Modes of Classroom Assessment in Computer Science

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Abstract: *This paper is about the role of classroom assessment in teaching at university level. In classroom assessment, students are directly involved during teaching in the classroom. It is about promoting learning, and not on evaluation and assigning grades. Based on this assumption, we introduced different classroom assessments at our university including an ICT based prototype to support the classroom assessment process. In this paper we analyze the different modes of classroom assessment in a matrix of assessment* for *learning and assessment* of *learning by enhancing it with temporal and conditional factors, before concluding the paper.*

Key words: *Learning, teaching, classroom assessment, peer assessment.*

INTRODUCTION

Classroom assessment has been an emerging subject to teachers and assessment institutes since couple of years. Besides studies on impacts of classroom assessment on promotion of achievement in low-performing schools [4], some researchers analyzed differences in performance assessment of students, who experienced embedded performance assessment, and of students who did not [5]. Rodrigez found out that classroom assessment help low-performers in controlling their own success in learning [6]. Stiggins pointed out how classroom assessment can be improved by introducing assessment *for* learning instead of only assessing *of* learning [9]. A long-term research ended in four conditions that must be satisfied to reduce achievement gaps in class-based education [10]. Driven by a clearly articulated purpose, assessments must reflect explicitly achievement expectations. Methods applied must enable reflecting the targets and can be used as teaching tools. Most relevant to our work, "communication systems must deliver assessment results into the hands of their intended users in a timely, understandable, and helpful manner" [10, p.16].

Regardless how classroom assessments are carried out so far, there are some problems in the process. First of all, the most assessment techniques are not used simultaneously in lectures. They do not have direct impact on the lectures, in which they have been assessed. Teachers gather the assessment data from students during lectures, which they cannot use directly during the same lectures. The effort for analyzing the assessment data is in most cases much too high to make a fast use of it. If the data is analyzed, the context and the content of the lecture are usually moved on.

Second, the information gathered is not available for the students assessed, until they result in marks or grade of the lecture. In most cases, there is no feedback provided to students referring individually to their strengths and weaknesses. As we know, learning is a process and happens continuously. Students need to reflect to their own learn effort by identifying their knowledge gaps and considering possibilities for improvements stated by knowledgeable people like teachers. Current assessment techniques are not aiming this issue.

One possible way for the improvement of assessment processes in higher education is to make assessment data available for students in the same context as they were assessed. Black and Wiliam showed that classroom assessment with accurate descriptive immediate feedback to students improves learning if students are also involved in the assessment process [1].

Students need to be aware of their knowledge on the one hand and of the subject that is going to be taught on the other. Teachers need to know how successful their lectures are. How is to guarantee the quality of teaching and learning in highly complex context like in higher education? How is to find out what can be done to achieve better learning results among students? Unfortunately, these questions are only partly answered in the research literature so far. The analysis has not gone beyond the distinction of assessment types and certain methods, without analyzing the impact factors for their success and improvements achieved by students. No ICT support is considered to improve assessment processes in classrooms.

This paper tries to present a systematic approach to this. On the one hand it identifies impact factors to classroom assessment, tries to describe different modes of assessment, and presents a new ICT based classroom assessment methodology. The goal is to find a way to monitor the level of achievement on the one hand (for students), and the level of the right choice of method, instruction or content on the other (for teachers).

In the next section we present some innovative assessment techniques we applied in our classroom lectures. This includes the ICT based prototype we introduced to support the classroom assessment process. Then we analyze the different modes of classroom assessment before concluding the paper.

CLASSROOM ASSESSMENT AT THE VIENNA UNIVERSITY OF TECHNOLOGY

In classroom assessment, students are directly involved during teaching in the classroom. The attention is on the emphasis of progress and an achievement and not on failure and defeat [7] [8]. It is about promoting learning, and not on evaluation and assigning grades.

Based on this assumption, we introduced different classroom assessments at our university, what we want to show here briefly. Lectures we chose for it were in a module called cooperative work in the curriculum of computer science and business informatics. The module was composed of lectures and group exercises assigned to students. Lectures were loosened up with interactive segments, which we want to describe here as examples of assessment of students' knowledge.

Before introducing different roles in meetings in a cooperative work setting, we asked students what they think that moderator, documenter, and devil's advocate do during a meeting. In more detail, we asked the following questions: What is the role of a moderator, documenter, and devil's advocate in a meeting? What do you know about these roles regarding, e.g., their importance, the ways of how they can be carried out? We distributed forms on an A4 paper (Figure 1, left) and asked them to fill in for each these three roles at least three items by describing with some words.

Name	Matrikel#	Marks
Moderator	• • •	
Documenter	• • •	
Devil's advocate	• • •	

Name	Matrikel#	Marks
A group of people		
Whole > Sum		
Working together		
Synergy		
Cooperation		
Reporting to one boss		
Sharing one aim		
Flexibility		
Serving one customer		

Figure 1. The first classroom "assessment FOR learning" [9] about the roles of moderator, documenter, and devil's advocate in a meeting (left); the second classroom "assessment OF learning" [9] about the most important characteristic of cooperative work (right).

Assessment by the teacher: An implementation for assessment for learning

Students write their answer onto the paper where the question is stated. Additionally, they put their comments and explanations to their answer. Answers are then gathered by the teacher and read later to mark them. These marks are then added to the marks they get in the written exam at the end of the semester and the exercises they have five times during the semester in form of group assignments. This type of assessment captures, on the one hand, the presence of students in a lecture, without letting them to fill in a dedicated form. On the other, it motivates students to join the lectures to collect additional marks for the final assessment and the grading of the module. The more important impact is that they can assess their knowledge before a new subject is introduced in the lecture. This way, their attention can be directed to the current subject and students become more active during the lecture. A big disadvantage is that teachers have a lot of assessment to do after the lecture, which can take a lot of time. Additionally, no direct feedback can be given to the individual answers of each student during the same lecture. The feedback is temporally postponed.

Peer assessment: An implementation for assessment for learning

After answering the question, each student exchanges with his or her neighbor the answer. Each student judges the correctness of the answer of his or her neighbor. After finishing this, the teacher tells to all the right answer, e.g., by showing explanatory slides. Each student marks the answer based on this information and hands it back over to its owner.

The advantage of such a classroom assessment is that all answers are corrected immediately; no additional work needs to be carried out by the teacher after the lecture. Students are made aware of their knowledge to that specific subject by getting their answer assessed ad-hoc. On the other hand, they learn more because they are confronted with an additional answer, which they have to understand before deciding its correctness. They have to be careful what the teacher explains about the question to avoid error in marking the answer of their neighbor. This requires a different level of knowledge, because there is a difference between answering a question and deciding whether an answer is correct to a question given. Another advantage is that not the teacher but a fellow student is judging the answers. It is not about being assessed by the teacher, it is about finding out how much knowledge one has to a subject, which will be the content of the lecture held. Students are relaxed and concentrate on the subject. At the same time, it is a type of competition between students with no harm if one is not very knowledgeable in a new subject. Each one compares his or her knowledge first with the knowledge of the neighbor. If there are several assessments carried out in one lecture with the same neighbor, students get to know each other in the sense how much the other person knows about that very subject. They build an impression about their neighbors by being aware of their skills and know how, at least regarding the current subject.

Peer reviewed assessments can then be marked by the teacher to use them for the final grading. Optionally, students can put their marks to the answer during the assessment. In this case, the teacher controls briefly the correctness of this and modifies the marking. The effort of assessing for the teacher is not as high as he or she would do the whole assessment by him- or herself.

The second example is about an "assessment OF learning" that we use at the end of the first lecture in the module cooperative work. It is about finding out the correct answer to the question: What is the most important characteristic of cooperation? Students must reflect on the information they were listening during the whole lecture (1,5 hours long) and prioritize the given alternatives for an answer, finally choose the right one, and explain the reason. Again, it is a single person assessment as in the first example. The question is formulated on one A4 page and distributed among the students in the classroom (Figure 1, right).

Assessment by the teacher: An implementation for assessment of learning

Each student chooses one answer and puts his or her comments to it. The answers are then gathered by us and read later to mark them. It is the same mode like in the first assessment example and corresponds to the advantages and disadvantages of it.

Assessment supported by ICT: An implementation for assessment of learning

We developed an ICT environment to capture the answers of the students by using short message service (SMS) via mobile phones. The idea is to provide a quiz like assessment environment in classrooms to ask short single-choice questions. The teacher shows a question with possible answers on the wall (Figure 2, left). Students see what they have to do to answer this question. They have two choices: they can send their answer via SMS to the telephone number displayed or they can use the web interface of the system to answer the question directly in a Web browser. The environment[1] facilitates a multi-user real time entry into a system, which sums up the answers and presents cumulatively the results in a diagram (Figure 2, right). It shows in percentage how many answers were correct, how many were not. The visualization is then used again in the lecture to give feedback to the whole class. Students can see what the correct answer was and can assess themselves whether their answer was correct or wrong.
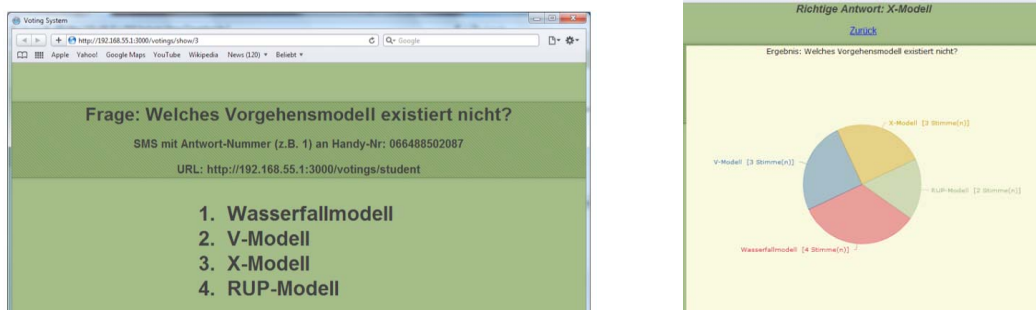

Figure 2. Question stated by the teacher during a lecture with possible answers to choose (left), the cumulative result of the answers gathered and presented in the classroom at that moment (right).

Besides having data received anonymously, there is an option to register the students with their mobile phone numbers. This offers the possibility to identify them and so use the data for marking their answers. In the current version this option is not implemented.
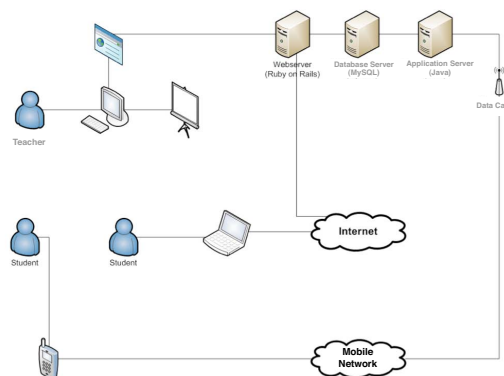

Figure 3. The architecture of the prototype implemented to support a classroom "assessment OF learning" [9] by using SMS technology.

The advantage of such a system is the immediate use and evaluation of the data entered to represent it in real-time to all. The feedback is ad-hoc and can be used to modify the course of the lecture depending on the result. If there are too many wrong answers, it is an indication for us that the content could not really be transferred clearly. There is a need to correct it or to repeat it with other words. This type of simultaneous assessment also offers the possibility to clarify a possible misunderstanding by directly

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[1] The design was made by the authors of this paper. The implementation was carried out within the scope of a student project by Thomas Womser and Stefan Zimper.

interacting with the students in the classroom. A disadvantage is, when there is a student without a cellular phone in the classroom. This makes an imbalance between the students in the classroom, and can be avoided by making computers available for students to enter their answer.

DIFFERENT MODES OF CLASSROOM ASSESSMENT

Based on our design and study of classroom assessments, we define several modes (Table 1). The main distinction we could identify is the one between "assessment *for* learning" and "assessment *of* learning" [9]. This is followed by the persons assess the learning effort or the knowledge that is already there. Asynchronous assessment for learning is not useful for students. Asynchronous assessment can only be direct, where as synchronous assessment can be direct or indirect depending on the identification and representation of persons assessed in the results.

If there is an ICT support, as shown in our case, the assessment happens in the classroom, results are accessible both for teachers and students, teachers use it to improvise or correct the teaching if needed, students see their current knowledge and are involved in the classroom activity.

If there is no ICT support, it is not possible for the teacher to assess the knowhow of the students in the classroom in a timely manner. Instead, teachers can gather this information during the class and assess it afterwards. In this case, students do not have access to their data. If students are directly involved in the assessment process, it is easily doable to use paper-based documents to find out what they know on the subject. This direct way of assessment improves the motivation of the students and the class performance in general. If assessment is designed this way, then it looks more like teaching and less like testing [3]. For the assessment by peers there is no need for ITC support.

Table 1: Modes of assessment.

Assessment *for* learning	Assessment *of* learning	Done by	ICT support
asynchronous	asynchronous	teacher	no
synchronous/indirect	synchronous/direct & indirect asynchronous	teacher & student	yes
synchronous/direct asynchronous	asynchronous	student	no
synchronous/direct	synchronous/direct	student	yes
synchronous/direct	synchronous/direct	peer	no
synchronous/direct	synchronous/direct asynchronous	peer	yes

Our prototype offered a new dimension to assessment possibilities. Having support of real time entry and evaluation of single answers by multiple persons provides a simultaneous feedback to the students in the classroom during the lecture. In our case it is indirect because it is not shown who answered the question correct or wrong, which relaxes the students and relies on their self-judgment. But it is possible to keep track of answers of single students by identifying them and their answers, which can also be used for grading the module. In case of assessments for learning only with ICT support it is possible to provide synchronous indirect feedback.

The assessment must happen immediately in the classroom to see at that very moment how much interest and knowledge students have to a certain topic. This facilitates intervention and improvisations by the teacher to meet information needs and close knowledge gaps of the students present in the classroom. On the other hand, students assess their knowledge without being graded for that. It is just important information for them to know what they already know about the subject. They are self-involved in judging their answer in compare to the right answer presented by the teacher. If their answer is

wrong, students know that they need to learn more about the subject. They may be more motivated to get to know why the answer is different than theirs. If their answer is correct, students get more confidence into the subject taught and get more motivated and engaged in the classroom activity. This type of experience contributes to their success and encourages them continue working on the subject more enthusiastically.

Classroom assessments provided by ICT-based mechanisms like in our prototype make lectures dynamic. On the one hand, students become a type of quiz-participants. They get curious about the result and have fun in the game-type interaction with the teacher. They see it at the same time as a chance to give feedback to the teacher, by showing their learning progress. They actively have impact on the lecture currently held. This involves them in learning process, not only as learners, but also as active evaluators of the lecture, which is directly transparent in the classroom. The teacher feels that his or her skills and content are measured in a sense. It is an unsecure situation; all participants are keen on finding out what the total learning progress in the classroom is. This makes classrooms to interaction areas, which can be modified and redesigned depending on the classroom assessment results.

CONCLUSIONS

In this paper, we presented our research on classroom assessment in computer science. Our goal is engaging and motivating our students without measuring their effort. Classroom assessments offer different modes to modify teaching and learning activities. With our prototype and analysis, we contribute to the improvement of classroom assessment, especially by showing how a new ICT based approach can support synchronous indirect assessment in classrooms.

As stated in the literature [10, p.12], classroom assessments can help increase confidence of students. In our study we could not gain this, because we applied classroom assessment only in one module and we could not follow the improvements of single students in their study. In our future work, we will investigate the middle- and longer-term changes of students if they are exposed to such classroom assessments. On the other hand, we will evaluate our ICT based approach and its quality and effectiveness for further modification and improvement.

REFERENCES

[1] Black, P., and William, D. "Assessment and Classroom Learning". *Educational Assessment: Principles, Policy and Practice*. 5(1), 1998, 7-74.

[2] Chappuis, S., and Stiggins, R. J. "Classroom Assessment for Learning". *Educational Leadership*. 2002, 40-43.

[3] Davies, A. *Making Classroom Assessment Work*. Merville, British Columbia, Canada, Connections Publishing, 2000.

[4] Jerald, C. D. *Dispelling the Myth Revisited*. Washington DC: Education Trust, 2001.

[5] Meisels, S., Atkind-Burnett, S., Xue, Y., and Bickel, D. D. "Creating a System of Accountability: The Impact of Instructional Assessment on Elementary Children's Achievement Scores". *Educational Policy Analysis Archives*. 11(9), 2003, 19pp.

[6] Rodriguez, M. C. "The role of Classroom Assessment in Student Performance on TIMSS". *Applied Measurement in Education*. 17(1), 2004, 1-24.

[7] Stiggins, R. J. "Assessment, student confidence, and school success". *Phi Delta Kappan*. 81(3), 1999, 191-198.

[8] Stiggins, R. J. *Student-involved classroom assessment*. 3rd Edition. Upper Saddle River, NJ, Merill-Prentice Hall, 2001.

[9] Stiggins, R. J. "Assessment Crisis! The Absence of Assessment FOR Learning". *Phi Delta Kappan*. 83(10), 2002, 758-765.

[10] Stiggins, R. J., and Chappuis, J. "Using Student-Involved Classroom Assessment to Close Achievement Gaps". *Theory into Practice*, 44(1), 2005, 11-18.

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