A Paradigmatic Shift from "Assessment *of* Learning" to "Assessment *for* Learning"

Referral center for assessment in e-learning
(http://www.carnet.hr/referalni/obrazovni/spzit)
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"Learning… is not making *deposits* in one's *data bank*. It is more like mixing a new ingredient into the *soup* of perception and cognition."

(Davis *et al*., 2000)

1. INTRODUCTION

E-learning is not just the distribution of static resources but an active and engaging experience which, as its best, should become an online dialog between the student, the tutor and other students in the course. If e-learning does not include rich interactivity than major opportunities for using computers to enhance learning and test new skills will be missed. Interactivity can be achieved through various mechanisms including discussion boards and web conferencing (Kukolja Taradi, & Taradi, 2004) simulations, summative and formative assessments with context sensitive feedback etc. Our paper focuses just on one of these mechanisms to enrich e-learning, that is the use of formative assessment. Thus, it is important to start with the understanding that assessment is a form of interaction and communication that should be used as a teaching tool and not just as an evaluation mechanism. In this sense, web-based assessments need to be seen as an interactive mentoring opportunity used to guide activities. Therefore a difference should be perceived between "assessment *of* learning" and "assessment *for* learning". The former means assessment for the purposes of grading and reporting whereas the later relates to assessment whose intention is to enable students, through effective feedback, to fully understand their own learning and the goals they are aspiring for. Assessment for learning helps teachers and students to know whether that current understanding is a suitable basis for future learning.

The aim of our study is to determine the effectiveness of a hybrid (face-to-face/web-based) problem-based collaborative learning environment on student learning outcomes in acid-base physiology. We wanted to test the hypothesis that one way to improve student success is to increase the frequency of formative tests.

2. METHODS

The population of the study consisted of two groups of second year medical students at the University of Zagreb Medical School: 37 students were enrolled in a

hybrid problem-based elective course of acid-base physiology and 84 students attended the same problem-based elective course in a traditional face-to-face environment. The amount of material covered in the hybrid course, and the depth with which it is covered, was in general equal that of a classroom-based course.

By using WebCT courseware tools we created a hybrid (blended) course that combines traditional face-to-face and e-learning approaches to provide educational services for an undergraduate second year elective course in acid-base physiology at the University of Zagreb, Faculty of Medicine. The course is designed to require students to work in small collaborative groups utilizing problem solving activities in order to develop topic understanding. The web-based learning environment is logically organized into 10 topics (e-tutorials) presented through a series of 78 web pages, illustrated with 62 original drawings and photographic images, 3 interactive Flash animations, 4 specialized calculators (scientific calculator, pH calculator, anion-gap calculator and square equation calculator). Each topic is presented by goals and objectives, content notes, assignments, quizzes and links to outside web resources. The syllabus and the calendar-tool guide the student through the course step-by-step. Using the WebCT assessment tool we created several test types: a diagnostic course pre-test, 26 formative self-tests and quizzes with immediate feedback, as well as a final summative test. It is important to stress that all 26 formative tests are not assigned to each student group. On average, one student is offered about 10 self-assessments (approximately 1 formative assessment per 1 e-tutorial). Students submitted their answers electronically and received instant feedback on their performance. In addition to multiple-choice questions, true/false, matching, calculated, short answer, and written paragraph questions were used.

At the end of the course, both groups were given similar final summative tests. The main difference was the delivery of the test: traditional students were offered paper-and-pencil tests which were evaluated electronically, while WebCT students had to complete online proctored tests. Both types of tests were "open book" problem-based test: students are confronted with a problem description based on real "patient cases" (medical findings of blood gases data of patients with acid-base disturbance). The test is made of 36 "cases" with a maximum score of 36. The test examines both factual recall and higher order thinking, including integration of knowledge and problem solving ability. Because of the need to determine the students' identities, the final exam is proctored by the instructor. The test is timed and automatically graded by the WebCT system.

Learning effectiveness has been measured in terms of student learning outcomes. Student learning outcomes assessment measures whether the learning outcomes, the objectives that faculty have set, are being met. For this purpose the scores of the final summative tests were analyzed. To examine if regular self-testing and feedback during learning via the WebCT virtual learning environment enhanced overall learning outcomes, we compared the final score on the summative test with the number of completed formative self-assessments.

Descriptive statistics are reported as means ± SE. Analyses of data were performed using Student's *t*-tests. Differences were considered significant for *P* values ≤ 0, 05.

3. RESULTS

Student usage of the site was generally high, but varied widely between individual students. A student accessed the WebCT course environment on the average 491 ± 30, ranging from minimum 170 times to maximum 857 times. A student spent on average 1620 minutes (36 school hours) in the virtual environment.

Regarding the mean score of the summative examination, there was a significant difference (t = 3, 3952; P = 0, 0009) between students learning in the hybrid environment and those learning in the traditional way. For the WebCT students, the mean score of the final summative test (of maximum 36 points) was 25,81 ± 0,66 (ranking from the lowest of 18 to the highest of 33), while the mean score for traditional classroom students was 22,08 ± 0,67 (ranking 7 to 32).

Students who achieved a high score in the final summative examination completed on average approximately two times as many formative assessment items and achieved a higher score for formative tests than students who did poorly. Students in the "high-score" group completed 4-8 formative self-tests, while students in the "low-score" group completed 0-3 formative assessments.

4. DISCUSSION

Over the past several decades, educational researchers are in agreement that one way to improve student success is to increase the frequency of exams. For example, Pikunas & Mazzota (1965) reported a 10% improvement when tests were given weekly instead of every 6 weeks. Henley (2003) found that formative self-assessment and summative assessment with automated marking and immediate feedback can have an important impact on student motivation assisting students to develop the skills necessary to become lifelong learners. He stated that students generally consider that topics assessed are the most important, both intellectually and for the purpose of achieving better marks. Thus, assessment is a learning experience for students and can achieve a considerable degree of improvement in student learning if used appropriately. Gordon (1992), also, concluded in his paper that the ability to accurately assess one's strengths and weaknesses is critical to the enterprise of lifelong learning. Kashy *et al.* (1998) reported that the use of immediate feedback, making students aware of what they do not know, increases understanding of the material. On the other hand, Keller (1983) stated that successful completing of assessments gives students a satisfying feeling of accomplishment and helps them develop a positive expectation for successful achievement. Making students aware of what they do/do not know, increases understanding of the material. This metacognitive skill (of "knowing when you know something and when you don't") is considered to be a key feature of tertiary-level education (lifelong learning).

In the past decade, information technology has become relatively inexpensive, very powerful, and nearly ubiquitous making the computer based approach to assessment and grading very practical and economical (Barua, 1999). Consequently, a more frequent use of assessments as interactive educational tools (rather than just evaluation mechanisms) is facilitated. However, one must keep within bounds and avoid to much testing. In other words, the danger today is as great for "over-testing" without purpose as it was in the past for "under-testing".

5. CONCLUSION

Our modest experience presented in this paper, as well as documented in works of other educational researchers, permits us to say that students' progress in a hybrid collaborative environment can be positively affected by the use of technology. The improvement discussed in this paper relates to students using web applications that can be embedded into the assessment activities so that more interesting and challenging problems can be presented to students in an online format. With an appropriate organization of assignments and formative assessments instructors can have students engaged in doing, rather than just passive experiencing or reading. Thus, the unique features of web-based instructional environment open up a new frontier for online instructors to practice a more student-centered pedagogy. Still, we must never forget that the effectiveness of a course is less dependent upon the enabling technology than on the skill with which the instructor uses the available technology to construct learning experiences.

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