

Continuous assessment as a tool for deeper learning

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INTRODUCTION

Assessment clearly guides students' learning. Learner-centered assessment has been observed to attract more attention lately [1] and one way to guide learning towards deeper learning is to apply the so called continuous assessment [e.g. 2-5] in form of learning assignments that are due throughout the whole course instead of conventional practice of having an exam in the end of the course.

The curricula is renewed in universities all over the world to support the needs of the changing working life. European Union has set recommendations of standards to European engineering programs in higher education [6]. These recommendations describe also the need of versatile assessing methods in order for students to be able to develop competences required in the working life [7]. The competences influenced most by applying continuous assessment belong to technical, methodological and systematic skills.

As we all know, students' learning can be affected by various actions. Entwistle and Peterson [8] underline the idea that the organization of the course content and assessment play important roles in high quality learning. In addition to physical learning environment the mental environment of the course has to be taken care of. It is important to support students' learning process by choosing assessment methods that encourage reflection and critical thinking as well as awarding conceptual understanding as means of enhancing deep learning.

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As evaluation and assessment clearly has an effect on students' work the question whether to do "assessment of learning" or "assessment for learning" has been raised [9]. The final exam is a typical case of assessment of learning by grading student's achievement and it is called summative assessment whereas formative assessment includes feedback to the students and is regarded as "assessment for learning" [9, 10]. However, in the academic assessment it is not often easy to distinguish between formative and summative assessment if both grade and some feedback are included. The importance of formative assessment in higher education is generally acknowledged but its role has been observed to cease at the expense of summative assessment [11]. On the other hand, formative assessment has been regarded as a better way to assess than summative assessment [12]. In the continuous assessment the feedback gives a fine tool to guide the students' learning towards the desired goal using simultaneously both formative and summative assessment.

Continuous assessment can clearly be seen as a mean of supporting both deep and strategic learning as they are defined by Entwistle [8]. When students have intention to learn deeply they have a strong motivation to understand ideas for themselves and really holistically seek ways to apply the studied issues whereas strategic learners have chosen to focus in passing the course which often means organizing one's studies in a very effective way. Continuous assessment can help students to define the levels of understanding required and it enhances high-level engagement in guiding students from memorizing and describing towards explaining, relating and applying. It can also be used as a tool to communicate the intended learning outcomes to students, which can increase their deep-learning motivation. [13]

The aim of this study is to find out how to engage students to work continuously during the course to result in deep learning and how to manage the workload of both teachers and students to support high quality in learning. In our university, a special effort has been put in developing assessment methods at both Bachelors' and Masters' level. In this paper, three case studies are introduced which describe the application of continuous assessment. All cases include learning assignments spread throughout the course in order to provide even workload for students during teaching periods and to provide check-points for both students and teachers to monitor the learning process.

1 METHODOLOGY

Three courses are in the focus of this study. The research material consists of teachers' experiences as well as student feedback gathered at different phases during the courses.

Case 1: The first case is a compulsory 2nd year Bachelor level course with ca. 200 students annually. On this course, students are choosing either learning assignments or the conventional exam. The teacher assesses all the learning assignments and students get feedback on everything they do. In addition to the assignments, an oral exam in groups of 4-5 students is taken at end the course. The final grades of students completing the course by learning assignments were compared with the students taking the conventional exam.

Case 2: The second case is a 1st year Bachelor level course with ca. 130 students annually. All students are taking eleven weekly individual learning assignments and five lab works in groups. The assignments include automated quizzes in virtual learning environment (Moodle). The laboratory works are assessed by the group reports. Using

automated quizzes makes it possible to run these assignments for group of 130 students yearly.

Case 3: The third case is a Master level course with ca. 60 students annually. The course grade is based on ten weekly assignments and feedback is given on each. In the assignments, the students are deepening their knowledge on the course topics by searching relevant material and completing a few-page essay. They can study the topics based on their own interests and background and strengthen the knowledge, which they regard as the most important in building their own expertise.

2 RESULTS AND DISCUSSION

The results of the three case courses are based on students' feedback and teachers' observations. In addition, for case 1 the results of the learning assignment makers and exam takers were analysed based on the information of the course grades during five years.

2.1 Case 1

In Case 1 the students chose between the learning assignments and the traditional exam in the end of the course and both groups studied the same contents. In Figure 1 the average grades of the group of students taking the continuous assessment are compared to the group of students taking the traditional exam. It is observed that students completing the learning assignments achieved better grades. In addition, all the students who chose to do the learning assignments passed the course at one trial whereas in the exam ca. 10 % of the students failed and they had to retake the exam. Average grades in Figure 1 are calculated with only those who passed the course excluding the failed ones.

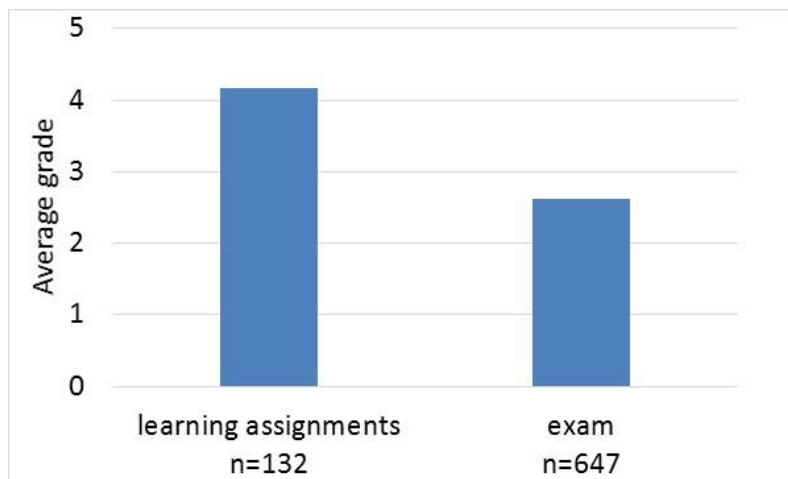


Figure 1: Average grade (max. 5) of students who take learning assignments compared to those who take the exam during five years time span.

Based on the feedback, the students appreciated the possibility to select their own way to complete the course. With the available teacher resources, all who wanted to participate in continuous assessment were able to do it (max. 30 students yearly).

Surprisingly, the exam takers and assignment makers both were able to present approximately 67 % change in their performance measured by the conceptual tests in the beginning and in the end of the course [14, 15]. A clear difference for the benefit of assignment takers was expected but the increase in knowledge level was percentually the same for both groups. This can be explained by a clear difference in the starting level between the two groups which led to higher final grades with the assignment makers. It would be extremely interesting to be able to meet these groups after one year again to see how the learning strategies affect their long term memorising and ability to use the concepts learned.

To assess the success of continuous learning at this course it is important to analyse the construction of the learning tasks to support the meaningful learning. The other interesting question is the length of the teaching period. The course is lectured and the learning tasks completed within seven weeks. Most probably it is too limited time for students to properly be acquainted with the subject or have reasonable time for their learning process [16]. Third and very important theme would be to analyse further the teacher's role as a tutor for students' learning process: how could the role be renewed to better support learning within both groups? On the other hand, it might be interesting to test, what kind of effect peer support would have in a sense that learning tasks would be completed in small groups.

Naturally, continuous assessment raises question on teaching resources. How many assignments can one teacher handle? It is not enough just to read the papers but students expect feedback. In students' opinion, personal feedback was highly appreciated. If there are teaching assistants available the workload can be shared but it has been observed that all the teachers don't apply given criteria in same way and they tend to assess in their own way. This problem has been solved by circulating students so that everyone gets feedback form each of the teachers.

Rubric style assessment with pre-formulated feedback and evaluation phrases is one tool to make teachers' work little easier. It has also potential in making assessment independent of assessor's person and e.g. moods and circumstances. The use of rubrics has not yet been researched at higher education extensively but experiences at lower educational levels can inevitably be applied [17]. They are effectively used already at several universities [18]. One challenge in using rubrics in chemical technology is writing of chemical structures end formula with computer. Students use various tools and sometimes take photographs of their hand-written answers which makes it impossible for any program to check them.

Computer based assessment or using student colleagues in reading the papers have been considered but not tried yet. Also making assignments in small groups would make teachers' workload smaller but then there are questions about guiding the groups' work, assessing groups and equal workload of each group member. Peer-review is also an alternative in handling teachers' workload in case of large (>20) student groups. This culture is just still developing in our university. Both teachers and students have quite strong perceptions against using peer review even though it has been experienced that students practically grade each other's work in a similar way as teachers do.

The results encourage the development of teaching and guiding of learning towards more active direction i.e. making students to process the studied knowledge continuously. This kind of research-based evidence is a powerful tool in convincing engineering teachers to commit in developing learning that is more active and assessment at their courses.

2.2 Case 2

The course presented as case 2 is a course given to freshmen during their first fall term. The idea is to support students' learning processes by applying continuous assessment methods already from the very beginning of their university studies. The course consists of twelve lectures and five lab assignments and the grading is based on weekly quizzes (50 %) and reports of lab working (50 %).

Students take a quiz in the course workspace (Moodle) each lecture week. The due dates of the quizzes have changed during the years. In the beginning, the deadline was the day before the lecture as it was intended that well prepared students would be motivated in being active at the lectures. Also checking of results before the lecture would have given, in optimal case, the lecturers' hints of what was regarded as difficult among the students. The lecture was extended with one hour and the correct answers of the quizzes were discussed. It is not obligatory to attend the lectures and the percentage of students attending the lectures was decreasing after the first five weeks from 80 % to 8 %.

As a result, the deadline of the quiz was moved to the evening of lecture day and lectures were advised to give hints to help with the quiz. When dealing with very basic concepts the lecturers found it extremely difficult to give hints without really solving the problems or giving the right answers. This did not change the lecture activity as intended. Moving the deadline to be after the lecture made it impossible to go through the correct answers together with the students during the lecture and students gave direct feedback that they were missing this part even though the automated system gave the right answer after filling the quiz. Once a lecturer provided a quiz which was possible to be completed only at the lecture and this naturally activated the students' attendance.

Based on our experience, the biggest challenge has been to produce quizzes that would be difficult enough to challenge the students really. There has been a discussion whether the quizzes should be totally based on the course book and lecture slides or is it a good idea to provide extra study material as some lecturers has done. The motivation for extra material has been the fact that it has been impossible to find a text book that would support all the areas taught.

The possibility to fill the quiz was restricted after the first year to three trials from limitless trials and each trial reduced 20 % of the maximum points. Students were, however, very quickly able to set a system where right answers were spread amongst them and almost everyone got maximum points. In the feedback, students claim that the assignments are too easy, not relevant and thus they did not motivate learning. Of course, students appreciated the high grades they obtained. Surprisingly some students gave feedback that they would appreciate an exam instead of quizzes because they were not able to see quizzes as appropriate measurement of learning and without the exam they feel that they are not able to see the course as one entity. In the future the possibility of the exam will certainly be considered even though it will be difficult to create exams that would be able to measure learning at this kind of a course having a wide introductory content. Next autumn a commercial learning package will be used to provide ready-made quizzes and exercises. Unfortunately this material covers the course content only partly.

2.3 Case 3

The course in the Case 3 has been organised in a similar manner since the start of the course, thus comparison to the course with conventional exam with similar content is not available. However, feedback has been gathered extensively since the beginning of the course for seven years. Actually, during the first years, the students were further motivated to give feedback continuously by rewarding them with extra points from the feedback. During the years, new assignments have been developed and old ones are updated according the students' feedback.

The course evaluation consists of eleven assignments which are related to eleven lectures during the course. The students are allowed to skip one assignment during the course if the workload in other courses is high or if the topic is not personally appealing. Completing all assignments enables to skip the worst assignment in the evaluation. Based on the feedback, the main motivation to skip one assignment is to allocate time resources to other on-going courses.

The average grade over the years has been 3.9/5 which is relatively high. This also indicates the commitment of the students to this course. The number of students per course has been varying between 25 and 60. The number of registered students has been a bit higher but mainly all those students who have started to make the assignments have completed the course during one semester. Only very few students have dropped out after turning in any assignments.

The assignments include questions which require an essay-type answer. In one assignment there are typically several smaller questions or issues which should be included in the answer. Typically reports up to four pages are turned in but in some rare cases reports close to 15 pages have been created. In those cases the students are guided to concentrate their ideas. The emphasis of the assignments is to teach the students to find the most essential content of the material they find and report that in "engineering language". One of the essential learning outcomes of the course is to teach the students to search for information and write small reports on the given topics. Feedback is given on each assignment and also format of the report is commented and the students learn to write a proper report with proper references during the course. The "copy-paste" technique is sometimes detected, especially in the first assignments, but the feedback with proper guiding is usually enough to improve the students' performance in the following assignments.

The course has been organised seven times with this concept and during these years the lowest grade on this course has been 2/5. Students' feedback indicate that they are more motivated to concentrate in narrower unities and thus they master these topics more easily than large sets which should be studied for an exam. This encourages the students to deeper their understanding of the topics. The students are motivated to study the given topics from their own view point and strengthen the knowledge which they regard as the most important in building their own expertise. In most of the assignments at least part of the answer can be concentrated on the student's own field of study.

During the course the students are citing to their earlier assignments which indicates that they are learning to build new information on their previous knowledge which is an important observation according to constructivist theory of learning.

The attendance on the lectures has not been very high except the first lectures. However, as the lecture slides were available for the students on-line, it was observed from the logs of the course workspace that practically all students had checked the lecture material when doing the assignments. In most of the cases the answers for the

assignments were not directly available from the lecture material, but some more detailed studies were required. As the topics of the assignments were linked with the lecture topics, the lecture material gave easily background information on the topic also to those students who were not present on the lectures. This is assumed to be the main reason for low attendance of the students on the lectures.

Some students regard this course as a very time-consuming course. However, the workload is calculated very carefully and the workload actually fulfils very well the given five credits. According to the survey made during one semester, the average time used for one assignment was below the scheduled ten hours: the students gave an estimation of time in each assignment and the average of these estimations varied between 5.2 h to 9.2 h in various assignments with the average of 7.7 h per assignment during the whole course. The scheduled time was 10 hours per assignment. However, the students regard this course as more time-consuming as they work constantly throughout the semester instead of concentrating on the topic only during few days before the exam, as in some courses carried out with conventional exams.

Based on the feedback given by the students, this course has motivated the students to study deeper the course topics. And some students have even changed the topic of their major studies to further concentrate on the topics introduced in this course.

3 CONCLUSIONS

Continuous learning presented in this paper can be seen as means of supporting students way from memorizing towards higher level engagement depicted with the terms like explaining, relating, applying and finally theorizing given by Biggs [13]. The value of continuous assessment is the enhancing of deep learning when students are actively involved during the whole course. Another benefit is that learning is divided into smaller parts and takes place evenly throughout the course instead of concentrating on the assessment period. This is also appreciated in the students' feedback. Furthermore, this way of assessment provides the teacher feedback of students' learning throughout the course and the difficult issues can be reviewed during the course if needed.

Feedback is of the utmost importance in the continuous assessment. One of the strong points of continuous assessment is the possibility to guide the student all the way during the course by giving feedback on their work. In these cases, teachers like to give feedback instead of bare evaluation by final grade which is often the case in the university level, i.e. combining formative and summative assessment.

However, giving feedback continuously throughout the course on many assignments is rather time consuming for the teachers. In continuous assessment it is expected that the students are taking the feedback seriously to improve their performance later on during the course. If the feedback is given after the course it remains unclear whether the students really take the feedback seriously as they don't have the chance to improve their grade anymore. It is stated [9, 19] that students tempt to just look at the grade and utilize the feedback only as justification of grades which is not a very motivating result from the point of view of teachers. It seems that some kind on compromises are to be found here in order to provide enough accurate feedback for the active students who really utilize it without killing teachers under their workload.

Students are interested in getting as much points as possible from their learning tasks but how to connect points and learning? In the cases presented here the guideline has been that all learning activities during the course is affecting the grade. This is expected

to motivate the students to do their best in each part of the course and to end up in understanding rather than performing the learning tasks and as a result deep learning is expected. However, it should be kept in mind that assessment must be in line with the teaching methods and learning outcomes.

Continuous assessment requires continuous actions and it is a good example of learning by doing instead of just reading course material before the exam. With continuous assessment it is easy to formulate various kind of assignments which enables students to align the assignments in their own interests and skills. There are more degrees of freedom in assignments than in questions in exam where typically only one answer is correct. This also supports different learning strategies and allows students to handle the assignments in various ways. A good set of assignments also includes various kind of assignments so that various skills are tested and learned by completing the assignments. To take a course by doing assignments may also allow students to have more freedom of time and location when completing the course.

Challenges in continuous assessment deal with creating meaningful exercises, keeping the workload of the teachers reasonable and ensuring coherency in assessment if various teachers are involved. Individual tasks and feedback is optimal but the available teaching resources have to be ensured. Essays were observed to be suitable for courses with limited number of students to ensure constructive feedback whereas automatically corrected quizzes were better for larger courses.

The quality of teaching also includes assessment which should be independent on teacher. The assessment criteria have to be planned very carefully if various teachers are participating in the evaluation. In this kind of case rubrics with pre-formulated feedback and evaluation phrases could provide a handy tool to align various teachers coherently. The assessment criteria are translated into various assessment phrases to set goals for each grade.

Based on our observations we think that continuous assessment helps the students to direct their activities in deeper learning. In addition, we think that continuous assessment gives us tools to guide the students to constructively align their learning by providing them an active role in their learning process.

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