Are students studying in the online mode faring as well as students studying in the face-to-face mode? Has equivalence in learning been achieved?

Aluwesi Volau Fonolahi
Student Learning Specialist
Faculty of Science, Technology and Environment
The University of the South Pacific
Laucala Campus, Suva, Fiji.
aluwesi.fonolahi@usp.ac.fj

M.G.M. Khan
Associate Professor in Statistics
Deputy Head of School, Learning and Teaching
School of Computing, Information and Mathematical Sciences
The University of the South Pacific
Laucala Campus, Suva, Fiji.
khan_mg@usp.ac.fj

Anjeela Jokhan
Associate Professor
Dean of the Faculty of Science, Technology and Environment
Faculty of Science, Technology and Environment
The University of the South Pacific
Laucala Campus, Suva, Fiji.
anjeela.jokhan@usp.ac.fj

Abstract

With the shift in pedagogy from learning in the traditional classroom setting (face-to-face mode) to online learning, it is important to find out how students are faring in the online mode and if equivalence in learning is achieved in the two modes. To answer these questions, the course results of students studying a first year undergraduate mathematics course in the two different modes at The University of the South Pacific were compared. The study revealed that there was no statistical significant difference in the pass rates of the students studying in the two modes but the students studying in the online mode had a significantly higher attrition rate. From the results, it was also discovered that students studying via the online mode achieved higher coursework marks but lower exam marks compared to students studying via the face-to-face mode. Yet the students' total marks in the two modes were similar, which led to the conclusion that students studying in the online mode are faring just as well as students studying in the face-to-face mode. It was evident that equivalent learning was occurring in the two modes albeit in different ways. The coursework assessments methods in the two modes were also compared.

Keywords: students' performance, coursework assessment methods, total marks, coursework marks, final exam marks, pass rate, attrition rate, mathematics course

Introduction

Many education providers are moving rapidly from providing education in the traditional classroom setting (face-to-face mode) to the online mode. Studying in the online mode is gaining popularity amongst students because of its convenience and flexibility. For educators, providing education in the online mode has many benefits. Many authors including Buchanan (2000), Cassady & Gridley (2005), Hewson & Charlton (2007), Angus & Watson (2009), Jordan & Mitchell (2009) and Hewson (2012) discussed the benefits of offering online courses. The benefits range from cost effectiveness to enhanced level of student engagement and enhanced flexibility. Also included in the benefits is the time saved because of automated delivery, storage of responses and scoring, and the enhanced

validity where human errors can be eliminated during the process of marking. Another critical aspect of online courses is the pedagogical benefits of providing tailored and/or immediate feedback.

There has been an increasing interest from educators and researchers to investigate students' achievement in the online mode compared to students' achievement in the traditional classroom mode. Results have been both positive and negative for online learning. Koory (2003) who taught an 'Introduction to Shakespeare' course in both the traditional classroom mode and the online mode at the University of California at Berkeley compared the results of her students in the two modes. She stated that the online mode resulted in better learning outcomes and her online students scored four times more A Grade than students in the traditional classroom mode. At Kansas University, Ragan and Kleoppel (2004) looked at a Pharm. D. curriculum from the School of Pharmacy and compared the exam results of students enrolled in the online program with those enrolled in the classroom-based program. The two groups of students took two tests; an open book exam and a practical exam where they had to demonstrate specialized equipment which was graded on a pass or fail scale. For the practical exam students in the classroom-based program were assessed by faculty members while students in the online program were assessed by a faculty member, a nurse or physician. In their study they concluded that online students had a higher average in the two exams. The U.S. Department of Education also conducted a study in 2009, where they reviewed more than a thousand empirical studies of online learning conducted between 1996 and 2008. In their study they concluded that on average students performed better in the online education situation than in the face-to-face situation (Feintuch, 2010). However, Harris and Parrish (2006) compared an online course with a traditional course and concluded that in-class students achieved significantly higher grades.

The number of mathematics courses offered online has also increased significantly, yet according to Jones and Long (2013), research findings on achievement in online versus on-site mathematics courses have been scarce. More than a decade before that, Harrington (1999) compared the achievement of students enrolled in a traditional statistics course with those enrolled in the online mode and concluded that students in the traditional course did well overall regardless of their overall grade point average (GPA). However, while students with high overall GPA did well in the online mode, those with low GPA did not do as well. Ryan (2001) compared the final grades of students who studied an 'Introduction to Statistics' course in a web-based mode, video-based tele-course mode and the classroom-based mode. He concluded that there was no significant difference in students' final grades in the three modes. Eggert (2009) also found no statistical difference in the successful course completion of online versus classroom-based developmental mathematics courses.

Recently, Ashby, Sadera and McNary (2011) conducted a comparative study of developmental mathematics students in a blended, face-to-face and online learning environment. Their results showed that there was a significant difference in the performance of students based on learning environment. Students in the blended environment had the least success, while face-to-face students performed less well when compared with online students. Also Xu & Jaggars (2011) studied the effectiveness of an online introductory English and Mathematics course and showed that students did not perform well in online courses.

A recent study conducted by Jones and Long (2013) to determine if equity was achieved when learning in an online mode and on-site mode in a mathematics course, revealed that it was possible for students in both modes to achieve equity as measured by their final course grades.

The effectiveness of online assessments has also been studied. Simonson, Schlosser and Hanson (1999) claimed that distance education needed to be based on the idea of equivalence in order to be successful. They introduced the Equivalency Theory which means that the more equivalent the learning experiences are for distance and local learners, the more equivalent will be the outcomes for the learning activity. Later Simonson (2000) elaborated on this theory, stating that the "learning experiences are not identical, but various learning experiences can be considered equivalent if they produce equivalent learning". To explain his theory he compared a triangle and a square having the same area and can be considered equivalent even though the two are different geometrical shapes. Simonson (2000) mentioned that the experiences of the local learner and the distance learner should have equivalent value even though these experiences might be very different. He stressed that it was important to note that different students in different locations may require a different mix of learning experiences, but the sum of the experiences for each learner should be equivalent in value.

To compare the assessments, Bocij and Greasley's (1999) claimed that students found online testing superior because they focused less on writing their answers and more on the test item, resulting in less stress. Cassady and Gridley (2005) studied the effect of online formative and summative

assessment materials on undergraduates experience with attention to the learner's behaviour (study habits, performance) and beliefs (e.g. test anxiety, perceived test threat). They compared the effect of students' perception of tests on performance in online and paper-based summative assessments and concluded that students taking online tests reported low levels of test threats. For formative assessments, their findings indicated a small benefit of using online practice tests prior to graded course exams. Both Cassady and Gridley (2005) and Hewson and Charlton (2007) report a lack of mode effect when using either online or offline assessments approaches.

Learner preference for online over offline assessments methods has been shown by Sheader, Gouldsborough and Grady (2006). They also claimed that while students may have reservations about online assessment practices, these reservations can somewhat be alleviated by actually taking an assessment online. Johnson and Kiviniemi (2009) showed the effectiveness of compulsory, mastery-based, weekly reading quizzes as a means of improving exam and course performance in an online course through better performance.

This paper reports the findings from comparing the achievement of students enrolled in the face-to-face and online modes of a first year degree mathematics course at The University of the South Pacific. To determine if equivalence in learning was achieved in the two modes, the coursework marks, exam marks and overall course marks were compared. The pass rates and attrition rates of the courses in the two modes were also compared. Lastly, the different types of coursework assessments used in the two modes were compared.

Objective

The University of the South Pacific (USP) provides education to its twelve member countries in the South Pacific region. Due to the USP's geographical setting and the diverse socio economic status of its students and the availability of modern technology, offering online courses is deemed to be the best way forward to deliver education to the USP region.

The Faculty of Science, Technology and Environment (FSTE) offered its first online course Mathematics for Social Science (MA101) in Semester 2 in 2010. Since then the face-to-face mode for this course has been discontinued and only the online mode has been offered. The FSTE is now in the process of offering programs in the online mode. This shift in program delivery demands the need to determine if equivalent learning is occurring in this alternative mode of delivery. The questions become: Is there any difference in students' performance in the online mode compared with those in the face-to-face mode? Has equivalence in learning been achieved in the two modes?

Methodology

To provide answers to the questions in the Objective section, cross-sectional data was selected and the results of students who took the course in the two different modes were statistically compared. Data was taken from four consecutive years for each of the two modes; for the face-to-face mode from 2006 to 2009 and for the online mode from 2010 to 2013 when the face-to-face mode was replaced by the online mode. In the face-to-face mode all instructions were given in the classroom, yet in 2007 due to the introduction of the Moodle platform, students were also given the opportunity to access notes online. However, all assessments were paper-based. On the other hand, in the online mode all instruction and assessments were done online via the Moodle platform and only the final exam was paper-based. In order to determine if online and face-to-face are equivalent, first the data was compared to see the percentage of students who did not complete the course. This was then discarded to ensure a fair comparison was done between the two modes. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) software and the results were generated.

The following hypotheses were formulated:

1. The performance in both the online and face-to-face mode was the same with respect to the pass rate.

2. The performance in both the online and face-to-face modes was the same with respect to the mean course work marks.

3. The performance in both the online and face-to-face mode was the same with respect to the mean final exam marks.

4. The performance in both the online and face-to-face mode was the same with respect to the mean total marks.

Results and Discussion

During the period the data was collected, a total of 300 and 1426 students were enrolled respectively, in the online and face-to-face mode.

Table 1.

Some Descriptive Statistics

Mode	Online	Face-to-Face
Pass	167 (55.7%)	920 (64.5%)
Fail	88 (29.3%)	451 (31.6%)
Did not sit the exam	45 (15.0%)	55 (3.9%)
Total	300 (100%)	1426 (100%)

Table 1 shows that a significant percentage (15%) of students during the sampling period did not appear in the final examination in the online mode compared with the face-to-face mode (3.9%). This supports the study conducted by Morgan & Tam (1999) that the attrition rate is higher in the online mode. Losty & Broderson (1980) also claimed that distance learners throughout the world have the characteristics of higher attrition rate compared to their campus-based counterparts.

A list of descriptive statistics for the course work (CW), the final exam mark (Final) and the total marks (Total) of these students in the two different modes are presented in Table 2.

Table 2.

Descriptive Statistics

Mode	Statistics	Online	Face-to-Face
CW	Mean	31.918	28.829
	Median	33.5	29.9
	Std. Deviation	10.1026	9.5658
	Minimum	0	0
	Maximum	48.7	49
Final	Mean	23.494	26.58
	Median	22.3	26.5
	Std. Deviation	12.1993	10.537
	Minimum	0.1	1.0
	Maximum	49.4	49.5
Total	Mean	55.412	55.389
	Median	57.0	56.4
	Std. Deviation	20.576	19.2318
	Minimum	2.0	1.6
	Maximum	97.0	97.1

According to the mean and the median of the total marks, the performance of the students in both the modes was similar (Table 2). However, the online students scored better in the course work compared with the face-to-face students. In contrast, students in the face-to-face mode performed better in the final exams.

The distribution of course work marks revealed that in the online mode the distribution is left skewed, which means that majority of the students attained high marks. In contrast, the course work distribution was widely spread out in the face-to-face mode (Figure 1).
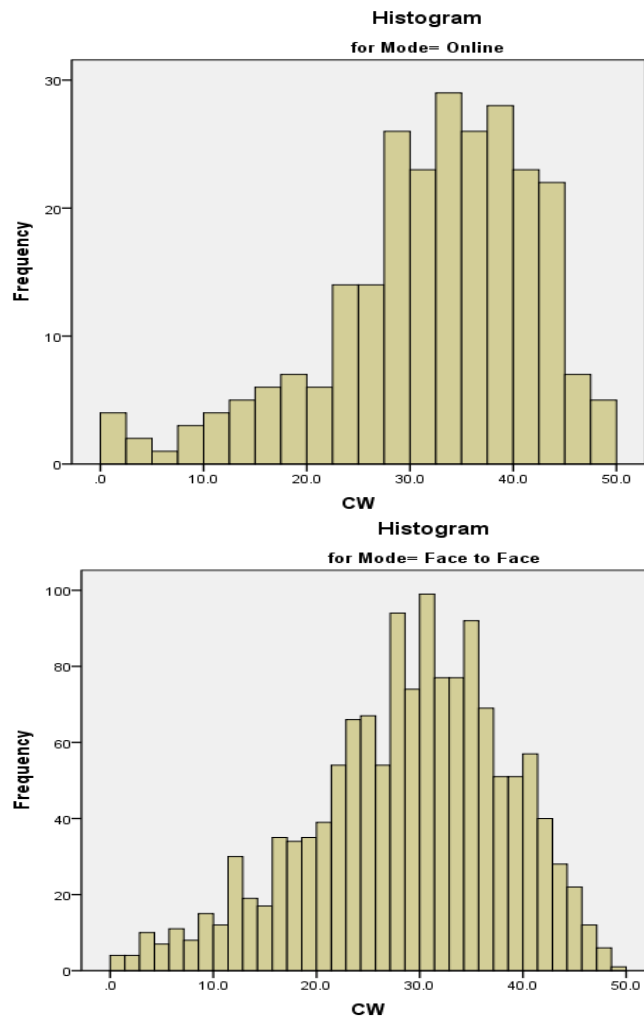

Figure 1. Distribution of course work marks

From Figure 2, it can be seen that the distribution of final exam marks in the online mode was uniform, whereas for the face-to-face mode the distribution was normal. This means that students in the online mode gained marks that were very similar. Their marks had a small range and a smaller standard deviation. On the other hand, the face-to-face students' performance was normal i.e. fewer students had very low and very high marks and more students had marks closer to the mean. Also this means that the face-to-face students had a wider range of marks and hence higher standard deviation.
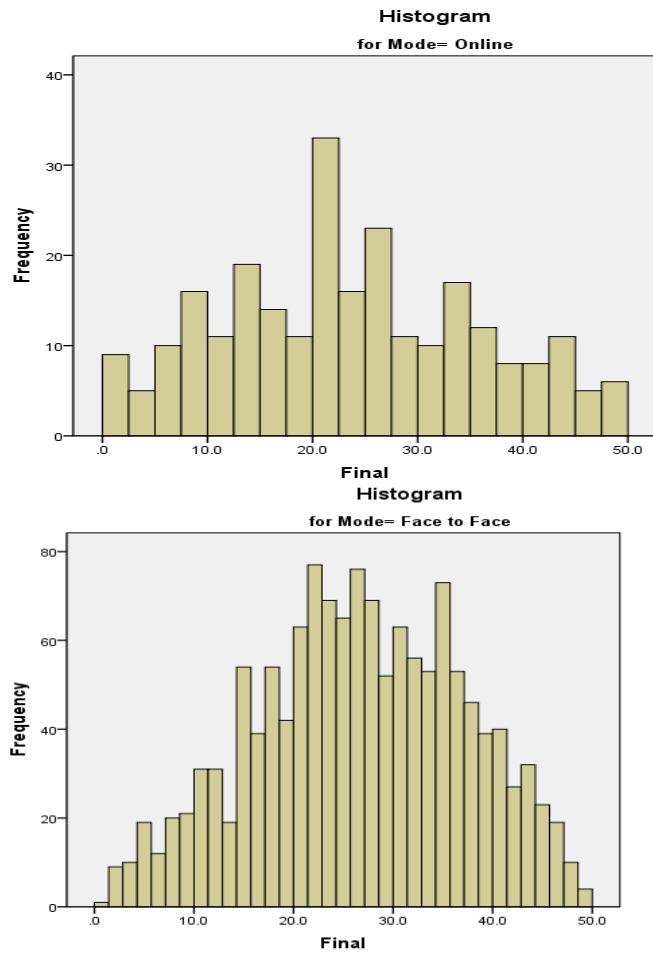
Figure 2. Distribution of final marks

However, Figure 3 shows that the distribution of total marks was similar in both the modes.
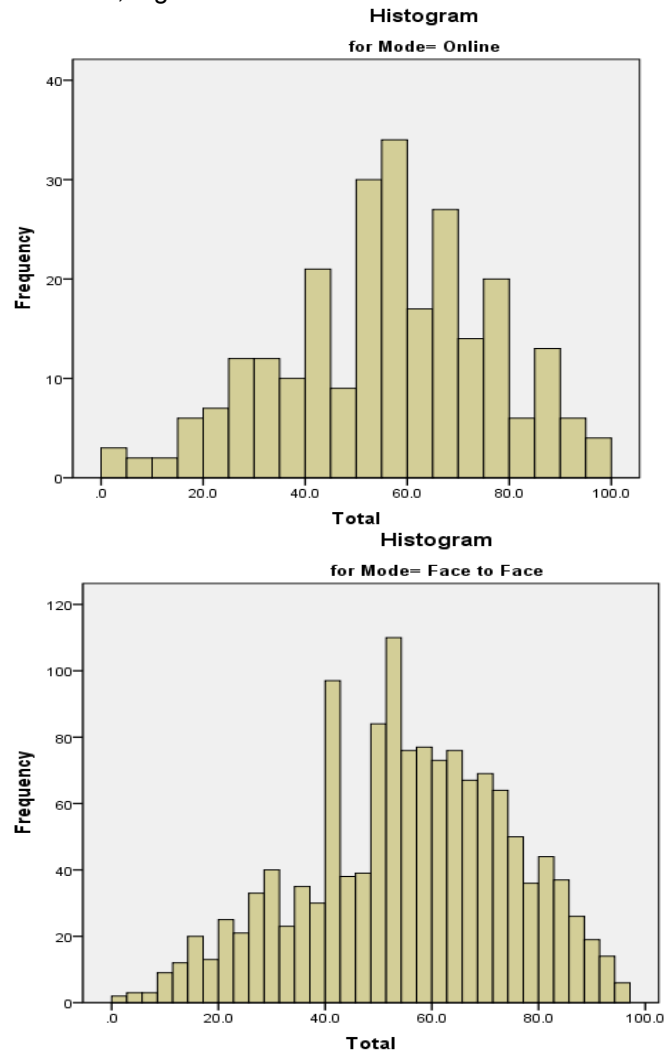

Figure 3. Distribution of total marks

Statistical Analysis

Based on the results presented in Tables 1 and 2, the following four hypotheses were tested:

i. H_0 : There is no significant difference in the pass rates between the online and face-to-face modes.

ii. H_0 : There is no significant difference in the mean course work between the online and face-to-face modes.

iii. H_0 : There is no significant difference in the mean final marks between the online and face-to-face modes.

iv. H_0 : There is no significant difference in the mean total marks between the online and face-to-face modes.

A Chi-square test of homogeneity was carried out to test hypothesis (i) and found that there was no significant difference in the pass rates between the two modes (χ^2 = 0.253, with p-value = 0.615).

Using the normality test, it was seen that the data on the CW, final marks and total marks, were not assumed to be normally distributed. Thus, the Mann-Whitney U non-parametric test was performed to carry out the tests stated in (ii)-(iv). The results are summarized in Table 4.

Table 3.

Whitney U non-parametric test

	Mann-Whitney	**p-value**
CW	138199.50	.000
Final	146504.00	.000
Total	173800.50	.884

The results from Tables 2 and 3 revealed that there was a significant difference (U = 138199.5, p-value < 0.001) in the mean CW between the two modes. This means that the online students scored higher than the face-to-face students. On the other hand, the face-to-face students performed better than the online students in the final exam since the mean scores between the two modes were significantly different (U = 146504.0, p-value < 0.001). However, there was no significant difference (U = 173800.5, p-value = 0.884) in the mean total marks between the two modes. This showed that the overall performance of the students in both the modes was similar irrespective of the modes.

In an attempt to understand why students in the online mode were performing better in the CW, the different types of assessments in the two modes were compared. The different types of assessments conducted for the two modes are given respectively in Table 4 and 5.

Table 4.

Type of assessments in face-to-face course

Assessment Type	No	Marks	% of the Total
Weekly Quiz	8	10	5%
Test	3	35, 40, 50	10% 10% 10%
Tutorial Participation	10	5	5%
Labs Participation (only in 2009)	10	10	5%
Assignment (only in 2009)	2	10	5%

Table 5.

Type of assessments in online course

Assessment Type	No	Marks	% of the Total
Weekly Quiz	14	10	6%
Online Test	2	10	20%
Weekly Forum activity	14	5	5%
Weekly lesson activity	10	10	6%
Glossary	16	5	3%
Assignment	2	10	10%

As seen from Tables 4 and 5, the online mode had a wider range of assessments i.e. 6 types of assessments (totalling 50% of the total marks)   compared to 3 (totalling 40% of the total marks) for the face-to-face mode except for the year 2009 when laboratory participation and assignments were introduced. It was also noted that the mark allocation for the online assessments were spread out, while for the face-to-face mode more marks were given to the tests.

In addition to this the activities in the online mode were such that each week students were able to accumulate marks while doing online activities. For example, there were 14 weekly quizzes for the online course and only 8 for the face-to-face course. Also there were 16 Glossaries, 14 weekly forum activities and 10 weekly lesson activities. As a result, online students were more engaged in continuous assessment than the face-to-face students. This supports the findings made by Micklewright *et al.* (2010) that weekly online assessments was a useful method of engaging students in learning activities. Haynie (1997) claimed that students study more earnestly when they are expecting an assessment. Haynie (1997) also reported that apart from engaging more frequently with the course materials, students change their approach to learning after they participate in weekly online assessment programs. These changes are increased in their self-management with less dependence on cramming and better planning and organization of their study activities. Simonite (2003) claimed that weaker students found online weekly assessments useful as these enhance performance by providing regular feedback.

Another characteristic of online mode that was observed was that many different types of assessments were occurring in a single week for online students. It showed that the same topic or content was assessed several times and in different ways and students were likely to go through the same content several times leading to better understanding of the concepts. This also resulted in students gaining higher marks in coursework assessments. This observation supports Ebbinghaus (1913) argument that people learn and retain information better through repeated exposure to the information. Roediger and Karpicke (2006) also found that repeated testing encouraged students to make an effort to study the same content repeatedly. For the online tests, students were given more than one chance to attempt the test and the highest mark achieved was taken as their test mark. This repeated attempt was an advantage for students to improve their marks. This is in line with what Mickelwright *et al.* (2010) claimed that online assessments scores were higher because of repeated number of attempts, which provided weaker students an opportunity to demonstrate their improvements compared to a single piece of coursework. Anakwe (2008) also gave another reason why students in the online mode gained high coursework marks. She argued that students felt more comfortable interfacing with the computer than using a pencil and paper. In addition Bocij and Greasly (1999) claimed that online students stressed less as they focus more on answering the questions rather than focusing on writing down the answers.

The analysis also showed that there was a significant difference in the mean exam marks of the online students compared with the face-to-face students who achieved higher marks in the exam. This supports Bridges *et al.* (2002) results, that coursework marks can be higher than written exam marks for online mode by between one-third and two-thirds of one honours degree class. Brown and Liedholm's (2002) also claimed that traditional students perform significantly better in exams than online students. From Table 5 and 6 it was observed that face-to-face students had been continuously sitting paper-based tests, that is, three tests in which they were required to write their working and answers and this was similar to the exam. However, online students had two online tests which were both multiple choice tests and very different from the exam format. This result supports Wallace and Clariana (2005) findings that test mode familiarity impacts test performance and also Parshall and Kromrey (1993) findings that test mode familiarity improves test performance. Another possible reason why online students would achieve lower mean mark in the exam could be test anxiety as discovered by Sarason and Mandler (1952). Anakwe (2008) found out that switching testing mode conceivably increase test anxiety (Maguire, Smith, Brallier, & Palm, 2010).

Yet, as revealed in the total marks, the students studying in the online mode had high coursework marks, which balanced out with low exam marks, while for the students in the face-to-face mode the low coursework marks were balanced out with the high exam marks. Thus the performance in the two modes was similar.

Limitations and Recommendations

The objective of this study was to determine if equivalence in learning was achieved. In this study the course MA101 was chosen because it was the first course to be offered online. One limitation noted

was that when this course was offered online the face-to-face mode was phased out. For further studies it is recommended that a course that is offered in both the modes at the same time is chosen.

Learning is not only impacted by the content of the course but also by the quality of teaching of the instructor. It would be interesting to find out how the students engaged and interacted with the instructor. While there was interaction between the instructor and the students during the course of the study, there was no evaluation of course carried out in the online course. This would have provided a useful feedback on the students' experience in the course

Conclusion

Since there is no statistical significant difference in the students' total marks in the two modes, it can be concluded that the performance of students in the two modes are similar and students in the online mode are faring just as well as students in the face-to-face mode. The result indicated that equivalence in learning as mentioned by Simonson (2000) has been achieved, since students were given different sets of assessments for the online and face-to-face courses yet the outcomes of their learning were the same as shown by the similar total marks. The different assessments types were given to suit the different course environment.

The results of this study reassure educators in the USP that providing education in the online mode can be equivalent to providing education in the face-to-face mode. Yet, further research should be conducted to help the delivery of online courses meet the needs of learners. Some areas of research that are worth pursuing are: students' perception of taking online mathematics and science courses, performance in each of the type of assessments, engagement on discussion forum and the different types of learning support that can be provided for courses in the online mode.

References

Anakwe, B. (2008). Comparison of Student Performance in Paper-Based Versus Computer-Based Testing. Journal of Education for Business. , 84 (1), 13-17.

Angus, S. D., & Watson, J. (2009). Does regular online testing enhance student learning in the numerical sciences? Robust evidence from a large data set. British Journal of Educational Technology. , 40 (2), 255-272.

Ashby, J., Sadera, W. A., & McNary, S. W. (2011). Comparing student success between developmental math courses offered online, blended, and face-to-face. Journal of Interactive Online Learning. , 10 (3), 128-140.

Bocij, P., & Greasley, A. (1999). Can computer-based testing achieve quality and efficiency in assessment? International Journal of Educational Technology. , 1 (1).

Bridges, P., Cooper, A., Evanson, P., Haines, C., Jenkins, D., Scurry, D., Woolf, H., Yorke, M. (2002). Coursework marks high, examination marks low: Discuss. Assessment and Evaluation in Higher Education. , 27 (1), 35-48.

Brown, B. W., & Liedholm, C. E. (2002). Can web courses replace the classroom in principles of microeconomics? American Economics Review. , 92 (2), 444-448.

Buchanan, T. (2000). The efficacy of a World-Wide Web mediated formative assessment. Journal of Computer Assisted Learning. , 16, 193-200.

Cassady, J. C., & Gridley, B. E. (2005). The effects of online formative and summative assessment on test anxiety and performance. Journal of Technology, Learning and Assessment. , 4 (1), 1-30.

Ebbinghaus, H. (1913). Memory: A contribution to experimental psychology. (H. A. Ruger, C. E. Bussenius Trans.) New York City: Teachers College, Columbia University.

Eggert, J. G. (2009). A comparison of online and classroom-based developmental math courses. Available from Proquest Dissertations & Theses database. (UMI No. 3388207), (Doctoral dissertation).

Feintuch, H. (2010). Keeping their distances: New study indicates students perform better online. Diverse Issues in Higher Education. , 27 (3), 20.

Harrington, D. (1999). Teaching statistics: A comparison of traditional classroom and programmed instruction/distance learning approaches. Journal of Social Work Education. , 35 (3), 343-352.

Harris, D. M., & Parrish, D. E. (2006). The art of online teaching: Online instruction versus in-class instruction. Journal of Technology in Human Services. , 24 (2-3), 105-117.

Haynie, W. J. (1997). Effects of anticipation of tests on delayed retention learning. Journal of Technology Education. , 9 (1), 20-30.

Hewson, C. (2012). Can online course-based assessment methods be fair and equitable? Relationships between students' preferences and performance within online and offline assessments. Journal of Computer Assisted Learning. , 28 (5), 488-498.

Hewson, C., Charlton, J. (2007). Comparing online and offline administration of multiple choice question assessments to psychology undergraduates: do assessment modality or computer attitudes influence performance? Psychology Learning and Teaching. , 6 (1), 37-46.

Johnson, B. C., & Kiviniemi, M. T. (2009). The effect of online chapter quizzes on exam performance in an undergraduate social psychology course. Teaching of Psychology. , 36 (1), 33-37.

Jones, S. J., & Long, V. M. (2013). Learning equity between online and on-site mathematics courses. MERLOT Journal of Online Learning and Teaching. , 9 (1), 1-12.

Jordan, S., & Mitchell, T. (2009). e-Assessment for learning? The potential of short-answer free-text questions with tailored feedback. British Journal of Educational Technology. , 40 (2), 371-385.

Koory, M. A. (2003). Differences in learning outcomes for the online and F2F version of "An Introduction to Shakespeare". Journal of Asynchronous Learning Network. , 7 (2), 18-35.

Losty, B. P., & Broaderson, D. D. (1980). Who Succeeds? A comparison of transcripts of graduates and inactive students of a nontraditional Bachelor of Arts Degree Program. Alternative Higher Education: The Journal of Nontraditional Studies. , 5 (2), 91-99.

Maguire, K. A., Smith, D. A., Brallier, S. A., & Palm, L. J. (2010). Computer-based testing: A comparison of computer-based and paper-and-pencil assessment. Academy of Educational Leadership Journal. , 14 (4), 117-125.

Micklewright, D. P., Pearsall, L., Sellens, M. H., & Billam, N. (2010). Changes in approaches to learning among undergraduate sports science students following a programme of weekly online assessments. Journal of Hospitality Leisure Sport and Tourism Education. , 9 (2), 141-155.

Morgan, C. K., & Tam, M. (1999). Unravelling the complexities of distance education student attrition. Distance Education. , 20 (1), 96-108.

Parshall, C. G., & Kromrey, J. D. (April, 1993). Computer testing versus paper-and- pencil testing: An analysis of examinee characteristics associated with mode effect. Paper presented at the annual meeting of the American Educational Research Association. Atlanta, GA.

Ragan, R. E., & Kleoppel, J. W. (2004). Comparison of outcomes on like exam administered to in-residence and asynchronous distance-based Pharm.D. students. Journal of Asynchronous Learning Networks. , 8 (4), 15-24.

Roediger, H. L., & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. Perspective on Psychological Science. , 1 (3), 181-210.

Ryan, W.J. (2001) Comparison of student performance and attitude in a lecture class to student performance and attitude in a telecourse and a web-based class. (Doctoral dissertation, Nova Southeastern University). Available from ERIC database. (ED467394).

Sarason, S. B., & Mandler, G. (1952). Some correlates of test anxiety. The Journal of Abnormal and Social Psychology. , 47 (4), 810-817.

Sheader, E., Gouldsborough, I., & Grady, R. (2006). Staff and students perceptions of computer-assisted assessment for physiology practical classes. Advances in Physiology Education. , 30 (4), 174-180.

Simonite, V. (2003). The impact of coursework on degree classifications and the performance of individual students. Assessment and Evaluation in Higher Education , 28 (5), 459-470.

Simonson, M. (2000). Making decisions: The use of electronic technology in online classrooms. New Directions for Teaching and Learning. , 2000(84), 29-34.

Simonson, M., Schlosser, C., & Hanson, D. (1999). Theory and distance education: A New Discussion. The American Journal of Distance Education. , 13 (1), 60-75.

Wallace, P., & Clariana, R. B. (2005). Test mode familiarity and performance-Gender and race comparisons of test scores among computer-literate students in advanced information systems courses. Journal of Information Systems Education. , 16 (2), 177-182.

Xu, D., & Jaggars, S.S. (2011). The effectiveness of distance education across Virginia's Community Colleges: Evidence from Introductory College-Level Math and English Courses. Educational Evaluation and Policy Analysis. , 33 (3), 360-377.