Extending Traditional Learning by Enforcing Collaboration and Self-assessment

Jernej Vicic, Branko Kavsek, Matjaz Kljun, Andrej Brodnik
University of Primorska, Faculty of Education Koper
Cankarjeva 5
6000 Koper
Slovenia
jernej.vicic@pef.upr.si, *branko.kavsek@pef.upr.si*, *matjaz.kljun@pef.upr.si*, *andrej.brodnik@pef.upr.si*

Abstract. *The paper presents a way to overcome the shortcomings of traditional learning by enforcing collaboration between students and introducing self-assessment as part of the process of final grade formation.*

Treating collaboration and self-assessment as two elements of a modern learning process that are very closely bounded together, the authors argue that these elements should by no means replace the traditional (ex-cathedra) way of learning but rather extend it.

A specifically designed computer science course is presented as an illustration of how the introduction of self-assessment combined with teacher evaluation can encourage collaboration between students. The benefits and drawbacks of this method are discussed.

Keywords. collaboration, self-assessment, traditional learning, e-learning, blended learning, Learning Management System (LMS), Information Communication Technology (ICT), social constructivism.

1. Introduction

With widespread use of computers and internet in everyday life and consequently in schools there is a general tendency to replace traditional learning methods with modern computerized alternatives that are nowadays known as *e-learning* [5].

Many authors however, argue that traditional approaches to learning will never be completely replaced by e-learning approaches. It has presently become widely accepted that e-learning is regarded to as a bunch of computerized (or ICT) tools that extend traditional learning. The combination of traditional and e-learning approaches has become known as *blended learning* [13].

We present an approach similar to blended learning with an important difference. Our approach does not rely on ICT to extend traditional learning but rather tries to overcome its shortcomings by enforcing collaboration between students and introducing self-assessment as part of the process of final grade formation.

Treating collaboration and self-assessment as two elements of a modern learning process that are very closely bounded together, we argue that these two elements naturally extend traditional learning approaches.

A specifically designed computer science course (a case study) is presented as an illustration of how the introduction of self-assessment combined with teacher evaluation can encourage collaboration between students.

As stated before, our core approach does not rely on ICT. However, in our case study ICT is used because of its many benefits in material preparation and delivery. Moreover, the use of ICT in our course delivery showed an additional increase of student's motivation to learn.

The paper is organized as follows. In Section 2 we give the motivation for our work by presenting the shortcomings of traditional learning approaches. Section 3 introduces the use of collaboration and self-assessment as possible extensions to traditional learning. At the same time, by extending traditional learning methods, we try to overcome their shortcomings. A case study (a computer science course) is presented in Section 4 illustrating the principles from Section 3 "in action". Section 5 gives some concluding remarks and suggests directions for further work.

2. Motivation

Why to use collaboration and self-assessment as elements of a modern learning process to push traditional learning on a higher qualitative level?

Let's have a look at learning from the point of view of social constructivism [17]. Anderson and Speck define seven principles of social constructivism [2]:

- Multiple interpretation of knowledge,
- Learning as an active process,
- An emphasis on the learning process as well as the end product,
- Problem solving in real world situations,
- Shared power by teachers and students,
- Collaboration in the learning process, and
- An opportunity for students to publicly share their work and reflect on what they have learned.

As we can see from the above list of principles, collaboration is one of them. Self-assessment is used, in our case, to promote and enforce collaboration.

The other principles, in particular multiple interpretation of knowledge, learning as an active process, shared power by teachers and students, and the opportunity for students to publicly share their work and reflect on what they have learned, follow naturally from collaboration as we show in Section 4, illustrating all through a case study.

3. Extending traditional learning

The idea is to extend traditional learning by enforcing collaboration between students and introducing self-assessment as part of the process of final grade formation.

Self-assessment involves students taking responsibility for monitoring and making judgments about aspects of their own learning. Self-assessment can be a way of assessing the product of learning but it is a learning process in itself. It is a way of improving student learning by passing on skills of evaluation and critical judgment to students. In this sense the term "self evaluation" may be more appropriate since it is about developing students' ability to make judgments about the quality of material.

The concept of collaborative learning, the grouping and pairing of students for the purpose of achieving an academic goal, has been widely researched and advocated throughout the professional literature [6, 8, 12, 14, 16, 18]. The term "collaborative learning" refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another's learning as well as their own. Thus, the success of one student helps other students to be successful.

Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. According to Johnson and Johnson [6], there is persuasive evidence that cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers [16]. Figure 1 illustrates the process of collaboration in learning.

In spite of these advantages, most of the research studies on collaborative learning has been done at the primary and secondary levels [6, 9]. As a comparison, there is relatively little empirical evidence on its effectiveness at the college level. However, the need for noncompetitive, collaborative group work is emphasized in much of the higher education literature [14]. Also, majority of the research in collaborative learning has been done in non-technical disciplines [8].

Here we try to accomplish exactly this: analyze collaborative learning at the college level and in a technical discipline, namely computer science. Next section presents a case study, where we tried to promote collaboration between students in a computer science course through self-assessment.

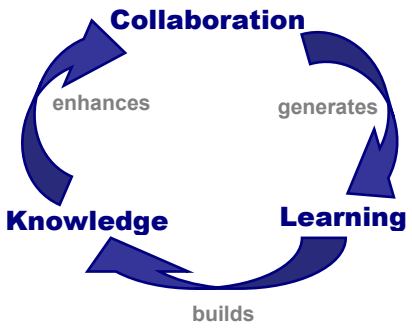

Figure 1. The role of collaboration in learning

4. Case study: A computer science course

Theoretical hypotheses were tested on a real-life experiment, a computer science course. The course main area of interest is multimedia.
The course is designed in two views:

- Multimedia and presentation theoretical basis
- Multimedia and presentation skills

Most important learning goals are scientific and expert presentations with an emphasis on multimedia technologies.

4.1 Course definition

Lectures presented theoretical basis both from presentational and rhetorical skills and multimedia. The main course topics were:

- how to make proper use of computerized presentational tools to prepare a good presentation,
- what (not) to do when performing an oral presentation in front of an audience – some basics from rhetoric,
- how to write a scientific article, and
- how to prepare a multimedia content and put it on the web.

The course main topics consisted in giving directions to the students on how to do a specific task. It was then their job to go into specifics either by doing a research on their own or by collaborating with their classmates or the professor. In this way students were free to choose with whom they wanted to collaborate and also they had the liberty of choice on what aspects of a predefined course topic to specialize/research. They were, however, asked to prepare a mini (5 minute) presentation on each of the topics.

Practical contents of the course were divided into two parts; basic rhetorical and presentational skills were presented by students. Each student was given a predefined topic at the inaugural lecture, students were supposed to do research on the subject and make a 20 minute presentation. The presentations were monitored and directed by the teaching assistant. Each presentation was thoroughly discussed.

The second part was a simulated conference article submission cycle where students did a research on a given topic, produced an article according to well-known conference guidelines [1]. Articles were reviewed by the teaching assistant and cross reviewed by students – a peer review process. Students were then asked to take in consideration the reviewer's suggestions and correct their articles accordingly. "Camera-ready" articles were then presented at final presentation.

The main idea of course creation was the employment of some of the new techniques that distinguish e-learning [5] from traditional learning techniques: self-assessment, collaborative study, continuous work.

Each technique's insertion into the course is discussed in greater detail.

Self-assessment; all oral presentations were discussed by students and a part of the grade was implicitly contributed by students. Articles were reviewed separately by students and professors, reviews contributed quite heavily to the final grade (see Table 1).

Collaborative study is being enforced through group presentations of student work and intense use of forums. Project collaboration was not among primary goals as many authors state that, unless thoroughly studied and prepared, it can lead to unnecessary problems [11, 7]. Forums were moderated by professors, but knowledge exchange was exclusively student's domain. Each presentation was discussed in detail by students, discussions were moderated by professors. All these activities were possible due to a moderate number of participants (only 14) and their close, almost intimate, acquaintance.

Continuous work was a main guidance in course definition to assure course compliance with Bologna convention directions [3]. Parts of the final grade were accumulated during the semester, so there was no need for the final exam at the end of the course. Table 1 illustrates the way the grade was given to students according to all the tasks they were required to prepare, each task with a weight, in such a way that all weights sum up to 100. Note that only one "badly" prepared or "not submitted" task was tolerated; in such a case a student – professor discussion followed and the student was asked to correct and/or resubmit the task. More than one "badly" prepared or "not submitted" task resulted in course repetition, which rarely happened.

Table 1. Grade repartition

Task	Weight	Assessor
Homework	30	Professor
Presentation #1	10	Assistant
Review	10	Student
Review resp.	5	Assistant
Presentation #2	15	Professor
Article	25	Prof.+Assistant
Diligence	5	Assistant
	Σ=100	

4.2 Course implementation

All course modules were based on LMS (Learning Management System). Moodle [4] was selected following an extensive LMS comparison [10]. Course creators were able to implement almost all functionalities defined at course creation time. Existing modules were not always suitable, but system's open architecture enabled easy and fast module modifications or even new module creation. Users and course creators with no programming knowledge may become dependent on Moodle developers' good will.

Frontal knowledge passing was done by the professor using online materials in the form of HTML and presentations (OpenOffice and Microsoft PowerPoint). All materials were prepared in advance and available in the LMS as simple file links enabling the students to prepare for lectures.

Students were given homework assignments; technical support was implemented using Moodle's module *exercise*. Instructions for homework assignments were given as an HTML document; the students were then expected to make an output as a file and upload the file into the LMS to complete the homework.

Moodle's *workshop* module was used to support all activities involving articles. It was reshaped to suite our needs as an expanded conference article submission tool. A tested and widely used conference submission system could be used to perform the peer reviewing process, but the *workshop* module enables self-assessment in a form of cross review between students. The definition of article topics and the description of research areas were presented as a set of instructions at the beginning of the course. Students were given a choice to pick one of the predefined topics or propose their own. The proposal of new topics was then further discussed with the professor in terms of their compatibility with general course guidelines.

The course culminated in a final product, a paper surveying the selected topic.

Topics defined at the beginning of the course were chosen from the field of multimedia in general. Topic examples from this year's selection: MPEG standards, video compression standards survey, audio compression standards survey, video conference systems.

4.3 Problems

Students were doubtful of new techniques, but final survey results (Figures 2 and 3) show that they accepted them.

Of the shelf LMS (Moodle) does not fully support techniques employed in course pilot. Some modules had to be modified to suite our needs. Moodle's open source accessibility and flexible design proved enabled easy module alterations.

4.4 Evaluation

In order to evaluate the impact of the proposed techniques on learning, we asked the students to fill-in two questionnaires.

The first questionnaire was designed to reflect exactly the things we wanted to know about the impact of the (in course) proposed approaches to learning. The questionnaire consisted of seven questions that are presented in Table 2. The students were requested to answer each question on a scale from one to ten, one expressing a very negative answer, ten a very positive one. An example: answering with a one to question 3 from Table 2 means "I feel not prepared at all", while answering to the same question with a ten would mean "I feel completely prepared".

The second questionnaire was chosen among Moodle's predefined questionnaires and reflects studies presented in [15]. The purpose of this second questionnaire is to measure various aspects of learning, such as relevance, reflective thinking, interactivity, tutor support[1], peer support, and interpretation on a scale of their occurrence in the course. The scale of occurrence, in our case, is a five-stage ordered scale with values almost never, seldom, sometimes, often, and almost always that represent the actual occurrence (in the course) of a specified aspect of learning.

[1] Tutor support is here intended as professor support.

Table 2. List of survey questions

NO	Question
1	Did you like the course outline?
2	Did you learn more than on traditionally outlined courses?
3	Do you feel prepared to present talks on conferences?
4	Will you be able to use the acquired knowledge in a potential new job?
5	Do you think the course demands more work at home than traditional courses?
6	Do you think the course promotes collaboration with classmates?
7	How would you rate the LMS support?

The first questionnaire was answered by 9 out of 14 students that attended the course and the results are presented in Figure 2. The heights of the bars in the figure denote the mean value of the answer while the vertical lines on top of each bar represent the standard deviation.

We can see from Figure 2 that students had in general a very positive attitude to answering to the questions of the first questionnaire (all means were pretty high above the average value of 5). The relatively large standard deviations are due to very negative answers from one of the students.

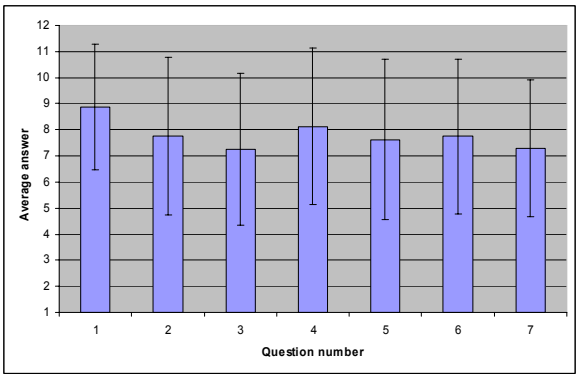

Figure 2. Survey results chart

The second (Moodle's built-in) was based on COLLES(actual) - Constructivist On-Line Learning Environment Survey [15]. It was answered by 8 out of 14 students that attended the course and the results are presented in Figure 3. The central points of the vertical rectangles in this figure denote the mean value of the answer while the heights of the rectangles represent the standard deviation.

It can be seen from Figure 3 that all the aspects of learning occurred quite often in our course with the difference of interactivity and peer support. This fact is rather surprising, but can be explained as this was their first experience with ideas of collaborative study and there were some communication problems in initial phases.

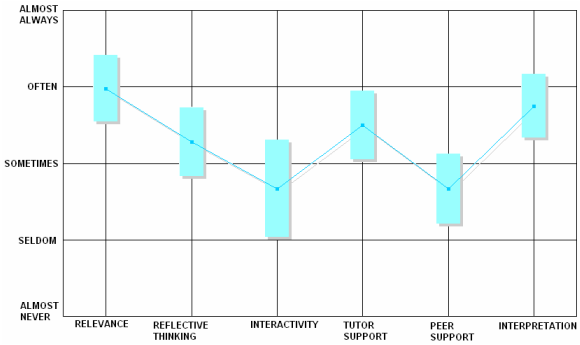

Figure 3. Results of Moodle's built-in survey

In conclusion, we could say that in general students positively embraced the newly designed computer science course of multimedia as is apparent from survey results. There are, however, aspects of learning that could be improved, namely interactivity and peer support. There was also a student that did not like the course and another thing to be improved is the response rate to questionnaires.

5. Conclusions and further work

Results from the previous section show that the introduction of self-assessment and collaboration together with other principles described in Section 4.1, contributed in general to the increase of student's satisfaction with the course and consequently to their greater motivation to learn (although we cannot prove the latter).

There was, however, a student that did not like the course at all and it resulted from the surveys that there are aspects of learning that could be improved, namely interactivity and peer support.

In further work we plan to extend our study to courses with greater number of students (ideally more than 50) in order to see if the same conclusions hold also for larger groups of students. At present we are conducting a research on a group of 30 students following a similar framework than the one presented in this paper. We also plan to improve the aspects of the course that resulted lacking in this study (interactivity and peer support) as well as propose a framework to treat students that were not satisfied with the proposed course methodology.

6. Acknowledgements

Thanks to all the assistants and professors who helped in the course preparation and implementation, in particular to Cene Bavec, who taught the course in its first years. Special thanks to all the students (past and present) who attended the course and helped in making it better every year.

The work reported in this paper was supported by the Slovenian Ministry of Higher Education, Science and Technology.

References

[1] ACM. ACM SIG Proceedings Templates. http://www.acm.org/sigs/pubs/proceed/template.html [02/27/2007].

[2] Anderson RS, Speck BW. Using Technology in K-8 Literacy Classrooms. Upper Saddle River, NJ: Prentice-Hall; 2001.

[3] Confederation of EU Rectors' Conferences and the Association of European Universities (CRE). The Bologna Declaration on the European space for higher education: an explanation, 1999. http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf [02/27/2007].

[4] Dougiamas M., Taylor PC. Interpretive analysis of an internet-based course constructed using a new courseware tool called Moodle, paper presented at HERDSA conference, 2002

[5] IsoDynamic. E-Learning: A White Paper; 2001. http://www.isodynamic.com/web/pdf/IsoDynamic_elearning_white_paper.pdf [02/27/2007].

[6] Johnson RT, Johnson DW. Action research: Cooperative learning in the science classroom. Science and Children 1986; 24: 31-32.

[7] Jones D. Solving some problems with university education: Part II. Paper presented at AusWeb99, Fifth Australian World Wide Web Conference, Southern Cross University, Ballina, April, 1999. http://ausweb.scu.edu.au/aw99_archive/aw99/papers/jones/paper.html [02/28/2007].

[8] Kadel S., Keehner J., (editors). Collaborative learning: A sourcebook for higher education, volume II. National Center on Postsecondary Teaching, Learning, & Assessment, Syracuse University; 1994.

[9] Kay R. Using asynchronous online discussion to learn introductory programming: An exploratory analysis. Canadian Journal of Learning and Technology, Volume 32(1) Winter / hiver 2006

[10] Kljun M., Vicic J., Kavsek B., Kavcic A. Evaluating Comparisons and Evaluations of Learning Management Systems, paper submitted to Information technology interfaces, 2007

[11] McMurray DW, Dunlop ME. The collaborative aspects of online learning: A pilot study. Paper presented at the '6th International Literacy & Education Research Network Conference on Learning'. Bayview Beach Resort, Penang, Malaysia. 1999.

[12] Rau W, Heyl BS. Humanizing the college classroom: Collaborative learning and social organization among students. Teaching Sociology 1990; 18: 141-155.

[13] Singh H, Reed C. A White Paper: Achieving Success with Blended Learning. Centra Software; 2001. http://www.centra.com/download/whitepapers/blendedlearning.pdf [02/27/2007].

[14] Slavin, RE. Cooperative learning: Theory, research, and practice (2nd edition). Boston: Allyn & Bacon; 1995.

[15] Taylor P. and Maor D. Assessing the efficacy of online teaching with the Constructivist On-Line Learning Environment Survey. In A. Herrmann and M.M. Kulski (Eds), Flexible Futures in Tertiary Teaching. Proceedings of the 9th Annual Teaching Learning Forum, 2-4 February 2000. Perth: Curtin University of Technology, 2000

[16] Totten S, Sills T, Digby A, Russ P. Cooperative learning: A guide to research. New York: Garland; 1991.

[17] Vygotsky L. Mind in Society. London: Harvard University Press; 1978.

[18] Webb N. Student interaction and learning in small groups: A research summary. Learning to Cooperate, Cooperating to Learn 1985; 148-172.