wiki also varied from 4 to 30 editions versions (Figure 2).

Figure 2- Contribution of each student (A, B or C) in each group, expressed by number of page versions (activities I, II, III)



This contribution was further analysed by task. Figure 3 shows that, although the majority of students were engaged in the wiki construction, two students did not contribute in one task (groups 4 and 7). Another finding is related with the similarity of each student's contribution in the different tasks.

Figure 3 - The extent to which each member of the group contributed to each activity (expressed in percentage)



Regarding the last activity, activity four, the strategy adopted by the majority of the groups was different. Since they had to answer three different questions related with factors that influence plant germination, eight groups created a page for each question. After analysing the number of versions per student we found that they had divided the work among themselves. Besides that, even when all students contribute, the degree of this contribution is even more unequal, both in terms of number and duration, with the contribution of one member occurring only in the final version. Probably this behaviour indicates that during this activity students were clearly more worried about the final product than about the process.

Even when the groups answered all the given questions on a single page, the track system indicates that one student worked much more in defined sections of the wiki. Once again, we believe that these findings are closely linked with the nature of the task.

3.2 Analysis of type of edition

A detailed analysis of table 1 shows that addition was the most frequent type of edition, with more than 50% of the versions including this type of action. Regularly, at the beginning of the writing process this was the only contribution that students made to the wiki. In later versions, adding new ideas persists but associated with other actions. In particular, before the teacher's comments, group number two has only made additions to the wiki. This pattern suggests that, while adding new information, students probably did not read the information previously posted.

Table 1 – Type of edition by percentage of total number of versions

Group	Add	Expand	Delete	Reorganize	Replace	Correct errors	Correct scientific errors	Format
1	69,2	30,8	15,4	15,4	30,8	**50,0**	23,1	34,6
2	87,5	**12,5**	18,8	**12,5**	31,3	**12,5**	**12,5**	43,8
3	57,5	30,0	**7,5**	15,0	**5,0**	25,0	**5,0**	35,0
4	76,2	23,8	33,3	**14,3**	23,8	**14,3**	**14,3**	28,6
5	73,3	**13,3**	**6,7**	**0,0**	**6,7**	33,3	**0,0**	**13,3**
6	53,7	22,2	**5,6**	**7,4**	**5,6**	**5,6**	**7,4**	18,5
7	53,3	23,3	**13,3**	20,0	20,0	23,3	**3,3**	43,3
8	72,7	27,3	**13,6**	**9,1**	22,7	22,7	**9,1**	27,3
9	61,5	**7,7**	30,8	**0,0**	15,4	15,4	15,4	15,4
10	70,8	29,2	25,0	**12,5**	20,8	25,0	**8,3**	16,7

Moreover, deleting and reorganizing were the two categories of actions with lower frequency. Although addition is important, the other content categories involve a much more collaborative interaction between students.

4. DISCUSSION

The effect of the task on collaboration in wiki environments has been studied, especially in second/foreign language classes (Lee, 2010; Lund, 2008; Mak & Coniam, 2008). In science education this aspect has not been explored as much as it should. Our analysis reveals significant differences between activities, especially in the last one where we found evidence of a cooperative rather than a collaborative behaviour. Considering that the learning environment was the same for all four activities, we think it is reasonable to point to the nature of the activity as the cause for this interactional behaviour. Our results are in accordance with Li's (2012) opinion that the design of the tasks is significant for the implementation of wikis intended for collaborative learning. This finding is probably explained by the students' perception about the value of individual participation for their assessment: at the beginning, the importance of all members engaging in every activity was stressed rather than the level of collaboration in each part of the activity. Previously we had found that the assessment process was one of the students' major concerns and this issue may have triggered an 'obsessive' concern with equal number and size of wiki versions (Valente, 2012). Due to the scale of the last activity, students may have worked under the 'assessment obsession' for the activity rather than towards the collaborative process.

Although we have made several efforts to enhance students' familiarity with the wiki features, we did not conduct any kind of preparation to help students towards the collaborative writing. Based on these results we believe, like Hadjerrouit (2012), that a prior explanation about the difference between cooperation and collaboration may benefit students' achievement.

As we reported elsewhere (Valente, 2012) the on-line communication was almost non-existent and the comments section was not used by students. In consequence, self or co-explanation, reflection and other metacognitive tasks were not fostered by the wiki. We believe that at a certain point, the features available in the wiki used were no longer sufficient to enhance communication. This is in accordance with Larusson and Alterman (2009) when they stress the importance of increasing the forms of communication in order to ease students' coordination. Therefore, in future implementations this is an improvement that needs to achieved.

We also found a difference between the number of versions and the type of actions that took place in the wikis. This is particularly relevant in terms of evaluation of the students' work. It is clear that evaluating the interaction based solely on the number of visits is not enough and it is even misleading. However, a deeper analysis of the type of interaction using conventional methods is extremely time-consuming for the teacher. This difficulty is obviously a problem that needs to be taken into account in the next academic year: how to assess the level of collaboration? We believe that finding an additional tool to automatically assess individual contribution and collaborative process may be a solution to this problem.

Unfortunately, the Moodle LMS did not allow us to track navigation events. For example, we do not have information about the number and duration of visits without editing. We believe that this information would be important in order to follow students' involvement in the wiki construction. Another limitation of our work is related with the lack of information on the students' interactions that occurred offline outside the classroom and on-line using other ICT tools. Although this is beyond the scope of this study we consider it relevant for a more complete understanding of

student's interaction with an e-lab notebook and we aim to analyse this aspect in a future study.

REFERENCES

Augar, N., Raitman, R. & Zhou, W. (2004). Teaching and learning online with Wikis. *In* R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: proceedings of the 21st ASCILITE Conference,* p.95-104.

Bonk, C. J. & Cunningham, D. J. (1998) Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. *In* Curtis Jay Bonk & Kira S. King (Eds.), *Electronic Collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (p. 25-50). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Hadjerrouit, S. (2012). Pedagogical Criteria for Successful Use of Wikis as Collaborative Writing Tools in Teacher Education. *Proceedings from the 3rd International Conference on e-Education, e-Business,e-Management and e-Learning*, IPEDR, p.11-15.

Kemmis, S. & McTaggart (2006). Participatory action research: Communicative action and the Public Sphere. *In* N.K. Denzin & Y. S. Lincoln (Eds.) *The Sage handbook of qualitative research* (3th ed. p. 559-603). Thousand Oaks, CA: SAGE

King, K. S. (1998). Designing 21st –Century educational networlds: Structuring electronic social spaces. *In* Curtis Jay Bonk & Kira S. King (Eds.), *Electronic Collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (p. 365-383). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Larusson, J. A. & Alterman, R. (2009). Wikis to support the "collaborative" part of collaborative learning. *Computer-Supported Collaborative Learning* 4(4), 371–402.

Lee, L. (2010). Exploring wiki-mediated collaborative writing: a case study in an elementary Spanish course. *CALICO Journal, 27*(2), 260-276.

Li, M. (2012). Use of Wikis in second/foreign language classes: A literature review. *CALL-EJ, 13*, 17-35.

Lund, A. (2008). Wikis: a collective approach to language production. *ReCALL, 20*(1), 35-54.

Mak, B. & Coniam, D. (2008). Using wikis to enhance and develop writing skills among secondary school students in Hong Kong. *System, 36*, 437-455.

Osborne, J. & Hennessy, S. (2003). *Literature review in science education and the role of ICT: Promise, problems and future directions.* A report for NESTA Futurelab (Report 6).

Romiszowski, A., & Mason, R. (1996). Computer-mediated communication. *In* D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (p. 397-431). New York: Simon & Schuster.

Roschelle, J. & Teasley, S. (1995). The construction of shared knowledge in collaborative problem solving. *In* C.E. O'Malley (Ed.), *Computer-Supported Collaborative Learning*. (p. 69-197). Berlin: Springer-Verlag.

Silva, B., Gomes, M. J., Oliveira, L. R. & Blanco, E. (2003). The use of ICT in higher education: Work in progress at the University of Minho. Barcelona: Universitat Oberta de Catalunya. Retrieved from http://www.uoc.edu/dt/20137/index.html

Tu, C.-H. (2004). *Online collaborative learning communities: Twenty-on designs to building an online collaborative learning community.* Westport, Connecticut: Unlimited libraries.

Valente, B.,Maurício, P. & Teodoro, A. (2012). Pre-service teachers ideas of collaborative work when using a wiki to construct a lab notebook. *4th International Conference on Education and New Learning Technologies - Edulearn Proceedings*, p. 1525-1534.

Wellington, J. J., & Osborne, J. (2001). *Language and literacy in science education*. Open University Press.