

Continuous assessment in engineering education: a pilot study

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Abstract—Learner-centred teaching inevitably involves continuously ongoing context-specific assessment of students understanding, attitudes, problem solving abilities, etc. At LTH Dept. of Electrosience students recognise this as an informal integrated part of the behaviour of appreciated teachers, who in turn claim they developed this rewarding strategy intuitively. The department has made classroom assessment methods familiar to its teachers, and formally integrated continuous student-feedback in all courses. Questionnaires show that in large classes (>80 students) positive effects of classroom assessment techniques are obvious to most students. In small classes (<30 students), the outcome is unclear, either due to well working subtle informal classroom communication (not obvious to students), or merely due absence of formative assessment.

To be efficient, formative assessment should be a “private” productive dialogue between teacher and class. It is therefore imperative from the schools’ perspective to monitor that formative assessment is ongoing without “ear-dropping” on the classroom dialogue. Such systems are possible to design, for instance by means of individual class-specific web-sites with restricted access and limited life-time. To secure continuity and robustness of the quality of each taught course, the final summative post-course evaluation includes the students and teachers evaluation of the formative assessment as a main element.

I. AIMS

As a part of LTHs ambition to improve teaching and learning (project “Genombrottet”), one of its departments, dept. of Electrosience, decided to launch the pilot project “Operative assessment” aiming towards improved learner-centered education. The main idea behind this is that teachers’ true understanding of their students perspectives on course curriculum and activities is significant of “good teaching”. The question is weather it is possible and useful to systematically integrate such monitoring of student views into the teaching system of a school [1]. In this context, it is imperative to distinguish formative assessments that continuously improve ongoing classroom activity (operative assessment) from conventional post-course evaluations, which report problems and outcomes to those outside the classroom after the course is finished (the school board, the student organizations, the university administration, the sponsors, etc).

II. CLASSROOM ASSESSMENT

Many teachers conduct classroom assessment intuitively and without thinking much about it. They may toss out questions in or before class which monitor deep understanding of the course context, they may read the facial expressions and body language of the students, or simply sample the moods of the students during coffee breaks. Problem is, not all university teachers do this. They may for instance have problems understanding informal off-class language, or sense they have too big a class to monitor. Or, they may simply not appreciate the virtues of learning-centred teaching. Further, teachers spontaneous intuitive monitoring of their students abilities may not always address urgent and specific questions related to the course curriculum. There are, however, well-established assessment methods available. A wide spectrum of efficient classroom assessment techniques (CATs’) were established and has been accepted globally [1-6]. Although they are used mostly to monitor course-related knowledge and skills, they may also be specifically aimed at other course aspects, for instance to assess critical and creative thinking, attitudes and values, or learner reactions to instructions and group activities. The use of classroom assessment techniques are normally not particularly time consuming for teachers or students, and does give teachers an opportunity to clarify, repeat, or change perspective of central concepts during subsequent class. Each CAT provides a positive loop, ideally leading to deeper student understanding of course topics prior to the introduction of next new concept (Fig. 1).

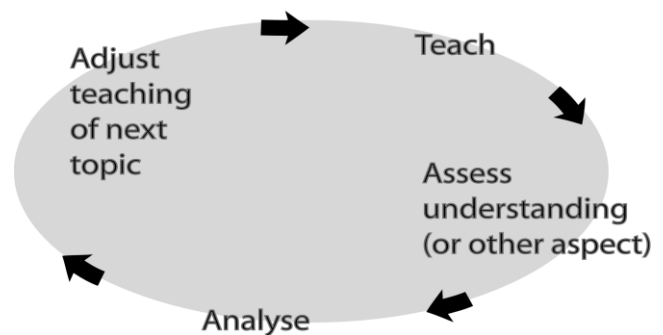


Fig. 1. Loops of classroom assessment need to be context specific, frequent and easily administered to impose positive impact on teaching and learning.

In this way, teaching of each concept takes its starting point from the students' pre-existing conceptual framework. To be an efficient tool in improving student learning, classroom assessment inevitably must be continuously ongoing, student-centred, teacher directed, and mutually beneficial for students and their teacher. It further needs to be context-specific, i.e., adapted to the learning situation of the specific part of the curriculum taught at the moment (Fig. 1).

III. TECHNICAL ASPECTS

Classroom assessment can be conducted in simple ways within the classroom for instance by students anonymously leaving answers the teacher's mailbox before leaving the room. Assessment may also be conducted around the clock on class web sites with restricted access (teacher and class only). However there is a difficulty in the systematisation of classroom assessment, as it is not aimed to those outside the classroom door. This can readily be solved by routinely asking students and teachers in the post-course summative assessment whether operative assessment has been going on, and to what degree it has had impact on teaching (Fig. 2).

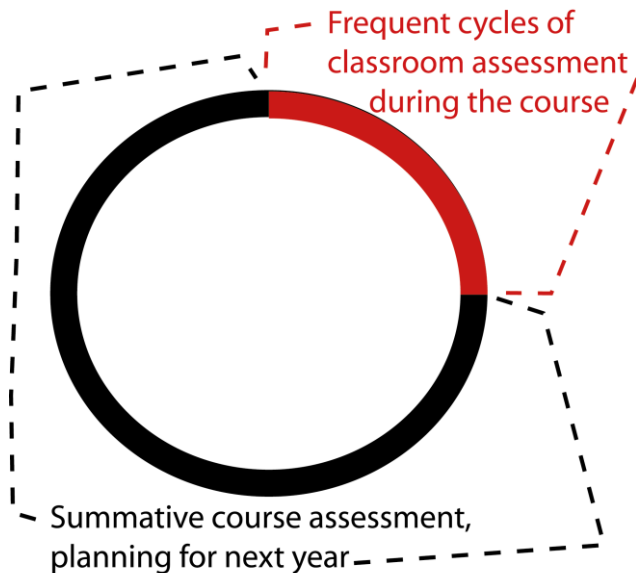


Fig. 2. Relation between summative and formative assessment.

IV. THE PILOT STUDY

Our pilot study includes operative assessment of all courses taught at the Department of Electrosience during the fall of 2002, including a full range of freshmen to advanced students. Electrosience is a large academic unit which recently was formed by the merging of three research units, the Department

of Applied Electronics, Department of Telecommunication Theory and Department of Electromagnetic Theory. Classes are typically large (up to 150 students), and 20 teachers are involved in teaching. The introduction of systematic classroom assessment ("Operative assessment") coincides with an administrative reorganisation of the teaching staff, which was necessary to secure and promote high quality courses. The courses are now supervised by a group rather than by a single teacher to ensure long-term follow-up and course improvement.

The teachers at Electrosience have recently been introduced to the principles of classroom assessment techniques, and were during the first semester (spring 2002) urged to find and modify assessment techniques which suite their classroom situations best. During this trial, a pedagogical consultant (AA) was available to meet questions or hesitance regarding the introduction of classroom assessment. After a 6-month period of trial, CAT activities have been evaluated.

V. RESULTS

Increased classroom assessment lead to typical advantages, i.e, increased student motivation as students realise that their teachers do care about their learning, and optimal "student knowledge growth" as teachers better keep track of the knowledge level and quality in their classes during the courses. In this context, increased student motivation has stimulated students to contribute feedback truly useful to their teachers.

The main question we ask ourselves in the longer perspective is whether continuous syn-course assessment (operative assessment) can be systematically imposed on a teaching organisation, or, if such pedagogic virtues are inevitably linked to the personal development of individual teachers regardless of administrative setting.

The results are based on interviews with teachers and questionnaires to the students after finishing the courses.

The introduction of the concept to the teachers was over all well received. There was consensus on the need for this kind of assessment although some hesitation on the implementation. A second meeting discussed this topic and new ideas were added to the ones already in use. After a couple of weeks we made some interviews on the impact so far. Some had succeeded in monitoring the learning outcome and hence reorganised the course plan. Others had noticed a lack of understanding but chosen not to respond to this, and we also saw one or two that ignored the whole concept on the presumption that it is each students' responsibility to learn the course and for the teacher this kind of assessment only delays and disturbs the general plan. The most positive signal from the teachers' interviews is the consensus that "This has a value of it's own for the teacher". It did indeed enhance the quality of the courses where it was performed at full extent, which is a guarantee for the continuance outside the frame of a pilot study.

The students were asked two questions after finishing the course:

Operative assessment means that the teacher is continuously monitoring student learning of each concept in order to adjust the course plan when needed. This may for instance include assignments, discussions, anonymous notes etc.

1) Have you experienced that operative assessment has occurred?

2) If so, what is your comment on the outcome of the operative assessment?

Student responses to question 1) are shown in Table 1 and Fig. 3. A positive response is more obvious for large classes, typically more than 80 students, than for small classes, typically less than 30 students.

TABLE 1 OUTCOME OF STUDENTS VIEW ON OPERATIVE ASSESSMENT .

| Course | Number of students | Did experience Operative assessment | Did not experience Operative assessment | No answer |
|--------|--------------------|-------------------------------------|---|-----------------|
| 1 | 27 | 9 | 14 | 4 |
| 2 | 126 | 85 | 16 | 20 |
| 3 | 80 | 12 | 3 | 65 ¹ |
| 4 | 41 | 23 | 1 | 17 |
| 5 | 20 | 12 | 0 | 8 |
| 6 | 22 | 6 | 7 | 9 |
| 7 | 120 | 41 | 5 | 74 |

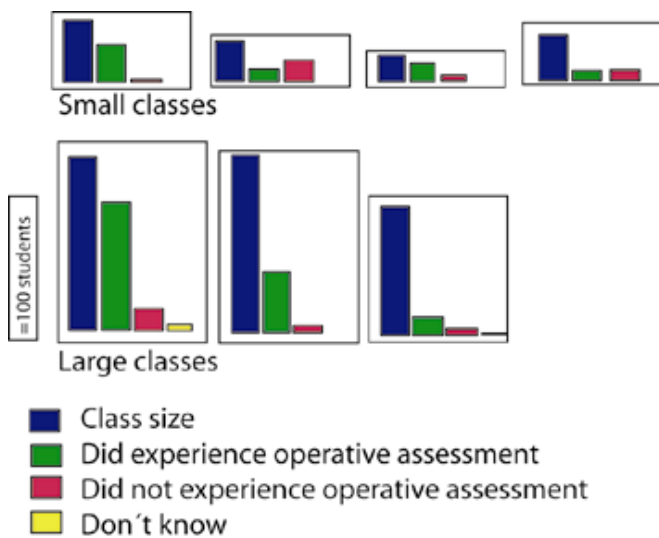


Fig. 3. Graph based on Table 1.

¹ Few students were reached by the questionnaire on this course.

The explanation to this is the fact that in small classes the communication between the students and the teacher is much easier and direct. Students in small classes don't always know when operative assessment is done because the teacher actually know each student's capacity and arrange the teaching accordingly. For large classes the benefit of operative assessment is more obvious for the students. They see the interest shown from the teacher and the outcome of the assessment that they are asked to reflect on. It is a better strategy to let the students provide the way to improve the result. Their own reflection on the learning process is very rewarding in the long run.

VI. CONCLUSION

This study shows that operative assessment as described will enhance learning, especially in large classes. When encouraged the teachers find it personally rewarding and valuable for the class. We believe that a framework at departmental level can effectively support ongoing operative assessment regardless of course type and teacher personality. Obvious pitfalls include teacher's fear of diverting from the original course plan, or not realising that sticking to the plan may hamper learning. We are aware of the constraint of a fixed time schedule. Maybe the schedule should focus more on the topics to cover, and less on chapters and weeks, so that each topic has to be penetrated and abandoned only after sufficient learning has been achieved.

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