

FORMATIVE ASSESSMENT AND MOTIVATION IN HIGHER EDUCATION: A SUCCESSFUL APPROACH IN MECHANICAL ENGINEER THERMODYNAMICS

M. Duarte

*Instituto Superior de Engenharia do Porto (PORTUGAL)
mic@isep.ipp.pt*

Abstract

Between 2000/01 and 2006/07, the approval rate of a Thermodynamics course in a Mechanical Engineer graduation was 25%. However, a careful analysis of the results showed that 41% of the students chosen not to attend or dropped out, missing the final examination.

Thus, a continuous assessment methodology was developed, whose purpose was to reduce drop out, motivating students to attend this course, believing that what was observed was due, not to the incapacity to pass, but to the anticipation of the inevitability of failure by the students.

If, on one hand, motivation is defined as a broad construct pertaining to the conditions and processes that account for the arousal, direction, magnitude, and maintenance of effort, on the other hand, assessment is one of the most powerful tools to change the will that students have to learn, motivating them to learn in a quicker and permanent way.

Some of the practices that were implemented, included: promoting learning goal orientation rather than performance goal orientation; cultivating intrinsic interest in the subject and put less emphasis on grades but make grading criteria explicit; emphasizing teaching approaches that encourage collaboration among students and cater for a range of teaching styles; explaining the reasons for, and the implications of, tests; providing feedback to students about their performance in a form that is non-ego involving and non-judgemental and helping students to interpret it; broadening the range of information used in assessing the attainment of individual students.

The continuous assessment methodology developed was applied in 2007/08 and 2008/09, having found an increase in the approval rate from 25% to 55% (30%), accompanied by a decrease of the drop out from 41% to 23,5% (17,5%). Flunking with a numerical grade lowered from 34,4% to 22,0% (12,4%).

The perception by the students of the continuous assessment relevance was evaluated with a questionnaire. 70% of the students that failed the course respond that, nevertheless, they didn't repent having done the continuous assessment.

Keywords: Formative assessment, continuous assessment, feedback, motivation, Higher Education.

1 THE CASE STUDIE

Thermodynamics is a second year course in a Mechanical Engineer graduation of Oporto's School of Engineering (ISEP). Between 2000/01 and 2006/07, the approval rate of a Thermodynamics course was 25% (20%, 29%, 25%, 34%, 24%, 18% and 24% from 2000/01 to 2006/07, respectively).

During this period, there were continuous assessment (30% of the final grade) and a final examination (70% of the final grade). Approval required a final grade of 50%, with a final examination minimum grade of 35%. In 2006/07 there was only a final examination.

The continuous assessment consisted of mini-tests during classes. The number of mini-tests varied from eight to four. The only feedback students received were the grades.

For years, it has been recognized in the literature, the need to change and improve assessment methods. In spite of that, the purpose of most assessment is still to grade students, and not the learning enhancement [1].

From the students enrolled in the course, an average of 41% chosen not to attend or dropped out, missing the final examination (47%, 38%, 28%, 45%, 40%, 42% and 46% from 2000/01 to 2006/07, respectively).

The approval rate and the dropout rate showed no positive influence from the continuous assessment from 2000/01 to 2006/07. That's why in years 2007/08 and 2008/09 the continuous assessment was completely changed.

The changes made included: home work assignments; 20 minute quizzes in class and a two-stage test.

In the end of each subject students were given a 20 minute quiz in class with open book and all other element they might regard as useful. In this way they read and prepare all the study material during the semester and they only needed to review to the final examination.

The two stage-test was about a subject that needed to be well understood because it was necessary for the consequent topics. Students didn't usually invest enough time and effort when it was needed only to realise latter that this subject was crucial.

The stages were a week apart. In the first stage, the students answer 20 questions in 30 minutes. Based on what they thought they missed, during the next week, they could try to improve their performance, by studying harder. The teacher didn't interfere with this process, and the students didn't know how well they did in the first stage. In the second stage, the test only included the questions that each student missed (each test is unique and individual) and had the duration of 30 minutes.

This type of test, where there is the possibility to improve is a way to make sure that students really try to improve.

In both cases (quiz and two stage-test) feedback was provide. An individual sheet for each student was available online with clues to help correct each wrong question.

Also feed forward was considered, as detailed information was given about the expected learning outcomes of each assessment, the grading criteria and other helpful information.

Care was taken in adapting the degree of requirement and complexity not only to the content but also to the extent students where expect to have learned in that particular time of the semester.

Home work assignments involve complex calculations and guided training activities, with partial results to encourage student's self-assessment and learning.

Some of the practices that were implemented, included: promoting learning goal orientation rather than performance goal orientation; cultivating intrinsic interest in the subject and put less emphasis on grades but make grading criteria explicit; emphasizing teaching approaches that encourage collaboration among students and cater for a range of teaching styles; explaining the reasons for, and the implications of, tests; providing feedback to students about their performance in a form that is non-ego involving and non-judgemental and helping students to interpret it; broadening the range of information used in assessing the attainment of individual students.

In 2007/08, continuous assessment was mandatory (72% of the students had to do it). In 2008/09, it was optional (63% choose to do it).

2 CONTINUOUS ASSESSMENT AND MOTIVATION

In the early 1970s, researchers found that what influenced students most was not the teaching but the assessment [2], which lead to the idea of the hidden curriculum [3]. According to students' testimony, what and how much they studied were completely dominated by the way they perceived the demands of the assessment [2]. This effect of assessment in students' learning is what Biggs defined as backwash [4], which means that students' learn what they think will be assessed.

Assessment drives learning trough motivation. Motivation concerns forming goals and making an effort to achieve them. Students' motivation vary and may change through the course. Intrinsic motivation is wanting to understand the subject; extrinsic motivation is wanting the reward of a certificate or a job [5].

A person's perceptions of the causes of success and failure are of central importance in the development of motivation for learning. Learners who attribute success to effort, and who perceive ability to be changeable and controllable are likely to deal with failure constructively, and to persevere with the learning task [6].

Motivation is defined as a broad construct pertaining to the conditions and processes that account for the arousal, direction, magnitude, and maintenance of effort [7].

Continuous assessment is the use of regular tests and assignment throughout a unit of study, where results for each piece of work contribute to the final result [8].

This exercises, assignments and progress tests given to students throughout an academic semester or year may serve as formative assessment, if regular feedback is provided to the students in order to stimulate learning and to provide students with information which will help them judge the effectiveness of their learning strategies to date. It also alerts teachers to any section of the course or approaches to teaching where students are having difficulties and which may need further attention [8].

However, extreme care must be taken in the feedback and grades provided to the students: unreasonably low marks may either persuade students to work much harder or, alternatively, to withdraw from the program. In a similar way high marks may give students a false sense of confidence in their own ability and knowledge. Students who are given unrealistically high marks in one subject may devote less time to that subject in order to concentrate on another subject where they think they are having difficulties. Formative assessment, used badly, can actually be a disincentive to further learning [8].

3 THE RESULTS

As a consequence of the continuous assessment methodology applied in 2007/08 and 2008/09, there was an increase in the approval rate from 25% to 55% (30%), accompanied by a decrease of the drop out from 41% to 23,5% (17,5%). Flunking with a numerical grade lowered from 34,4% to 22,0% (12,4%).

The perception by the students of the continuous assessment relevance was evaluated with a questionnaire. 70% of the students that failed the course respond that, nevertheless, they didn't repent having done the continuous assessment.

To analyze how students perceived continuous assessment as important for their academic performance, all students were inquired anonymously. 96 responded (48,5% of students who attended; 53,0% of students enrolled).

15% of students who chose to do continuous assessment preferred not to have done it, not perceiving it as helpful to their academic performance, which concurs with the majority not obtaining approval (12,5% did not obtained approval; 2,5% obtained approval).

42,8% of students who chose not to do continuous assessment, preferred to have it done, having perceived this assessment as useful, even in cases where approval has been obtained (28,6% did not obtained approval; 14,2% obtained approval).

Whereas the option for choosing continuous assessment implies a larger investment of student, it would be likely that those who flunked chose to not to do it. Still, 70% of students in these circumstances would choose to do it all over again.

It was found that the approval rate, according to the number of attempts to succeed in the course, of the students who chose continuous assessment and did the final examination, improved, mainly students enrolled for the first time.

In students enrolled for the first time, the average approval rate went from 31,4% (2000/01 to 2005/06) to 74,2% (2007/08 and 2008/09), improving 136%.

In students enrolled twice, the average approval rate went from 49,0% (2000/01 to 2005/06) to 82,4% (2007/08 and 2008/09), improving 68%.

In other students, the average approval rate went from 48,3% (2000/01 to 2005/06) to 71,6% (2007/08 and 2008/09), improving 48%.

So, it possible to conclude that the continuous assessment implemented in 2007/08 and 2008/09 improved the approval rate and lowered the dropout rate. Students believed that this type of assessment helped them to succeed even when they didn't in fact succeed. This belief is a key aspect of motivation.

REFERENCES

- [1] Fernandes, D. (2005). *Avaliação das aprendizagens: Desafios às teorias, práticas e políticas*. Lisboa: Texto Editores.
- [2] Gibbs, G. & Simpson, C. (2002). *How assessment influences students learning – a conceptual overview*. Retrieved July, 12, 2007 from http://www2.open.ac.uk/cehep/ssrg/documents/42_02.pdf
- [3] Ramsden, P. (2003). *Learning to teach in higher education* (2nd ed.). London: Routledge.
- [4] Biggs, J. (1999). *Teaching for quality learning at university*. Buckingham: Open University Press
- [5] Bostock, S. J. (2004). *Motivation and electronic assessment*. Alexander, S. & Irons, A. (Eds.). *Effective Learning and Teaching in Computing*. pp. 86-99.
- [6] Harlen, W., & Crick, R. (2003). *Testing and motivation for learning*. *Assessment in Education*, 10(2).
- [7] Katzell, R. A., & Thompson, D. E. (1990). *Work motivation: Theory and practice*. *American Psychologist*, 45(2), 144-153.
- [8] Miller, A. H., Imrie, B. W. & Cox, K. (1998). *Student assessment in higher education: A handbook for assessing performance*. London: Kogan Page.