An Exploratory Study of the Effects of using web accessible pre-recorded lectures and slides on the Performance of International Students

MARI PAANANEN University of Hertfordshire
MARY SIMPSON University of Hertfordshire

Abstract This project aims to evaluate the effect of using web accessible recorded lectures and slides as a supplement to traditional face-to-face teaching for International students. Specifically, we examine whether the use of blended learning has an impact on students' exam results. In our study, held in accounting classes, we have used traditional teaching methods (lectures and seminars) during the first half of a semester and during the second half we recorded lectures using SMIRK (Simple Media Integrating Resource Creator) and made them available on the University's Managed Learning Environment, StudyNet, and used the face-to-face time in the classroom for seminars only. We have evaluated the association between the availability of SMIRK lectures and the students' performance in tests under the traditional and blended learning modes to test whether students' performances are increasing as a result of using SMIRK. We also collect information on attendance, students' StudyNet activities, other demographic details, and grade point average (GPA) at enrolment, to ascertain whether or not alternative explanations are driving our results. We find that students are performing better when taught using blended learning. Students achieved a significantly higher mark with the average mark in the first in-class test increased from 0.45 to 0.61 (one-tailed p-value 0.006) and the average mark in the end of semester comprehensive in-class test increased from 0.45 to 0.56 (one-tailed p-value 0.055).

Introduction

The importance of on-line education (distance and blended learning) is growing like never before, and both in the UK and the US the discussion is no longer concerned with when but how to transform and reconfigure higher education to adapt to the development (Allen and Seaman 2003). The expectation is that the number of students taking on-line courses will increase each year and that blended learning will grow in popularity. (Blended learning refers to using several different techniques (computerized or not) in conjunction to teach and learn new material.) The changes in higher education resulting from advances in web based technologies mean that the traditional model and pedagogy where lecturers present lectures as monologues to be processed by students remaining passive is no longer relevant (Kippen 2003). However, the expansion in the use of blended learning or on-line learning raises a number of important questions about the

47

nature and use of web technologies and the pedagogic issues which may arise as a result of changes in the traditional model of learning and teaching (Bell 2002, Kirkwood and Price 2005).

We contribute to the literature by examining the effect of on-line technology on students' performance when used as part of a blended learning course. Blending web based (on-line) technology with traditional face-to-face teaching is now generally referred to as blended learning (Boyer-Commission 2004, Picciano 2006). Blended learning has grown in importance as part of the educational process and is seen, by many, as offering students various opportunities for learning, as it provides access to both traditional face-to-face teaching and on-line learning activities (Reasons 2005).

We evaluate the effect of web-based technology, used as a supplement to traditional face-to-face teaching, on student performance. Specifically, we examine whether the use of SMIRK instead of lectures change students' test results. (SMIRK is a tool for capturing, producing and then sending audio-visual presentations over the internet. SMIRK is mainly used in University-level education to prepare presentations that are loaded onto a managed learning environment as part of e-learning. Audio, graphics and captioning are the basic building blocks but other elements such as Flash movies, links (internal and external) are easy to include. SMIRK is used to produce accessible presentations that can be streamed over the web.) We compare the effects of traditional teaching methods (lectures and seminars) used during the first half of a semester to SMIRK (please refer to Appendix 1 for an example view from a SMIRK presentation) recordings made available on StudyNet during the second half of the semester (a blended approach). During the second half of the semester face-to-face time in the classroom was limited to seminars only with mini-lectures made available if requested by the students. We assess the effects of these two methods by comparing the students' performance in in-class tests under the two treatments using the standard t-test and the Wilcoxon-Mann-Whitney test of medians. In order to rule out alternative explanations, we also control for attendance, students' frequency using StudyNet, gender and grade point average (GPA) at enrolment. In addition, we control for the effect of students getting to know what the instructor requires over time by testing the students performance at two separate points in time. That is, one in-class test took place in the middle of the semester before SMIRK, a second later in the semester after SMIRK with a final comprehensive in-class test at the end of the semester.

We find that the students' performance in in-class tests were significantly better with respect to the material taught using SMIRK compared to the material provided using only traditional teaching techniques such as lectures and seminars.

48

Literature Review

Previous research show some indications that the use of information technology in teaching may improve student performance (Parker and Gemino 2001, Dowling 2003, Koory 2003, Kalyuga 2004, Nwabueze 2006) Dowling *et al* (2003) and Nwabueze (2006) compare a flexible delivery model to a traditional teaching model. Dowling *et al* (2003), teaching an accounting information system course, use a traditional delivery model comprising a two hour lecture and a one hour workshop on a weekly basis while the flexible delivery model provides a three hour seminar every other week. Controlling for age, gender, study mode, prerequisite mark and location, they find that the flexible delivery model is positively associated with a better student performance measured as the mark in the final in-class test. However, the results must be interpreted with caution since the number of in-class hours in smaller groups may have driven the improved student performance as opposed to the flexible delivery model. Interestingly enough, Dowling *et al* (2003) also find that full-time younger students perform better than older part-time students and that female students' marks, in general, are higher than male students. Nwabueze (2006), teaching an algebra course to undergraduate students uses the traditional chalk-and-talk method to teach one group of students and uses computer aided techniques in conjunction with face-to-face sessions with the whole group. Controlling for previous knowledge of algebra and gender effects, he finds that the students in the group using computer aided techniques perform better compared to the students taught using the traditional delivery mode. In addition, contrary to Dowling *et al* (2003), he finds no significant differences across gender. Both of the above studies are very similar to ours.

Koory (2003) and Parker and Gemino (2001) examine the difference in student performance between traditional teaching models and on-line modes of teaching. Koory (2003), teaching an English course, compares a group of students who are taught using a traditional, on-campus mode of delivery featuring lectures, general discussion groups, and in-class writing assignments to an on-line course. She finds a significant difference in the learning outcome between the two groups, the on-line group demonstrate a much higher performance compared to the traditionally taught students. However, as pointed out by the author, the design of the on-line course is more suitable to an adult learning style and the majority of the on-line students were older, more independent and experienced compared to the traditionally taught on campus group. Parker and Gemino (2001) teaching a systems analysis and design course at undergraduate level, also compare the performance of students taught using a traditional delivery mode and interactive virtual seminars. Contrary to the above studies, they find no significant difference in performance across the two groups. However, they find that students taught using interactive virtual seminars perform better than the other group when being tested on conceptual issues while they perform

49

worse when being tested on technical issues. This finding may be an indication that certain subjects and certain parts of the taught material are better suited to on-line teaching than others.

Finally, Kalyuga *et al* (2004) investigate the effects of simultaneous presentation of written text and audio. They find that students exposed to written text and audio simultaneously perform less well compared to students exposed to just one media at a time. This finding may be an indication that the use of SMIRK is counter productive since this tool provides graphic material in conjunction with audio and written text. However, we believe that there is an important difference between Kalyuga *et al*'s (2004) experiment and our study. Their experiment captures and tests the immediate effect of exposure to written text and audio, while the students in our study have access to the SMIRK recording at all times and can replay the content on demand.

In sum, previous research on the effects of web-based technology on students' performance is inconclusive, although there are promising indications of positive effects. There is some indication that web-based technology enhances students learning but this may be caused by self-selection bias related to the student groups opting for web based learning compared to groups who do not. In addition, some teaching material may be more suitable to teach using web-based technology than other material.

Our study tests students' performance across the first and the second half of the semester. We use web-based technology to provide pre-recorded lectures with slides together with a short written synopsis visible below the slide presentation (see Appendix 1). In order to mitigate the negative effects that might result from the lack of normal lecture interaction we cover technical examples, in greater detail, as part of the SMIRK presentation. These would normally not be covered in the traditional lecture (if nothing else because of time constraints) but dealt with in the seminar. To hold the effects across students constant we test the two teaching modes on one homogenous group of students over a period of one semester. We also test for possible demographic differences that might drive our results.

Research Design

We use a group of International post-graduate students studying on a finance program designed for students seeking a career as financial analysts. All the teaching is conducted in English while only one of the students has English as her first language. Table 1 offers brief demographic information on the student group.

Table 1 Demographic information about the participating students

Description	Number of students
Female	10
Male	7
Major undergraduate degree:	
Accounting	7
Accounting & Finance	1
Computer Information technology	2
Finance	2
Statistics	1
Economics	3
Undergraduate degree in the UK	4
Undergraduate degree overseas	12

	GPA
Mean entering GPA	2.17
Median entering GPA	2.20

We taught the first half of the semester using a traditional teaching mode with a weekly one hour lecture and one hour seminar. The second half of the semester was taught using SMIRK to deliver the lectures on-line. Both modes were immediately followed by a multiple choice in-class test of the taught material. During the second part of the semester a pre-recorded lecture was uploaded to StudyNet using SMIRK, about four days before the next class meeting. The SMIRK lecture comprises three parts, a slide show based on a PowerPoint presentation, a pre-recorded lecture narrating the slide show, and a short written caption reiterating what is said in the lecture. The topics taught in each part of the semester are as shown in table 2.

Table 1 The subjects taught using the traditional teaching delivery mode and the flexible teaching mode.

The traditional delivery mode	The flexible delivery mode
Framework of financial statement analysis	Dilutive securities and earnings per share
Accounting income and assets the accrual concept	Analysis of inventories
The Statement of Cash Flows and The Analysis of Cash Flows	Long-term assets
Worldwide accounting diversity and international standards	Analysis of long-lived assets the capitalization decision
Analysis of Financial Statement	Analysis of long-lived assets depreciation and impairment

The class meetings comprise an abbreviated review of the lecture (about 15 minutes) to elicit questions and a seminar of one hour. We also offer the students the opportunity to use a second hour to discuss the material should they feel that this is necessary. Occasionally they used some of this time but never the full hour. Our study may suffer from a similar weakness to Dowling *et al*'s (2003) study whereby the results may be driven by the fact that students are given more small group face-to-face teaching when blended learning is used.

The use of the new technology was not without problems and we experienced technical difficulties such as problems initially with the sound. Moreover, the instructor was not familiar with the process of recording her voice, thus the first recordings were, according to the students, rather monotone. However, these problems are not likely to drive the results in the predicted direction and they were resolved as the semester went by. We assess the students' performance in two separate statistical evaluations. First we test the difference between the first in-class test, where the taught material was delivered using the traditional lecture and seminar, and the second in-class test where the material was provided using a blended approach to teaching. Then we re-run the tests using the students performance in a comprehensive in-class test held at the end of semester. That is, we compare the students' performance again at the end of the semester across the two different teaching modes; traditional versus blended. We do this in order to control for the fact that students become familiar with the instructor's expectations and requirement over time.

Finally, we also examine how useful the students perceived the pre-recorded lectures to be in relation to the assessment of the module.

Results

We use the standard t-test to test the significance of the differences across the mean differences between students' performance under each teaching mode and Wilcoxon-Mann-Whitney to test the median differences between students performance under each teaching mode. We also examine the impact of gender, prior GPA, whether the student's major undergraduate specialization is accounting and/or finance, to confirm that these variables are not driving the result. In addition, we also examine StudyNet user frequencies since we interpret high user frequencies as a sign that students are indeed using the blended learning resources provided on StudyNet, including the SMIRK recordings. Table 3 Panel A (See Appendix 2), confirms our prediction that students are performing better when taught using the blended learning mode using SMIRK. Students achieved a significantly higher mark when SMIRK was used, the average mark in the first in-class increased from 0.45 to 0.61 (one-tailed p-value 0.006) and the average mark in the end of semester comprehensive in-class test increased from 0.45 to 0.56 (one-tailed p-value 0.055).

We also test a number of additional variables in order to rule out alternative explanations for students' improvement and to further investigate causes of the improvement in students' performance. In Table 3 Panel B (See Appendix 2), we compare whether there is a difference in the improvement in performance across gender. We found no such difference, both female and male students gained from the use of SMIRK. However, interestingly enough, male students demonstrate a significant improvement in the first in-class test but no significant improvement in the comprehensive in-class test. Female students, on the other hand, demonstrate a significantly better mark in the comprehensive in-class test but not in the first in-class test. We also find that, on average, students with an overseas undergraduate degree gained more from the use of SMIRK and the blended teaching mode in the first in-class test (p-value 0.009) but not in the other (p-value 0.33). Students with a UK undergraduate degree, on the other hand, showed no statistically significant difference in performance levels. This may be interpreted as an indication that tools like SMIRK are of more value to students with weak English who are less used to studying at a UK university. It may be that the size of our sample in conjunction with the fact that only 25% of these students had studied in the UK before indicates that this type of blended learning provides a significant boost in these circumstances. However until we test this type of blended learning on a larger more diverse group it's impossible to generalize. Finally, we find no significant difference in performance under the different delivery methods across students who came in with an undergraduate degree in accounting and those who did not. Both groups experienced a significant improvement using a blended approach to teaching.

Further analysis of the different user frequencies of StudyNet across gender suggests that the use of StudyNet differs between female and male students. Female students' user frequencies were higher when compared to male students' user frequencies and increased much faster once SMIRK was added to the on-line resources. Table 4 shows that, although both groups increase their use of StudyNet when the blended learning is offered, female students' usage increases significantly more.

Table 4 Test of difference in student frequencies using StudyNet across teaching delivery modes

	N		In the traditional delivery mode	Std. Dev.	In the flexible delivery mode	Std. Dev.	Difference	p-value[1]
Female students' user frequencies measured as number of times StudyNet has been used	10	Mean Median	37.900 39.500	9.25 5	37.100 37.000	10.39 7	0.800 -2.500	0.8 58 0.8 20
Male students' user frequencies measured as number of times StudyNet has been used	7	Mean Median	29.571 32.000	13.2 77	33.714 36.000	7.931	-4.143	0.6 09 0.1 59

Finally, we also conducted a survey among the students asking about their perception of the usefulness of SMIRK. Using a scale from 1 to 5, where 1 is very useful and 5 is not very useful at all; the usefulness of SMIRK came out as 2, quite useful. We also encouraged students to comment on SMIRK. Twelve of the seventeen students chose to comment on SMIRK, the comments are listed in Table 5. These comments indicate, quite clearly, that this cohort of students had some language problems and that web based pre-recorded lectures provide an additional learning opportunity.

Table 5 Student comments on the perceived usefulness of SMIRK

Comment
Efforts appreciated
It is really good to catch up the point that may lost in the lecture. But I still get used to normal lecture. It will be better that give normal lecture plus webcast for revision.
Quite useful.
Interesting, but just a little bit hard to use out of Campus's LRC
It is quite interesting and good. You feel that your tutor is with you all the time.
It's better to have class rather than webcast lectures. But for people who cannot catch up on class is a good way for them to have webcast lectures.
It is really significant.
The webcast lectures are okay only that I do not check on it regularly.
Beginning was voice problem. Now is improved. It is very useful for checking any time and clear.
It is quite good but I am still not used to it.
They are okay to deal with but do not provide room for questions and answers.
I think webcast is a very useful and helpful teaching resource, but I cannot make me concentrates as in normal class.

Conclusion

We examine the effect of using a blended learning teaching mode, using pre-recorded lectures, on students' performance. Our results suggest that the blended learning mode does indeed improve students' performance. However, our results must be interpreted with caution due to the limited sample size (only 17 students) and the fact that these were international students most of whom were studying in the UK for the first time. In addition, we are unable to disentangle what proportion of the improvement is caused by the increased seminar type of class time and how much is caused by the use of pre-recorded lectures. Finally, the results could be driven by how easy

or hard the students found the material taught under the different teaching modes.

Having said this, we interpret the results as encouraging and if these results can be replicated using larger, more varied student groups and controlling for the subject matter we think that this may be the beginning of a revolutionary change in how to teach accounting. Considering that increased globalization has resulted in a tremendous increase in the number of university students taught in English and not their native language, this way of teaching may be an important tool to improve these students' performance. Our study suggests that all students' performances improve under a blended learning mode using pre-recorded lectures. However we also find that students with an overseas undergraduate degree gained more when compared to students with a UK undergraduate degree even when English was not the first language of either group. We interpret this result as an indication that blended learning using pre-recorded lectures is of more value to students whose English is weaker and who have not previously studied in a UK university. This may also be interpreted as useful in a context where students suffer impaired reading ability.

References

Allen, I.E. and Seaman, J. (2003) *Sizing the Opportunity – The Quality and Extent of On-line Education in the United States, 2002 and 2003*, The Sloan Consortium

Bell, M., Bush, D., Nicholson, P., O'Brien, D. and Tran, T. (2002) *Universities on-line: a survey of on-line education and services in Australia*, H.E.G. Commonwealth Department of Education Science and Training, Available: http://www.dest.gov.au/sectors/higher_education/publications_resources/summaries_b rochures/universities_on-line.htm [Accessed 5 April 2007]

Boyer-Commission (2004) Reinventing Undergraduate Education: A Blueprint for America's Research Universities

Dowling, C., Godfrey, J.M. and Gyles, N. (2003) "Do hybrid flexible delivery teaching methods improve accounting students' learning outcomes?" *Accounting Education* 12(4), pp373-391

Kalyuga, S., Chandler, P. and Sweller, J. (2004) "When Redundant On-Screen Text in Multimedia Technical Instruction Can Interfere With Learning" Human Factors 46(5), pp567-581

Kippen, S. (2003) "Teacher reflection and theories of learning on-line" *Journal of Educational Enquiry* 4(1), pp19-30

Kirkwood, A. and Price, L. (2005) "Learners and learning in the twenty-first century: what do we know about students' attitudes towards and experiences of information and communication technologies that will help us design courses?" Studies in Higher Education 30(3), pp257-274

Koory, M.A. (2003) "Differences in Learning outcomes for the On-line and F2F versions of "an introduction to Shakespeare"." *Journal of Asynchronous Learning Networks* 7(2)

Nwabueze, K.K. (2006) "Technology class format versus traditional class format in undergraduate algebra" *Technology, Pedagogy and Education* 15(1), pp79-93

Parker, D. and Gemino, A. (2001) "Inside on-line learning: comparing conceptual and technique learning performance in place-based and ALN formats" *Journal of Asynchronous Learning Networks* 5(2)

Picciano, A.G. (2006) "Blended learning: implications for growth and access" *Journal of Asynchronous Learning Networks* 11(3)

Reasons, S.G., Valadares, K., and Slavkin, M. (2005) "Questioning the hybrid model: student outcomes in different course formats" *Journal of Asynchronous Learning Networks* 9(1)

Appendix 1 An example of the view of a SMIRK lecture on deferred tax

Appendix 2 Table 3

Table 3 Test of difference in student performance across teaching delivery modes and the effect of control variables

Panel A: Main test	N		Performance in traditional delivery mode	Std. Dev	Performance in flexible delivery mode	Std. Dev.	Difference	p-value[1]
Performance in-class test	17	Mean Median	0.452 0.483	0.164	0.611 0.655	0.151	-0.158 -0.172	0.006 0.002
Performance comprehensive in-class test	17	Mean Median	0.450 0.471	0.184	0.561 0.600	0.184	-0.111 -0.129	0.055 0.037

Panel B: The effect of control variables	N		Performance in traditional delivery mode	Std. Dev	Performance in flexible delivery mode	Std. Dev.	Difference	p-value[2]
Performance female students in-class test	10	Mean Median	0.500 0.471	0.119	0.578 0.667	0.174	-0.076 -0.196	0.269 0.161
Performance female students comprehensive in-class test	10	Mean Median	0.459 0.500	0.110	0.603 0.667	0.187	-0.111 -0.129	0.050 0.069
Performance male students comprehensive in-class test	7		0.437 0.412	0.267	0.500 0.567	0.242	-0.063 -0.155	0.652 0.701

Performance of students with UK degree in-class test	8	Mean Median	0.500 0.517	0.092	0.582 0.638	0.195	-0.082 -0.121	0.114 0.300
Performance of students with UK degree comprehensive in-class test	8	Mean Median	0.456 0.471	0.121	0.588 0.583	0.183	-0.132 -0.112	0.112 0.140
Performance of students with overseas degree in-class test	9	Mean Median	0.410 0.448	0.205	0.636 0.690	0.102	-0.226 -0.242	0.009 0.009
Performance of students with overseas degree comprehensive in-class test	9	Mean Median	0.444 0.411	0.234	0.537 0.600	0.241	-0.093 -0.189	0.330 0.420
Performance of students with degree in accounting in-class test	7	Mean Median	0.453 0.448	0.128	0.645 0.655	0.103	-0.192 -0.207	0.009 0.015
Performance of students with degree in a subject other than accounting comprehensive in-class test	10	Mean Median	0.435 0.441	0.192	0.517 0.567	0.177	-0.082 -0.126	0.053 0.084

[1] One-tailed test [2] Two-tailed test