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STUDENT ASSIGNMENTS PERFORMED ONLINE – ASSESSMENT OF INDIVIDUAL AND TEAM WORK

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Abstract: *Various types of eLearning activities have been applied at the Department of Mathematics and Informatics, Faculty of Sciences in Novi Sad for the last eight years. Using different tools, mostly open source ones, and coordinating all the activities within Moodle learning management system (LMS), we started with a simple repository of learning resources. From there, we continued towards creation of eLessons, quizzes, glossaries and similar resources, and usage of discussion forums, chats, instant messaging and other communication means. Several years ago we also started with the application of Web 2.0 mechanisms in our regular teaching practice. These activities proved to be very successful and have been welcomed by our students, even those that required them to perform some (extra) work in order to pass parts of the exams. Activities consisted of tests solving, working on individual assignments, or even performing team work in wikis. Usage of wikis even helped us fight cheating in teamwork assignment solving by detecting students who did not do their part of the task hoping to take credit for their teammates work. Using wikis, we were able to evaluate individual contributions more precisely and more fairly thanks to the ability of the LMS to reveal all of the activities and history of changes.*

Keywords: *assessment, teamwork, wiki*

1. INTRODUCTION

Some of the available learning management systems are used today at the universities worldwide as the main eLearning tool, or precisely a set of tools that take learning content and organize it in form of courses, divided into modules and lessons, supported with quizzes, tests and discussions. In many institutions these platforms are even integrated into their student information systems.

Members of the Chair of Computer Science at the Department of Mathematic and Informatics, University of Novi Sad, started using eLearning facilities during the school-year 2003, when they introduced LMS Moodle into everyday teaching activities and practice. At first it was just the simplest form of its usage, creation of a repository of learning material.

However, after noticing satisfaction of our students, and possibilities that eLearning gave us in improving our teaching methodology, but also following the trends in eLearning practice, over the years we have progressed through several phases:

- development of eLessons and presenting teaching resources in a different, active, multimedia form;
- creation of quizzes (partly for self-evaluation) and glossaries of important terms and notions;
- management of assignments: their submission and assessment;
- simulation of classroom activities through usage of chats and forums (for discussions, role-playing games, and similar) and finally
- using wikis for students' joint work on team assignments, together with its ability to help us evaluate and grade these assignments in a more suitable way.

Excellent experiences with LMS Moodle obliged us to study it much more and get involved with it in a various ways, even outside of actual teaching. For both research and educational reasons we organized several projects using Moodle as a basic experimental educational space: bilateral project of Serbia and Slovenia [10], [11], multilateral project of Serbia, Czech Republic, and Greece, and four projects funded by international educational associations. As a result, several courses were developed, and two booklets have been written on Moodle and its features.

Good experiences persuaded us that this LMS is the right eLearning platform for our and similar institutions. Satisfaction of both students and teaching staff using its functionalities was presented in several papers [3]. After eight years of using this platform for courses held at Chair of Computer Science [6], system has been officially supported at the faculty level, and now all five departments of Faculty of Sciences are successfully using it for their teaching/learning needs [9].

Our team has, however, lately focused on the advanced applications of the chosen LMS, primarily for supporting individual and team assignments in different courses. Research shows that students working on their assignments in small teams tend to learn more, and retain the newly gained knowledge longer. We agree that the inclusion of team exercises helps students get diverse ideas, opinions, and feedback, thus improving both their knowledge and their final grades.

The rest of the paper is organized in the following sections. Second section presents the work conducted at other universities related to ours. Third section introduces our case study, while the fourth one explains the way in which Moodle and its wiki module helped us fight cheating among students. In the last section we share some conclusions, and present results of different surveys conducted with our students over the years.

2. RELATED WORK

During the last couple of years Web has shifted from being a medium, in which information was transmitted and consumed, into being a platform, in which content is created, shared, repurposed, and passed along [7]. The emergence of Web 2.0 thus enables and encourages participation through open applications and services, so what eLearning 2.0, how we might define the state of the art in this field, truly aims at is collaborative nature of learning [8].

LMSs typically offer a variety of means to facilitate information sharing and communication [18]. They let educators distribute information to students, produce content material, prepare assignments and tests, engage in discussions, manage distance classes, enable collaborative learning with discussion boards, chats, news services, etc. Yet most eLearning platforms still focus more on distribution of learning material than on social interaction or possibilities to construct shared knowledge.

In the field of Computer Science, however, working in teams is an inevitable part of one's everyday working assignments, so we find practicing teamwork during their course of studies to be essential for our students. It does not surprise that most courses that deal with system analysis and design and many programming courses at other universities as well require students to work on team projects.

When facing team assignments students actually face new challenges since they need to practice both their technical and soft skills in order to solve those assignments successfully. This can seem to be rather difficult to them, especially if they are solving such assignments for the first time. Not rarely they try to cheat or find some shortcuts to the solutions, which brings additional difficulties to the already nontrivial task for teachers – assessing team performance, as well as individual impact of team members on the team's overall result.

Considering cheating issues, it is astonishing that about 45% of faculty students admit that they had turned in work done by another student at least once in the past year. They do it although the astounding 98% of them sees such behaviour as moderate or serious cheating according to [15]. Similar results can be found in [19], where author proves that two thirds of students cheat on tests, and 90% cheat on homework.

Some warnings about the reasons causing such behaviour can be found in situations when given assignments are, in students' opinion, "meaningless", or when the only reason for solving them is the grade they receive [19]. Therefore, in order to avoid fading the motivation for best work and increasing desire to beat the system, the priority for teachers must be creating assignments that engage students' lives, interests, and individual intellects.

3. CASE STUDY

This paper presents our experiences in using wikis as means of introducing collaborative activities in two courses: an introductory eBusiness course for the first-year students [13], as well as an advanced course in Software Engineering (developed within a long-lasting international project [3], [4], [5]) for final year students of Computer Science.

There are some crucial differences between the two chosen courses. In case of the eBusiness course, the freshmen had never used Moodle before, while the final year students in the Software Engineering course had been using it for several years before getting their first wiki assignments. Furthermore, the first year students are in general unfamiliar with most of their colleagues, while the final year students have already formed some closer relationships with the colleagues. Thus, teams for the first year students were formed by the lecturers, while the final year students were allowed to choose their team members by themselves.

It is already known that ideal teams should be diverse enough to include students with a range of intellectual abilities, academic interests, and cognitive styles. In case of the eBusiness course the students were asked to complete an online including:

- questions regarding their personal characteristics and academic background,
- the Index of Learning Styles (ILS) questionnaire, the most frequently used model for determining students' learning styles,
- the Belbin Team Role Inventory questionnaire (included a year later), an assessment used to gain insight into an individual's behavioural tendency in a team environment [2] and determine two potentially best team roles for every individual (primary and secondary, out of the several possible options: plant, resource investigator, co-ordinator, shaper, monitor-evaluator, team worker, implementer, completer finisher, and specialist).

According to the results of the conducted questionnaires we formed conveniently sized teams of 4-5 diverse students taking into consideration all bits of information gathered on them.

After having some negative experiences with the way students handled teamwork assignments and the process of creation of their final solutions, we decided to try using wikis. Namely, teams, especially self-formed ones, were consisting of friends willing to cover for their non-working members. Behaviour like this has been observed at other universities as well – overall participation can be high, but often just a small proportion of students perform

the bulk of the work and contributions of other team members are just superficial [12].

The situation becomes even more alarming if students are required to perform several team assignments within a course, like in our two courses. A lot of less-ambitious students simply stop participating in assignment solving after one or two tasks are completed, or as soon as they collect enough credits fulfil pre-exam requirements. As a consequence, the rest of the scattered team members have to work much harder, without being fully rewarded for their efforts – being presented only with the final solution lecturers are frequently not able to recognize individual contributions made by the team members.

Using wikis as an environment for the collaborative solving of assignments was thus seen as the possible way of introducing supplementary possibilities for teachers to track the extent of the individual contributions to team assignments, which could allow for a fair process of teamwork evaluation, as well as to prevent cheating as much as possible, or at least to detect it at a very early stage.

4. WIKI IN ACTION

What additionally contributes to the rising popularity of wiki technology is the fact that it is nowadays easily available through various free hosted and open source educational software solutions. However, selecting a wiki platform that is most suitable for a specific learning context is a somewhat challenging task.

Features that usually make an impact on the wiki selection process are edit style, imaging support, authentication, and tracking [1]. Moodle LMS offers, among other useful activity modules, wiki implemented as a stable working environment that students learn to use rather quickly. So we opted for such an integrated solution instead of a standalone application.

Apart from trying to find ways to evaluate our students' teamwork more fairy and consistently, we also liked to investigate how they felt during the usage of wiki for building their joint solutions to given assignments, as well as in respect to the evaluation of their joint work. Finally, we also paid attention to the possible effects of the team formation mechanisms applied on the final results of team projects.

At the end of each school year we ask our students to fill out a survey consisting of few simple questions concerning the teamwork. Some of the results, collected before switching to using wikis are presented in Table 1. They confirm mischievous behaviour of students while solving team assignments. Especially important are opinions of students concerning "equal participation" of all team members in assignment solving, which convinced us that it is necessary to find a solution for the problem of students trying to avoid their duties [17].

Table 2 presents records on the behaviour of students who were consequently solving two team assignments using wikis in the Software Engineering course. The differences between the values in two columns presenting different assignments are striking and suggest that it took time for students to adapt to the new environment and the methodology we had chosen in order to solve the presented assignments.

Table 1: Results of a survey concerning teamwork assignments

Question	2009/2010	2010/2011
How do you rate difficulty of the assignments? (1–too easy/5–too difficult)	3.41	3.25
Did you find the assignments motivating? (1–not at all/5–very much)	3.52	3.21
Do you think that working in a team was valuable for gaining realistic experience? (1–not at all/5–very much)	4.15	4.29
How often did you wish to change a member of a team with some other member, or just "fire" her/him? (1–very often/5–never)	2.3	1.64
Do you think that assignments solving would be easier, better, and more successful if you have done it alone? (1–not at all/5–very much)	2.22	1.79
Did all of the team members participated equally in assignment solving? (1–not at all/5–very much)	2.17	2.14

This does not surprise since the first assignment in this course was for almost all students their first contact with wiki (according to the answers they gave in the mentioned survey conducted at the end of the course).

Table 2: Analysis of student behaviour while solving assignments within the Software Engineering course

Parameter	Assignment 1	Assignment 2
Total number of accesses	8812	2464
Total number of changes	1410	862
Number of accesses per student	2 – 1125	0 – 168
Average number of accesses per student	103	26

We also liked to get insights into the possible improvements in teams' performance that might be achieved by introducing more parameters in the process of team formation. Therefore we analyzed students' results accomplished while solving the same assignment in Introduction to eBusiness course in two consecutive years – before and after introducing the results of Belbin Team Role Inventory questionnaire into the team

formation procedure. Results are presented in Table 3. It seems that students' behaviour in the second year was more articulate and focused on getting to the problem solution and that they needed less time and fewer changes of the joint document to accomplish satisfactory results. At the end of the course their grades were even slightly higher that those achieved in the previous year.

Table 3: Analysis of student behaviour while solving the same assignment within the Introduction to eBusiness course in two consecutive years

Parameter	pre-Belbin	post-Belbin
Total number of accesses	19229	7691
Total number of changes	1398	1217
Number of accesses per student	0 – 574	0 – 821
Average number of accesses per student	154	118

However, a new issue arouse in both courses. It seems that some of the teams decided to ignore the wiki and instead created their solutions on paper or using some text processing application, possibly during their meetings, and than just simply divided it into parts which the team members copied into the wiki. Since the majority of those contributions were made very late in the task, online collaboration among team members did not happen. This made lecturers but afterwards students as well unsatisfied because it was not able to grade students' contributions properly and thus those students who (perhaps by chance) got to enter the erroneous part of the solution got the inferior grade, even though the whole team was equally responsible for it.

Generally, even when the suggested procedure is fully followed and when the proper tools are used, the assessment of each individual student's work performed within a team is a rather complex task for lecturers. Luckily LMS Moodle, i.e. its Wiki module has an ability to show the complete history of development of a solution. Each access of each participant of a team is recorded and the system can show when it happened, from which IP address, and most importantly – what was done by that person during that editing session. Using these functionalities all the changes, additions, or deletions of the solution's contents can be followed step-by-step, which can be of great help in determining the appropriate personal grade for each of the team members, according to their individual contribution to the final solution. Our experiences with this kind of grading and assessment have been considered and published in several research papers, for instance [14], [16].

What this kind of assessment procedure certainly causes is a large extra workload for the lecturers. To us, however, it seems to be worthwhile since it brings more transparency to the grading process and improves its fairness.

On the other hand, such assessment of individual student input to the teams' solutions was subject of some students' discussions and complaints, yet no more than any other kind of grading mechanism applied in other courses. To our satisfaction, after one or two completed assignments, teams that performed some illegal actions and tried to cheat the system in some way stopped those activities. Non-doers were either dismissed from teams, or they actually started working and contributing to the final solutions produced by their teams.

There was of course also a possibility that there were some "passive" team members, valuable for the team functioning, yet not too active within the wiki activity. While the activity as such asked for active involvement and frequent contributions, perhaps not all of the students were, at least not initially, suited for this kind of achievements.

However, as the assignments went on, the participation of the team members balanced. With mutual consideration between students and lecturers, slightly less rigid assessment of individual contributions, and additional self-assessment performed by team members we reached the stage where both lecturers and students were satisfied with the final results.

5. CONCLUSIONS

Although conducting collaborative teamwork requires a lot of effort from both students and lecturers, since its benefits are substantial we believe it is worth the effort. The biggest gains are:

- larger participation of students in course activities,
- their improved acceptance and understanding of the material,
- larger percentage of retention of the gained knowledge,
- mastery of soft skills,
- increased enthusiasm for self-directed learning.

However, including collaborative assignments to courses for lecturers means introducing teamwork to students and tracking their advancement through the assignment solution process very carefully. For these purposes, usage of Web 2.0 tools, wiki in particular, is rather convenient. Current generation of students is very accustomed to such tools and they often use similar solutions for their personal needs, so they easily accept the technical part of the concept. It is soft skills and organizational capabilities that most of them still have to develop. Team assignments solved during their course of studies, if performed appropriately, could be of great help in their gaining such useful skills.

This paper presented the results of the empirical research based on the experiences in using wiki as means of introducing collaborative activities in two different courses at the same time: an introductory eBusiness course for the first-year students, as well as the course in Software Engineering for students at the last year of Computer Science studies. In particular, it gave insights into our experiences with the possibility of wiki to help lecturers fight cheating, or avoiding dedicated work.

Wikis were, once again, proved not to be inherently collaborative. Additional mechanisms are thus required to promote participation and collaboration among students. They are used in order to help students achieve better results, but also to provide teachers with tools that could help them in performing the evaluation of individual contributions to team efforts, and the cohesiveness of the working teams in a fair and more precise manner.

We also looked into the ways to prevent some of the students' cheating intentions, which was to a certain extent worthwhile. Some of the students who did not actually want to participate in assignments solving left their teams and helped us assess their teammates more fairly and more precisely. Others that were caught not working on the first 1-2 assignments changed their minds and started participating in solving the following tasks. Finally, those hard working students who did most of the job received exactly the grades they deserve.

Students' opinions and feelings emerging during the work on wiki assignments and in respect to the evaluation of their joint work were also investigated. There were some complaints and comments, though most of them rather mature and helpful. They could be summed up in the following quote: "It is a great technique, but only if it is used properly". What's more important, students were mainly satisfied with their grades.

In general, students did achieve admirable results, and most of them passed the exams smoothly. Our experience with the usage of LMS Moodle, and in particular its Wiki module, thus confirms that the available tools are fully functional and appropriate for the needs of a university course (for assignments in which students are required to produce more or less textual output as a solution). Still, having such activities in a course does create a huge workload for lecturers if they are to be performed correctly. These activities must therefore be taken into account when planning future course runs.

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LITERATURE

[1] Augar, N., Raitman, R., Zhou, W., *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, pp. 95–104, 2004.

[2] Belbin, M., *Management Teams: Why They Succeed or Fail*, Butterworth Heinemann, Oxford, 2010.

[3] Bothe, K., Budimac, Z., Cortazar, R. Ivanović, M., Zedan, H., Development of a Modern Curriculum in Software Engineering at Master Level across Countries, *Computer Science and Information Systems*, ComSIS Consortium, Vol. 6, No. 1, 2009

[4] Budimac, Z., Putnik, Z., Ivanović, M., Bothe, K., Schuetzler, K. Conducting a Joint Course on Software Engineering Based on Teamwork of Students, *Informatics in Education*, Institute of Mathematics and Informatics, Lithuanian Academy of Sciences, pp. 17-30, 2007.

[5] Budimac, Z., Putnik, Z., Ivanović, M., Bothe, K., Schuetzler, K., On the Assessment and Self-assessment in a Students Teamwork Based Course on Software Engineering, *Computer Applications in Engineering Education*, Vol. 19, No. 1, pp. 1–9, 2011.

[6] Chair of Computer Science, Department of mathematics and Informatics, Faculty of Science, LMS Moodle: http://perun.pmf.uns.ac.rs/moodle/

[7] Downes, S., E-Learning 2.0, *eLearn Magazine*, 2005(10). Retrieved July 19, 2011, from http://elearnmag.acm.org/featured.cfm?aid=1104968

[8] Drášil, P., Pitner, T., *E-learning 2.0: Methodology, Technology, and Solutions*, in E. Mechlova (Ed.) International Conference on Information and Communication Technology in Education, pp. 165–169, 2006.

[9] Faculty of Science, Novi Sad, LMS Moodle: http://moodle.pmf.uns.ac.rs/

[10] Ivanović, M., Welzer, T., Putnik, Z., Hölbl, M., Komlenov, Ž., Pribela, I., Schweighofer, T., *Experiences and privacy issues - usage of Moodle in Serbia and Slovenia*, Proceedings of the International Conference on Interactive Computer Aided Learning, Villach, Austria, pp. 416-423, 2009.

[11] Ivanović M., Komlenov Ž., Welzer T., Hölbl M., Schweighofer T., *Experiences with the Use of Moodle in Serbia and Slovenia*, Proceedings of the 6th International Conference "New Horizons in Industry, Business and Education", Technological Educational Institute of Crete, 2009.

[12] Judd, T., Kennedy, G., Cropper, S., Using wikis for collaborative learning: Assessing collaboration through contribution, *Australasian Journal of Educational Technology*, Vol. 26, No. 3, pp. 341–354, 2010.

[13] Komlenov Ž., Pešović D., Budimac Z., *Empowering electronic courses by introducing collaborative activities – A case study: Introductory eBusiness eCourse for students of Computer Science*, Proceedings of the 13th International Conference on Interactive Computer Aided Learning "Academic and Corporate E-Learning in a Global Context", Hasselt, Belgium, September 15–17, pp. 624–634, 2010.

[14] Komlenov, Ž., Budimac, Z., Putnik, Z., Ivanović, M., Wiki as a Tool of Choice for Students' Team Assignments, *International Journal of Information Systems & Social Change*, Vol. 4, No. 3, 2013 (in print).

[15] McCabe, D., Cheating Among College and University Students: A North American Perspective, *International Journal for Educational Integrity*, Vol. 1, No. 1, 2005.

[16] Putnik, Z., Budimac, Z., Komlenov, Ž., Ivanović, M., Bothe, K., *Wiki Usage in Team Assignments for Computer Science Students*, in Proceedings of the International Conference on Computer Systems and Technologies, Vienna, Austria, June 16–17, pp. 596–601, 2011.

[17] Putnik, Z., Ivanović, M., Budimac, Z., Samuelis, L., *Wiki - A Useful Tool to Fight Classroom Cheating?*, in Proceedings of the 11th International Conference on Web-based Learning, Sinaia, Romania, September 2–4, 2012 (in print).

[18] Romero, C., Ventura, S., García, E., Data mining in course management systems: Moodle case study and tutorial, *Computers & Education*, Elsevier, Vol. 51, No. 1, 2008.

[19] Stephens, J., *Justice or Just Us? What to Do about Cheating*, Carnegie Foundation for the Advancement of Teaching, 2004.