The Effectiveness of Different Assessment Strategies: An Empirical Study

Completed Research Paper

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ABSTRACT

In this paper we report on our experiences from aligning assessment strategies with available resources when constantly redesigning an introductory course on business information and communication technologies at a North American university. The examination and assignment results of 148 students have been analyzed to better understand the effectiveness of different assessment strategies when redesigning the course. We have managed to adapt our assessment strategy to using fewer resources while maintaining an effective learning environment. The data analysis suggests that no significant differences occurred with regards to learning outcomes and that a computer-supported assessment strategy has advantages with regard to preparing students for examination.

Keywords

Assessment strategy, teaching approach, learning outcomes, computer-supported learning, resources, education

INTRODUCTION

One of the most time-consuming tasks at any level of higher education is grading. This is particularly the case with formative tasks such as assignments where some form of feedback is required. In many North American universities, the task of grading is given to Teaching Assistants (TAs). Employing TAs to do this often requires extra financial resources that, in this time of restricted budgets, most universities are reluctant to provide. This leaves instructors who provide formative assessment with a problem. The grading of assignments is necessary, the feedback makes a valuable contribution to student learning (Biggs and Tang, 2011), but there is a lack of resources to provide this feedback.

An alternative that has been adopted in many universities and colleges is to automate the grading whilst still providing feedback. A number of such systems have been developed, and reported on. Some for grading general essays are fully automated such as SA Grader (www.sagrader.com) and MarkIt (www.essaygrader.com) whilst other use computer-assisted rubrics to make the grading more efficient (Anglin, Anglin, Schumann and Kaliski, 2008; Czaplewski, 2009). There are other automated systems for grading computer programs (Ala-Mutka, 2005), and assessing computer literacy (Debuse, Lawley and Shibl, 2007; Matthews, Janicki, He and Patterson, 2012).

In the past few years, Pearson Education has introduced a number of web-based applications for training and assessment for courses in areas such as Accounting (www.MyAccountinglab.com), Finance (www.myFinanceLab.com) and IT applications, particularly for Microsoft Office (www.MyITLab.com). These have been adopted by thousands of instructors (Pearson Education, 2013b), as they allow for students to sharpen their skills on-line with immediate feedback, and provide instructors with an automated grading system for assignments (Gregory, 2012). These systems are also popular with administrators, as they remove the need to provide TA resources to do the grading. Unfortunately, although there is a great deal of anecdotal evidence regarding the use of these systems and data from the publisher (Pearson Education, 2013a), there is little independent empirical evidence that these systems are effective in terms of student learning.

In this paper we account for our choices to align our assessment strategy with available resources. We describe the circumstances under which MyITLab was integrated into an introductory course in business information and communication technologies, and examine the impact it had on learning outcomes.

The remainder of the paper is organized as follows. In the next section we provide the background to the course development and the reasons for changes in the assessment strategy. This is followed by a brief overview of the introductory course in

information and communication technologies that we have redesigned and taught, and a description of the modifications made to how the course was organized to align it with available resources. The methods used for measuring, collecting, and analyzing data are given. We conclude the paper with a discussion of the findings, and suggest directions for future research.

BACKGROUND

In 2008 members of the Information Systems faculty at a North American university redesigned its introductory course on business information and communication technologies for first year students. The new course design placed the students in the middle of the learning experience. This was achieved by an explicit teaching and learning strategy that focused on actively intertwining theory with practice. Further a range of topics was covered to introduce new business students to the multifaceted subject of information systems.

Although the course received much positive feedback from students, it soon materialized that the course was too expensive to run. With several hands-on elements, training sessions, and assignments, the course was rather resource intensive. Management quickly perceived it as too resource intensive. As a consequence parts of the course needed to be redesigned to account for the demands of making it less expensive. These restrictions required a redesign of the course to align the assessment strategy with the available resources.

THE COURSE

The curriculum for first year students in a Bachelor of Commerce program at a North American university includes a compulsory introductory course in business information and communication technologies. The course aims to facilitate the development of management and analytic skills using modern technologies in organizations. It focuses on breadth rather than depth, allowing the students to get familiar with a number of different areas of business.

Previously the course was a programming course for business students, and it focused on solving business problems using computers. By 2008, the content of this course was deemed to be inappropriate for general business students, and the course was completely redesigned, covering the latest technologies used in business (for detail, cf. Ramirez, Hine, Ji, Ulbrich and Riordan, 2009; Ramirez, Ji, Riordan, Ulbrich and Hine, 2010). The redesigned course was introduced in the fall term of 2008. It requires three hours per week of lectures and one hour per week of tutorials in a computer laboratory to gain practical skills. These laboratory sessions are conducted by TAs.

The course assessment consists of four assignments, three quizzes, one media report, a midterm assessment, and a final examination. The assignments are used for both learning and assessment (Biggs and Tang, 2011; Newby and Nguyen, 2010). From a learning perspective, their purpose is to allow students to develop skills that will help them not only in their studies but also later in their career. They also advise students about their current standing at a certain point in time, allowing them to improve/adjust their learning process. Formative assessment feedback was given on the assignments based on the set criteria specified and so that student can understand where they are on the learning curve and what they should be doing to improve themselves in the subject or to attain the next level, while the summative assessment feedback on the exams would be the accountability measure that establishes whether or not the students have the skills necessary to pass the course (Anglin et al., 2008; MacLellan, 2001).

The first assignment deals with the use of information to solve identified problems. Assignment 2 helps with the development of skills in using social software to collaborate with other people within a business. The third assignment is about problem solving using Microsoft Excel. The fourth assignment is a stock-market group project. The quizzes are held in class, and cover topics from the lectures and readings. The media report is a group work based on a current news report and presented in class. The final examination has two components: a computer-based test that involves using Microsoft Excel to solve business problems, and a traditional paper-based examination covering the remaining parts of the course.

The course as a whole is integrated, but some of the components are more closely linked than others. This applies particularly to Assignment 3 and the Microsoft Excel test of the final examination. The third assignment is designed to enhance the students' problem-solving skills by giving students opportunities to use Microsoft Excel to solve specific business problems. Although such a skill has been viewed as a rather tangential skill related to the strategic role of information systems (Ives, Valacich, Watson, Zmud, Alavi, Richard, Baroudi, Beath, Clark, Clemons, Davis, Davis, Dennis, El Sawy, Fedorowicz, Galliers, George, Gray, Hirschheim, Jarvenpaa, Jessup, Kemerer, King, Konsynski, Kraemer, Luftman, March, Markus, Mason, McFarlan, McLean, Olfman, Olson, Rockart, Sambamurthy, Todd, Vitale, Weber and Whinston, 2002), it is still widely considered important as to learning about productivity tools (Firth, 2008). To develop these skills, students were given

four separate mini cases in Assignment 3. For each mini case students were required to identify related business problems, potential solutions to the problems, and then implement their solutions using Microsoft Excel. To facilitate this, TAs run computer laboratory sessions to allow students to gain experience through hand-on exercises. In addition to the hands-on labs, instructors give lectures on problem-solving concepts and methods using Microsoft Excel. The in-class material covers amongst others statistical analysis, relational and logical operations, what-if and sensitivity analysis.

The assignments are graded by TAs, except Assignment 4 that is graded by the instructors. Grading in all cases follows a grading rubric that is available to students when the assignments are posted online at the beginning of the course. This means that the students know exactly from the beginning of the course what is expected in each assignment. The Microsoft Excel component of the final examination, referred to as the Excel Skills Test, covers material similar to that of Assignment 3.

APPLIED ASSESSMENT STRATEGIES

In the following we focus on the development of the students Microsoft Excel skills and the associated Assignment 3 and Excel Skills Test. Grading these assignments/tests are particularly time- and resource-intensive activities. Over the years, three different assessment strategies were applied to deliver the Microsoft Excel course component to the students.

Assessment Strategy 1: Manual Grading

In 2009 the course was run as described above. During that time, the Excel Skills Test was conducted in several consecutive sessions in the university's computer laboratories. To minimize the possibility that students would leak the exam questions, each Excel Skills Test session used tests comparable in difficulty but not identical to each other.

Assessment Strategy 2: No Formal Grading

After running the course in this way for three terms, the university management announced that the course was using too many resources. In particular, they stated that the use of TAs was not in proportion with other courses and we were asked to reduce TA hours.

Grading Assignment 3 was a very cost intensive TA task (measured in TA hours used for grading). Since we did not see much chance of redesigning this part of the course at such short notice, we decided to adapt an assessment strategy that has been applied by other universities. Namely, we put more responsibility on the student and encouraged more self-study.

Consequently, in 2010 we kept Assignment 3 in the course outline, but made it optional. We stressed to the students the importance of this assignment and that it would help them prepare for the Excel Skills Test. However, we were afraid that the new design might negatively influence the learning outcomes and had mixed feelings about this particular design choice. It certainly would satisfy management, but what about the students?

Assessment Strategy 3: Automated Grading

We ran the course as described in Phase 2 with Assignment 3 for three terms, but as it was optional, we had no idea of how many students actually did it. We strongly believe that testing their skills makes them learn better, so we had to find a way that would allow us to reintroduce Assignment 3 without using any TA resources. We did so in 2011 by considering automated grading of the assignment. For this purpose we evaluated different platforms and the result is that we adopted MyITLab (www.myitlab.com), which, as stated previously, is a platform for online training, learning, and assessment for Microsoft Office Applications. We now made Assignment 3 compulsory again, requiring students to use MyITLab to complete it, so that it can be graded automatically (Napier, Dekhane and Smith, 2011; Speckler, 2010).

METHODOLOGY

Sample selection

The population of interest for this study consists of all students in a particular introductory course to business information and communication technologies at a North American university. Because some of the design changes to align our assessment strategy with available resources needed some time to implement, we decided to eliminate any potential distortion in the results by excluding results other than from the winter terms. Any teething problems with a new design could usually be resolved during the fall, and as a result the winter term better represented stable design changes.

In our study we included only freshmen. In practice, few sophomores, juniors, and seniors are taking this course. We chose to exclude these students because the course is designed and meant to be an introductory course that should be taken during the

first year of university studies. Most of the students at a higher level had taken the course before and retook it to improve their results. If we had included those students, average values would probably increase.

The population used for this study thus consists of those students who met the following criteria: students (1) were freshmen, (2) completed Assignment 3 when it was mandatory, (3) completed the Excel Skills Test, and (4) took the course in one of the winter term sessions between 2009 and 2011. The sampling frame was obtained from official records (grade books). The final sample consisted of 148 freshman-level students (43 from Winter 2009, 62 from 2010, and 43 from 2011).

Measuring an assessment strategy's effectiveness

Considerable debate has ensued regarding the most appropriate method of assessing the effectiveness of an assessment strategy because of the multi-dimensional nature of teaching (Looney and Akbulut, 2007). They have accounted for various approach, including measuring the various dimensions of teaching and subsequently evaluating their effects on student learning (Feldman, 1997). Although different approaches have all their supporters and detractors, scholars generally agree that effective teaching cultivates student learning (Looney and Akbulut, 2007). Measuring student learning with the help of formal tests is a widely accepted and applied procedure in higher education (Biggs and Tang, 2011). We therefore follow Looney and Akbulut's (2007) suggestion and use learning outcomes as proxy for measuring the effectiveness of an assessment strategy.

Learning outcomes were measured through assessing the students' performances in Assignment 3 (Winter 2009 and 2011 only) and the Excel component of the final examination, the Excel Skills Test. Learning outcomes were assessed by applying common grading rubrics. Applying these rubrics helped in establishing similar grading rules and results when manually grading. Points between 0 and 100 were assigned on the basis of a fine-meshed grid that allowed us to record results on a scale that is close to a ratio scale.

FINDINGS

Descriptive statistics

Table 1 summarizes the descriptive statistics; sample size, mean, and standard deviation for the Excel Skills Test for Winter 2009, 2010, and 2011, and for Assignment 3 for Winter 2009 and 2011.

	Excel Skills Test		
	Sample size	Mean	Std. deviation
Winter 2009	43	49.8	30.5
Winter 2010	62	45.4	27.9
Winter 2011	43	54.8	22.7
	Assignment 3		
	Sample size	Mean	Std. deviation
Winter 2009	43	85.1	16.0
Winter 2011	43	80.3	14.4

Table 1: Descriptive statistics for scores on Excel Skills Test and Assignment 3

Excel Skills Test

Independent samples *t*-tests were carried out to compare the means of the Excel Skills Test scores for each of the terms: Winter 2009, 2010, and 2011. Table 2 shows that the mean for the Excel Skills Test dropped to 45.4 in 2010 from 49.8 in 2009. As mentioned previously, a drop was expected, but turned out not being significant (p = .449). There was a not significant increase (p = .072) in the mean from 45.4 in 2010 to 54.8 in 2011. Comparing the change in the means between 2009 and 2011 shows a not significant increase (p = .392) in the mean from 49.8 to 54.8.

Mean Winter 2009	Mean Winter 2010	Mean Winter 2011	*t*	*p*
49.8	45.4		-0.76	0.449
	45.4	54.8	1.82	0.072
49.8		54.8	0.86	0.392

Table 2: Comparison of means of scores on Excel Skills Test

Assignment 3

An independent samples *t*-test was carried out to compare the means of the Assignment 3 scores for the terms: Winter 2009 and 2011. Table 3 shows that the mean dropped from 85.1 in 2009, when the assignment was manually graded by TAs, to 80.3 in 2011, when it was automatically graded by MyITLab. The difference in the means was not significant ($p = .156$).

Mean Winter 2009	Mean Winter 2011	*t*	*p*
85.1	80.3	1.43	0.156

Table 3: Comparison of means of scores on Assignment 3

The relationship between the Assignment 3 and Excel Skills Test scores was analyzed through univariate linear regression analysis, using Assignment 3 as the independent variable and EST as the dependent variable for Winter 2009 and Winter 2011. Tables 4 and 5 show a somewhat stronger correlation in 2011 compared to 2009.

Variables	Unstandardized coefficient (*B*)	*Std. error B*	Standardized coefficient (β)	*t*
Assignment 3	.860	.265	.453	3.251**
$R^2 = 0.21$; *adjusted* $R^2 = 0.19$; $F(1, 41) = 10.569^{**}$ Sig. ** $p < .01$				

Table 4: Regression analysis for Winter 2009

Variables	Unstandardized coefficient (*B*)	*Std. error B*	Standardized coefficient (β)	*t*
Assignment 3	.626	.161	.519	3.891***
$R^2 = 0.27$; *adjusted* $R^2 = 0.25$; $F(1, 41) = 15.140^{***}$ Sig. *** $p < .001$				

Table 5: Regression analysis for Winter 2011

DISCUSSION

The objective of this paper was to compare the effectiveness of different assessment strategies to deliver an introductory course in business information and communication technologies.

Over the years three different strategies were applied with regard to teaching Excel in the classroom and laboratory environment, and assessing learning outcomes. While the original course included a mandatory Excel assignment, graded by TAs, this assignment was made optional in 2010 because of financial resource constraints. Although students were encouraged to voluntarily solve Assignment 3 in preparation for their Excel Skills, students did not receive any formative feedback during this year and it was not possible to tell whether students actually did the assignment or not. To better support student learning, Assignment 3 was reinstated in 2011 when MyITLab was adopted. This time the assignment was graded automatically and the on-line learning environment provided formative feedback to the students.

It was found that there was a drop in the mean of the grades obtained by students in the Excel Skills Test when Assignment 3 was optional (Winter 2010). This drop, however, turned out not to be significant. With no significant difference in the learning outcomes over all years, it is suggested that all three strategies are basically equally effective when teaching Excel skills to students. However, univariate linear regression analysis showed that when Assignment 3 was mandatory, the assignment is a significant predictor of the score obtained in the Excel Skills Test, whether the assignment is graded manually by TAs or automatically by MyITLab.

The difference in the means for the assignment scores between Winter 2009 (when it was graded by TAs) and 2011 (when MyITLab was used to grade the assignment) was not significant. The mean in 2011 was lower than the one in 2009. This could indicate that MyITLab is more rigid in grading and unable to give credit for effort. The difference in the means for the Excel Skills Test grades between 2009 and 2011 was not significant. This would imply that technology to assist learning

could help universities to do more with less. It shows that comparable learning outcomes can be achieved with different formative assessment strategies.

Effective teaching is important as it facilitates effective learning (Biggs and Tang, 2011; Looney and Akbulut, 2007). This effectiveness in part depends on the organization of the course and the adopted assessment strategy. Our research suggests that effective assessment does not need to be too resource intensive and that university can progress towards a lower-cost assessment strategy without jeopardizing quality.

Directions for future research

Comparing the effectiveness of three different assessment strategies was done through the lens of learning outcomes in this paper. Assessment, however, is of multi-dimensional nature (Looney and Akbulut, 2007) and learning outcomes might not only be influenced by the adopted assessment strategy but also, for example, by an instructor's ability to teach subject material. The instructor's understanding of the subject area as well as her/his pedagogical skills might have a significant impact on student learning and measurable outcomes. It is therefore suggested to investigate in future research large, multi-section courses to find out whether learning outcomes can be attributed to the effectiveness of an assessment strategy or an individual instructor's teaching ability.

CONCLUSION

In this paper we have reported on our experiences from aligning assessment strategies with available resources. We constantly redesigned an introductory course on business information and communication technologies at a North American university to meet budget cuts and align our assessment strategy with available resources. The examination and assignment results of 148 students have shown that we succeeded in redesigning the course in a way that uses fewer resources and maintains an effective learning environment. Since the analysis suggests that no significant differences occur with regards to learning outcomes between different assessment strategies, it appears at first that it does not matter which strategy to apply. However, the analysis also shows that a computer-supported assessment strategy appears to have advantages with regard of preparing students for examination and, therefore, became our favorite assessment strategy for the course.

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