New Method Using Wikis and Forums to Evaluate Individual Contributions in Cooperative Work while Promoting Experiential Learning: Results from Preliminary Experience

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Abstract

This paper shows a new method for using Wikis, forums, and other web-based productivity tools in blended learning strategies [20][22] to promote the acquisition of competences in Higher education [4] while enhancing experiential learning of students [16] in social collaborative knowledge building scenarios. This methodology also facilitated the grading of student individual contributions in cooperative work, helping to detect any shortcomings that may prevent student active involvement in their learning process, allowing to conduct not only product evaluation but also process evaluation. Based upon previous successful experiences, the free, on-line software platform, TikiWiki CMS/Groupware, was selected to achieve this methodology. [5][6][10][11]. Students had to think about "What's the 'type of contribution' that I'm going to make right now?" before submitting new contributions in forums, comments, or document editions (either text or spreadsheet based). Each student's contribution type and size (in bytes) was stored in a log on the website, and could be queried, filtered, and exported for further analyses. The method was tested on an Environmental Sciences course, and its strengths and weaknesses are discussed in the paper. The method description includes a suggested process to convert student contributions (type and size) into numerical grades. However, the main potential of this method is not just final assessment for student accreditation, but serving data for tutorships with students along the process of the learning activities, in order to detect and revert whatever handicaps that prevented some students improving their contributions to the group work or cooperative learning "in time" (much prior to assignment submission to teacher). This preliminary study resulted in a three-times greater time investment by teachers. Further data needs to be collected to better estimate the true costs of this new method.

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Categories and Subject Descriptors D.2.2 [**Design Tools and Techniques**]: User interfaces. H.3.1 [**Content Analysis and Indexing**]: Indexing methods. H.4.1 [**Office Automation**]: Groupware, Spreadsheets, Word processing. I.7.1 [**Document and Text Editing**]: Document management. K.3.1 [**Computer Uses in Education**]: Collaborative learning.

General Terms. Measurement, Human Factors, Design, Experimentation

Keywords Experiential-reflective learning, Knowledge building, Assessment, Individual Contributions, Computer Supported Cooperative Learning (CSCL), Action log, Tikiwiki CMS / Groupware.

1. Introduction

This paper describes using wikis, forums, and other computer tools to help teachers evaluate individual student contributions within groups or cooperative learning environments. This approach enhances the acquisition of "competences" in Higher education [4] and causes students to better think about the type of contributions they make (or planned to make) in groups, as part of "blended learning" scenarios [20][22].

1.1 Conceptual framework

The "experiential-reflective learning" pedagogical model underlies this project [16]. This model, initially designed at the University of Harvard, is not well known in higher education, despite its enormous potential. It allows for teaching with a student-centered approach, promoting each student's capacity to learn and enhancing the development of creative and critical thought abilities.

The experiential-reflective learning occurs when a student observes and reflects on a prior experience, and then performs some type of abstraction, thereby integrating those reflections with prior knowledge. These abstraction are used as guides for subsequent actions.

The experiential-reflective learning describes the acquisition of knowledge in a cycle of learning of four successive phases: (1) "Concrete Experience", (2) "Reflective

Observation", (3) "Abstract Conceptualization", and (4) "Feedback or Active Experimentation".

Kolb's model of these four phases is a simple description of the learning cycle that shows how the experience (1) is translated through the reflection (2) into concepts (3), that, in turn they are as guidelines for feedback or active experimentation, and ultimately to plan new experiences or create alternate actions(4). In this method, the processing of concepts, competences and acquiring of attitudes is understood from the point of view of the students.

In the experiential-reflective cycle, students are asked to define the type of contribution they made (or are making), when they interact with their companions (when discussing or editing documents). Students agreed that the community does help them learn more and faster [2]. They were also more conscious of contributions they made (and of what type), since these contributions were the basis by which they were going to be evaluated. Additionally, they were required to be self-motivating in order to make significant contributions to the electronic discussions or when editing a group document. Our premise was, by helping students be more conscious of its own learning process, they can obtain better learning results [18].

Therefore, our objectives were to: (a) Stimulate the experiential-reflective learning of students by forcing them to answer the question "*What type of contribution is the one that I am going to do – or I am doing – myself right now?*"; and (b) Assist teachers in assessing the individual contributions of students, both individual and collaborative, when the teacher was not present during the contribution.

1.2 Computer tools to support the project

Recent years have seen a significant increase in the use of computer tools for collaborative work in university educational environments [12][6][1]. In this process, the problem is used to be located at the learning of the tool, in a first instance. This comprises from forums usage to spaces like "Wikis" [3][8][9], including more complete environments as the corresponding to the e-portfolios [11]. And most students are not used to them at all yet.

After introducing students to these computer tools, it becomes important to ensure that each student's contribution is not based upon simply copying and pasting information from other sources. Additionally, students should use the tools to explore and contrast opinions, not merely list them. Although computer tools can help students take a more active role in collaborative construction, simple participation by using these tools does not guarantee learning and the construction of knowledge [23]. Teachers also tend to miss the more elaborate contributions; those that involve complex interactions in which doubts are expressed, problems & suggestions are proposed, and the participants use prior information to develop new hypothesis and alternatives.

An additional, more difficult problem, may arise: monitoring and evaluating students' activities [14][21], beyond a simple log of students connections, which pages they have seen, or documents downloaded [17]. Indeed, the teacher that develops an activity of social knowledge building with these tools [10], can be found in a complex situation by the own nature of these tools which are not ready for such uses.

2. Methods

2.1 Teaching scenario

This method was studied using the 2005/06 course, "Evaluation of Environmental Impact", from the 6th semester of Environmental Sciences degree at University of Barcelona, Spain (http://uniwiki.aia06.ourproject.org). The course contained 52 registered students, divided into groups of 20, 19 and 13 students (groups T1, T3 and T4, respectively). The author of this paper served as the teacher for groups T3 and T4. Only results for group T3 are included in this paper, since there seemed to be no relevant differences between both groups.

The project developed in the practical classes of this subject (3 credits out of 9 when including theory). Students were required to integrate knowledge obtained from prior university degrees or from their own experiences. The assignment for each group was to collaboratively create a document that relates to a system of environmental management, such as an environmental audit or a plan of environmental improvement (these examples were used by a previous course and this course, respectively).

This work comprised 30% of each student's final grade for the class. The work shown here was from January until July 2006, and included some meetings in person with students (1 meeting in weeks 2, 5, 8 and 12) as well as days of autonomous work, from weeks 2 to 11 (Figure 1).

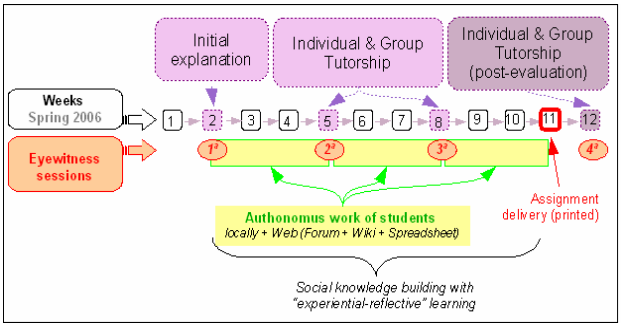

Figure 1. Action plan of the eyewitness sessions with students and faculty. For more information, see text.

Students were requested to choose one or more contribution type, from a semi-closed lists (Table 1). They could also suggest new contribution types to be added to the list during the first weeks of the course, if teachers agreed.

Table 1. List of "contribution types" used in the project. ("I" stands for Contribution importance in evaluation; the more asterisks, the greater relative importance)

I	Contribution type	Description
	Others (report)	Other contribution type not listed in the menu at present (report which one to teachers)
*	Organizational aspects	Proposals and other questions related to the organization of the work team, scheduling,....
*	Improvements in markup	Improvements in markup, spelling, etc. (bear in mind that final document quality for printing (nicer tables, paginated table of contents, page markup...) will be performed at the end
*	Support requests	Simple questions, help requests, etc. without too much making of previous information
**	Help partners	Help group or course mates who asked questions, requested support, formulated doubts, etc. (group or course forum)
**	New information	New information has been added to text or discussion
***	New hypotheses	New hypothesis has been prepared from preexisting information, and possibly, some new information (if so, mark option ' New information ' also)
***	Elaborated questions and new routes to advance	Elaborated questions and new ways to move forward in the work which they were not taken into account previously (not just simple questions or elementary requests of support)
***	Synthesis / making of information	Synthesize or refine speech with preexisting information

2.2 Technology deployed

Tikiwiki CMS/Groupware v1.10 (http://tikiwiki.org, from now onwards, "Tiki") was used as the Web platform to support not eyewitness group activity from students, following other previous successful experiences [5][6][8][9][10][11]. Tiki is feature rich and versatile enough to produce the desired learning environment. Main used features were Wikis [3] with their Plugins, Forums, Comments and Spreadsheets with Contribution feature activated on all of them, on the student side, and Action log, in addition, on the teacher side. Other authors have explored other ways of using Wikis in education [6][19] and in other fields [13], but the methodology used in this experience is a novel approach that had never been applied up to date.

Because it would be difficult for such a large group to meet in person and fully discuss every single issue that may arise during the 10-week period, students were encouraged to use the web platform to create and edit the document they had to write, and to maintain discussions by using forums or comments on Wiki pages (Figure 1). For each new message that students made, they had to select the contribution type(s) (Table 1) from a form, that best identified their message. Similarly, when editing a Wiki page, Tiki spreadsheet or adding comments to any other object such as file galleries and image galleries, students were shown a similar form to identify the contribution type (Figure 2).

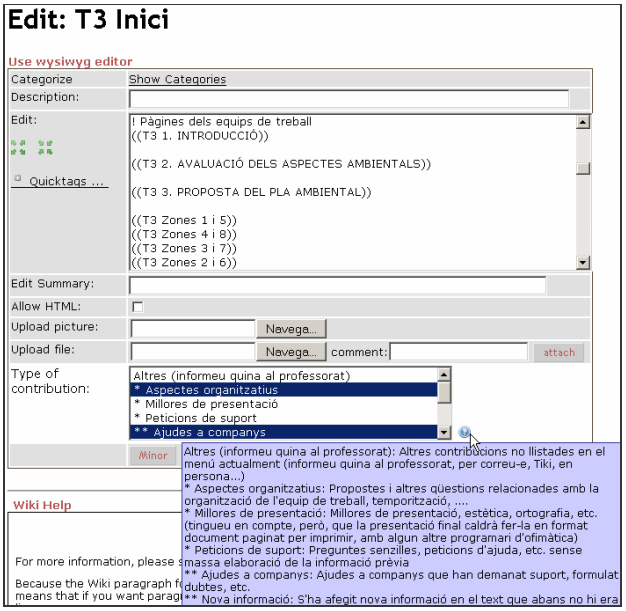

Figure 2. Example of Wiki page at edition time, where a box with multiple selection of "Type of contribution" is observed in the lower part, and a help icon on its right ( ) with an emerging explanatory pop up box.

Information detailing each student's contribution (type/s and size), was recorded in the Tiki action log, and types could be re-associated by the teacher, if necessary.

2.3 Numerical measurement of individual contributions in cooperative group work

Knowing both type and size of contributions provides an initial method of valuing each student's contribution.

However, using size by itself has the limitation of not evaluating the quality of each student's contribution. Although two students can each include 5 kilobytes of "synthesis of the information", (recorded as the same

quantity and quality of contribution for both of them), one contribution could be more elaborate than the other.

As in the use of any technology, this computer-mediated methodology should not be a substitution of evaluation by teachers. Rather, it can be used to assist teachers in their evaluation and grading of students. And if reflection of students is stimulated concerning their individual contribution types (and which ones are the most valued, according to the objectives of the course), as in this case, therefore it is more probable that students learn more and better, through their experiential-reflective learning cycle. They are more conscious about what they do know, or the abilities they already execute without difficulties, and about what they do not know or have not acquired yet.

Each student's final grade was determined by multiplying the group grade by an individual weighting factor for each evaluation criterion (Table 2). This procedure allows teachers to have an extensive range of learning evidences, that include as much the process as the final product, with variety of focus, contents, methods and instruments, as it is recommended in the European Space of Higher Education.

The group grade was determined by the overall quality of the final product delivered to the teacher – a document with the printed version of the assignment --, as well as the teacher's impression of how well the group functioned.

The weighting factor took into account the order of magnitude of the total bytes added and deleted by each student, respect the average on order of magnitude for the same criterion considering all the working group, so that it ranged from zero to 1. The order of magnitude was calculated from decimal logarithms, since the result indicates if contribution size was in terms of bytes, tenths of bytes, hundreds of bytes, kilobytes, ...

3. Results and discussion

3.1 Contributions in groups

Students of group T3 carried out contributions, in general, for the entire 10 week period, in order to add new information, synthesize it and discuss organizing aspects, including some modifications to improve the presentation of the content along the process, by order of greater to smaller quantity of information contributed or suppressed.

The average (± standard error) contribution size by student in the 10 weeks in total was 15.8 ± 3.0 kb for group T3, and 13.1 ± 3.9 kb for group T4. As for the suppressions of content, the averages were 4.8 ± 1.2 kb and 3.4 ± 1.2 kb, for groups T3 and T4, respectively. These numbers don't include information from the last edition work by the person with the editor-in-chief role.

This person exported the final content from the Wiki into a word processing program, in order to paginate the final paper, including headers and footers, paginated table of contents, spelling and grammar checking, etc. This was taken into account manually by teacher, since it was not logged in database (Table 2).

Table 2. Evaluation criteria, estimation methods and grading percentage. "(*P*)" *(Process):* information was obtained from discussion and document edition time; "(*FP*)" *(Final Product):* from printed final document (students wrote their names where they contributed)

Criteria	Estimation method	%
Teamwork	*(P)*: Sum of sizes of all contribution types	15
Synthesis & clarity of information	*(P)*: Statement (corrected) of students, and sum of sizes of specific contribution type ("*** *Synthesis / making of information"*)	30
Quantity & quality of contributed information	(a) *(P)*: Statement (corrected) of students and sum of sizes of related contributions types ("** *New Information*", "*** *New hypothesis*", "*** *Synthesis / making of information*"), and (b) *(FP)*: Revision by teachers of individual attribution statements of each section at final printed document	40
Formal quality of work	(a) *(P)*: Statement of the students and specific contribution size and type ("* *Improvements of presentation*"), and (b) *(FP)*: Arbitrary scoring by teachers to last work by editors-in-chief to final document prior to printing	15

3.2 Individual contributions

In general, the individual contribution from each student was very diverse, as expected in group works, oscillating from people that contributed with modifications from the order of magnitude of 50 kb of text (Figure 3, for group T3, which corresponds to more than 3 times the average of all the students), to others that were below 5 kb of content (a third of the average).

However, few students formulated new hypothesis, or elaborated questions or comments which supposed new ways to move forward, or that supposed solutions to new situations that they did not know how to initially confront.

Nearly all students contributed (either through discussions in forums or through document editions), but only between a third and the half of them (for the groups T3 and T4,

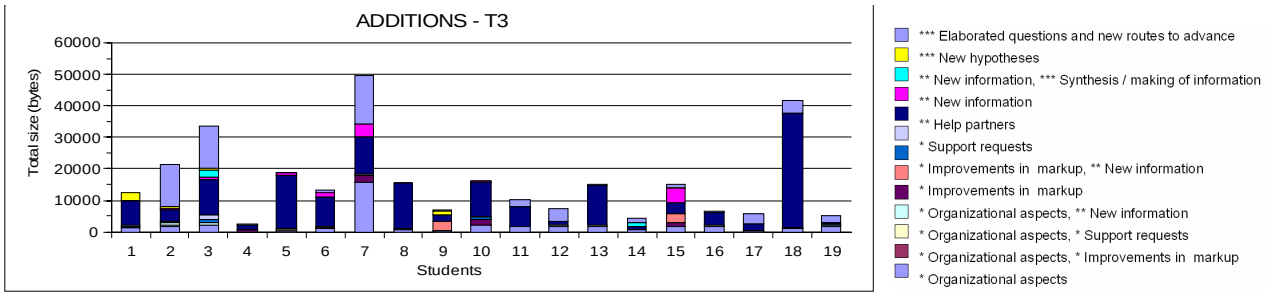

Figure 3. Contributions as additions of content, in bytes for group T3, for the whole period of 10 weeks. Same type of graph existed for deletions of content (not shown).

respectively) contributed notably to the prior information added by themselves or their mates. This result is low, but satisfactory when compared to the earlier year: the same students made even fewer contributions according to their teacher [Pilar López, personal communication]

4. Conclusions

4.1 Strengths and weaknesses

4.1.1 Strengths

This methodology: (a) allows the students to participate in their own learning process, giving them greater opportunities for self-regulation of their effort invested to develop the specific and cross competences; (b) allows teachers to have quantitative data to characterize the contributions of each individual of a work group [15]; (c) means a substantial improvement respect to traditional methodologies in the ability to evaluate student learning when teachers are not eyewitness of the activities; (d) facilitates the personalized tutorship "in time" so each student can realize what aspects he/she has adequately developed, what other aspects have not been adequately developed (and remedy can be put in time); (e) allows teachers to distribute more homogeneously in time the task to supervise, validate or correct and feedback to students.

4.1.2 Weaknesses

This methodology also released other aspects that may be considered weaknesses of the system. This methodology: (a) computes "quantity" of contributions (sum of bytes added, sum of bytes deleted) but it does not appreciate the intrinsic quality of the edited text. Therefore, the critical reading, validation and appraisal of students contributions by teachers is necessary; (b) can be inadequate if it is used to promote "police control" of students actions. The main potential of this method is not just in the final evaluation for student accreditation, but in serving data for tutorships with students along the process of the learning activities, in order to detect and revert whatever handicaps that prevented some students improving their contributions “in time” (prior to assignment submission to teacher); (c) could have some students who refuse to use it, if they previously have had a negative experience with Wikis. This may be, due to lack of adequate prior instruction about the best practices for using Wikis. [7]; (d) requires that teachers dedicate more time to the evaluation of the student contributions (type and sums of sizes). In our case, this required three times the amount of time to evaluate (only) the final product of a person or group without taking into account the whole process prior to printing [13]. This educational methodology might suppose between the two and three fold the time invested by the teacher in global for all the associated activities with the subject: preparation, development (eyewitness classes, tutorships, other duties), evaluation and trips. Further data from new study cases needs to be collected to better estimate the costs of this new information.

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