

The Effects of Pre-Instructional Support on ODL Learners in a Blended Learning Environment on the Learning of Mathematics

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ABSTRACT

Open Distance Learners at Open University Malaysia (OUM) are generally mature working adults who have left school for a considerable number of years. They may not remember the basic foundations in mathematics that they have learnt in school. Furthermore, mathematics being generally perceived as a tough subject and quite unpopular makes studying it again difficult after so many years; and this can result in anxiety among most learners. This is apparent in the low GPA of students taking basic and introductory mathematics at OUM. With this in mind, a study was conducted to provide this OUM Online Distance Learners (ODL) initial support to better prepare them for further understanding of mathematics in their future course of study. A one-day workshop was conducted to provide pre-instructional support to selected OUM learners. The workshop which was attended by 22 students, focused on the following: basics of numbers, algebra, logarithms and exponents. A pre-test was administered at the beginning of the workshop, the contents were then taught and finally a post-test was administered towards the end of the workshop. Further, an analysis was carried out to assess the impact of pre-instructional support on the long-term enhancement of student knowledge, motivation and sustenance for the course. At the end of the semester, students' results were analyzed and compared with results of those students who did not attend the workshop. In addition, comparison of results was also made between students who were under the workshop instructor (current tutor) and students under another tutor.

Results obtained showed that the pre-instructional workshop has an impact on the students' ability to understand and apply what was taught. There was a strong correlation between workshop participation and final exam score. Independent samples t-test conducted showed that there was a significant difference between the mean score of online discussion ratio and final examination between participants attached to a tutor conducting the workshop and extended coaching compared to participants attached to another tutor using the normal teaching guide.

INTRODUCTION

Open Distance Learners at Open University Malaysia (OUM) are generally mature working adults who have left school for a considerable number of years. According to Open University Malaysia's (OUM) statistics, from the 67,000 learners currently enroll for 2008, 95% are mature working students. As such, they may not remember well the basic foundations in mathematics they have learnt in school and mathematics being generally perceived as a tough subject, makes studying the subject again difficult after so many years and this could result in anxiety among most learners. Studies have shown that there were several sources of frustrations in learning mathematics amongst which were inefficient learning strategies, difficult rapport with truth and reasoning in mathematics, insufficient academic and moral support on the part of teachers and finally, poor achievement (Sierpiska & Knipping, 2007). Therefore, it is not surprising that the states of mind of these OUM learners translate into low Grade Point Average (GPA) among learners taking the basic and introductory mathematics at OUM. Analysis of interviews with these OUM students also tends to point to the fact that this is true.

To facilitate better understanding of mathematics among learners, Open University Malaysia has offered to learners who do not possess a credit in Mathematics at O'Level (Malaysian Education Certificate) to undertake the Preparatory Mathematics course. As an initial measure before commencing the course, however, the researchers provided the pre-instructional support of basic mathematics to enhance and to improve the mathematical skills of these learners. Considered as part of supplemental instruction, the purpose was to increase their level of readiness in learning mathematical subjects via open and distance learning mode. The learners were also taught to familiarize themselves with the equation editor software for the purpose of discussions and communicating mathematical problems via online. Moreover, these skills would also be able to facilitate them for assignments and other future usage. With this in mind, a study was conducted to assess the input of this pre-instructional support through face-to-face and to determine the effectiveness of the continuous supplement coaching.

LITERATURE REVIEW

As Open and Distance Learning mode is gaining popularity, there are many comparative studies conducted over the last few years. Russell (2001, 2005) in his research opined that there is no significant difference between learning that takes place in a traditional environment versus distance education. This was supported by Neuhauser (2002) who found that course delivery media was not sufficiently significant to affect course outcomes.

Many believe that technical subjects including mathematics cannot be delivered 100% via online. According to Engelbrecht and Harding (2004), this could be due to the inability of the Internet Hypertext Markup Language (HTML) to represent mathematical symbols and also the general belief that mathematics can only be taught successfully via face-to-face approach. In the study by Dash (2004), he concluded that face-to-face workshop improved significantly the achievement of the distance teacher trainees. He reported that learning from other means get strengthened by supplementary interactive media like face-to-face development workshop.

Weems (2002) conducted a comparative study on the Introductory Algebra subjects offered to two groups of students; one taught via online and the other via traditional approach. He found that there is no significant difference between the achievements of both groups of students. A similar research conducted by Ryan (2001) on the Introductory Mathematics subject also yielded the same result. However, Russell (2006) found that there is a significant difference between the final grades for the Introductory Mathematics course for online and traditional students and that the mean grade for online students are lower than the mean grade of traditional format students.

According to Pillay, Irving and Tones (2007), many institutions that adopt online learning have very little regard on prerequisite personal and technicalities required by students for academic achievement and satisfaction, which are predictors of retention. Though the level of technical skills with regard to using and navigating in online learning does not directly affect students' achievement, they do influence their engagement with technology.

According to Lotze (2002), adult learners returning for academia after a long absence often experience high level of discomfort with technology. Thus, many Online Distance Learning (ODL) institutions introduced orientation programs to improve on their learners' readiness in ODL learning. Zieger (2005) noted that there was an increased interest in the research on the impact of orientation programs on undergraduate students during 1980s, where institutions begin to see the importance of such programs on students' satisfaction and retention. Dessler (2003) opined that an ideal orientation program should be able to make students feel comfortable, understand the university's culture and environment, expectation and goals and become socialized into the system. Tinto (1987) termed these efforts as academic and social integration, which have impact on students' decision to persist in their programs.

Lotze (2002), in his comparative study on the teaching of mathematics and statistics via face-to-face and online, found that students in the online learning mode not only struggle with the mathematics concept but also hampered by the use of mathematical symbols, which is necessary to understand and explain the concept. Thus, it is important to introduce both the basic concepts of mathematics and how to use software such as Microsoft Equation Editor to communicate these symbols as part of the orientation program or pre-tutorial session to enhance learning of mathematics via online.

Math has been regarded by learners historically as one of the many difficult courses or "high-risk" courses due to its low success rate in completion. Many learners are not prepared for higher level of studies and do not know how to study (Martin & Arendale, 1993). According to Hodges (2001), institutions now turn to supplemental instruction (SI), one of two forms of academic assistance besides tutoring to help students succeed in their studies. The education innovative SI was developed by Deanna Martin in 1973 at the University of Missouri in Kansas City. Many researches conducted on SI have shown significant results where it does influence grades and even retention (Phelps, 2005 & Doty, 2003). Tatum (2000) in his ABC Theory (Affirm identity, Build community and Cultivate leadership) opined that every learner in a learning environment needs a supportive climate of achievement.

RESEARCH QUESTIONS

The following questions were used to guide the research:

1. Was there a significant difference in the mean scores of pre and posttest of the participants of the workshop?
2. Was there a significant difference in the online discussion ratio and final exam score of participants of the workshop between one tutor and another?
3. Was there a significant difference in the online discussion ratio and final exam score between participants and non-participants of the workshop for the two different tutors?

METHODOLOGY

The research involved a total of 88 learners from three different classes taught by two tutors, R and S. Of the two tutors, only tutor R was involved in conducting the workshop. 22 learners turned up for the workshop voluntarily. Of these 22, 10 of them were tutored by tutor R and 12 by tutor S.

The participants of the workshop were given a set of 10 basic multiple choice mathematics questions to answer before the start of the workshop. Towards the end the workshop, participants were given another set of 10 questions almost similar to the pretest questions to answer. The pretest and posttest scores were then recorded and analyzed.

The research continued throughout the whole semester where tutor R provided additional supplement coaching via online and tutor S only provided normal face-to-face coaching as per lesson guide. At the end of the semester, the online discussion ratios of all the learners were obtained by dividing the number of messages posted in the online discussion forum with their online discussion marks. Learners' final examination marks were also captured.

A paired-sample test was conducted on the pretest and posttest scores to find out if there was any impact of the workshop on the participants' level of understanding. A Spearman Correlation was conducted in order to find out if a linear association between the mean score of online discussion ratio and final exam marks for the two tutors existed.

The independent samples t-test was used to compare the means of online discussion ratio and final examination marks for participants of workshop for tutor R and tutor S to see if there was a significant difference between the two groups or was it due to random error.

STRUCTURE OF THE MATHEMATICS PREPARATORY WORKSHOP

The one-day workshop was divided into five sections; (1) Overview of ODL concepts of learning which included goal-setting, successful learning strategies, time management and tips for improving mathematics; (2) Basic Mathematical concepts involving Numbers, (3) Algebra, (4) Exponential and Logarithms; and (5) using Learning Management System (LMS) and Equation Editor to enhance online learning

The pretest was administered immediately after the first section. For the next three sections, learners were divided into five groups where each group was given a question to discuss and present. The posttest was administered at the end of the final presentation of Mathematics Online. Table 1 below summarizes the structure of the workshop.

Table: 1 – Structure of the Mathematics Preparatory Workshop

Mathematics Preparatory Workshop Structure	
	Session 1: Overview on ODL concepts of Learning: Goal-setting, Successful Learning Strategies, Time Management and Tips For Improving Mathematics.
<i>Pretest</i>	
	Session 2 : Instructions on Numbers
	Group Activity 1 Presentation
	Session 3: Instructions on Algebra
	Group Activity 2 Presentation
	Session 4: Instructions on Exponential and Logarithms
	Group Activity 3 Presentation
	Session 5: Mathematics Online: LMS/Equation Editor
<i>Posttest</i>	

FINDINGS

The results of the analysis of data based on the research questions are presented as follows:

Research Question 1

Was there a significant difference in the mean scores of pre and posttest of the participants of the workshop?

The Pearson correlation test conducted on the pretest and posttest scores was found to be 0.685, significant at the 0.01 level (2-tailed) indicating that the workshop has an impact on the test scores. Paired-samples test conducted showed there was an increase in the mean score by 17.23 after attending the workshop. The t-value of -4.194 obtained was significant as shown in Table 2 indicating the significant difference between pretest and posttest scores of participants of the workshop.

Table: 2 – Paired Samples T-Test for Pretest and Posttest Scores

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-Test Score - Post-Test Score	-17.273	19.3174	4.1185	-25.838	-8.708	-4.194	21	.000

Research Question 2

Was there a significant difference in the online discussion ratio and final exam score of participants of the workshop between one tutor and another?

A Spearman correlation test conducted on the online discussion ratio and final examination marks score showed that there was a strong correlation between the online discussion ratio and final exam marks of participants and tutors. The rho coefficient for online discussion ratio and final exam score obtained was 0.867 and 0.561 respectively at 0.01 level.

Referring to Table 3, the mean score of online discussion ratio and final exam marks were higher for participants of the workshop attached to tutor R compared to tutor S.

Table: 3 – Comparing the mean score of Online Discussion Ratio and Final Exam Score between Workshop Participants for Tutor R and Tutor S

	TUTOR	N	Mean	Std. Deviation	Std. Error Mean
Online Discussion Ratio	Tutor R	10	25.630	17.5818	5.5599
	Tutor S	12	3.017	1.8693	.5396
Final Exam Marks	Tutor R	10	35.225	15.3471	4.8532
	Tutor S	12	16.042	7.9099	2.2834

Independent Samples t-test carried out yielded the following results as shown in Table 4 below. The results showed there was a significant difference in the online discussion ratio and final examination score of participants of workshop between tutor R and tutor S.

Table: 4 – Independent Samples T-Test for Online Discussion Ratio and Final Exam Score

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Online Discussion Ratio	4.048	9.170	.003	22.613	5.5860	10.0125	35.2141
Final Exam Marks	3.577	12.908	.003	19.183	5.3635	7.5878	30.7789

Research Question 3

Was there a significant difference in the online discussion ratio and final examination score between participants and non-participants of the workshop for the two different tutors?

The Spearman coefficients obtained showed that there is a correlation between online discussion ratio and final exam marks, and learner's participation for Tutor R (0.380, Sig. = 0.05 and 0.408, Sig. = 0.03). However, for Tutor S, the correlation is only significant for final exam score (0.483, Sig. = 0.03) but not for online participation ratio.

As shown in Table 5, the mean scores of online discussion ratio and final examination marks for participants attached to tutor R were higher compared to the mean scores of online discussion ratio and final exam marks for non participants. Additionally, Table 6 shows that the mean scores of online discussion ratio and final exam marks for participants attached to tutor S were also higher compared to the mean scores of online discussion ratio and final exam marks for non participants.

Table: 5 – Comparing the mean score of Online Discussion Ratio and Final Exam Score between Workshop Participants and non-Participants for Tutor R

	Participation Status	N	Mean	Std. Deviation	Std. Error Mean
Online Discussion Ratio	Yes	10	25.630	17.5818	5.5599
	No	42	10.979	7.9609	1.2284
Final Exam Marks	Yes	10	35.225	15.3471	4.8532
	No	42	16.393	16.3317	2.5200

Table: 6 – Comparing the mean score of Online Discussion Ratio and Final Exam Score between Workshop Participants and non-Participants for Tutor S

	Participation Status	N	Mean	Std. Deviation	Std. Error Mean
Online Discussion Ratio	Yes	12	3.017	1.8693	.5396
	No	24	1.750	1.1006	.2247
Final Exam Marks	Yes	12	16.042	7.9099	2.2834
	No	24	8.208	8.7277	1.7815

The results of the independent samples t- test conducted to compare the mean score of online discussion ratio and final examination marks of participants and non-participants of tutor R indicated there was a significant difference between the mean score of online discussion ratio and final examination marks between participants and non-participants of Tutor R as shown below. There was also a significant difference between the mean score of online discussion ratio and final examination marks between participants and non-participants of Tutor S as shown in Table 8.

Thus there is a significant difference in the final exam marks between participants and non-participants of the workshop irrespective of tutors. However, only the online participation ratio of tutor R is significant compared to tutor S.

Table: 7 – Independent Samples T-Test for Online Discussion Ratio and Final Exam Score for Tutor R

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Online Discussion Ratio	2.573	9.895	.028	14.651	5.6939	1.9463	27.3566
Final Exam Marks	3.312	50	.002	18.832	5.6858	7.4120	30.2523

Table: 8 – Independent Samples T-Test of Online Discussion Ratio and Final Exam Score for Tutor S

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Online Discussion Ratio	2.167	14.929	.047	1.267	.5845	.0203	2.5130
Final Exam Marks	2.615	34	.013	7.833	2.9952	1.7463	13.9203

DISCUSSION

This present paper is the outcome of a research study to evaluate the effectiveness of the face-to-face pre-instructional support on learning mathematics in a blended learning environment. The purpose is to increase the learners' readiness in learning mathematical subject via open and distance learning mode.

Generally, the results of the study indicate that the workshop conducted has improved the achievement of learners. The results obtained on the pretest and posttest analysis showed significant outcome and the higher mean score of the posttest proves the fact that the input of the workshop did have an impact on the participants. Participants of the workshop irrespective of their tutors achieved higher mean scores for online discussion ratio and final examination scores compared to those who did not participate.

When comparing workshop participants for both tutors, the findings showed that different tutors produce different effects on the learners' results. The workshop participants attached to tutor R (who has extended coaching via online) have higher mean score for ratio and final exam compared to participants who are attached to tutor S (who used normal teaching guidelines).

CONCLUSION

The results obtained in this research support the study conducted by Dash (2004) and Russell (2006) that face-to-face workshop does improve the achievement of the learners significantly. The results also indicate that the content provided during the workshop and the continuous support provided by the tutor via online can significantly increase the learners' online forum participation and examination results. This corroborates with Lotze's (2002) findings that it is imperative to introduce both the basic concepts of mathematics and equation editor software skills as a pre-tutorial session to enhance learning of mathematics via online. He also added that this pre-tutorial or orientation session can reduce the adult learners' discomfort dealing with technology that is caused by long absence of studying.

Generally, the study has proven that the pre-instructional support provided at the beginning of the semester contributes to the achievement of the learners in high risk subject. This workshop conducted as part of the orientation programme and the extended coaching via online which act as supplemental instruction (SI), have proven to provide academic assistance to these learners to succeed (Hodges, 2001).

RECOMMENDATIONS FOR FUTURE IMPLEMENTATIONS

Open University Malaysia (OUM) adopts a blended learning approach to suit the needs of its learners. The flexible mechanism of this blended learning approach in Open University Malaysia (OUM) encompasses face-to-face, self-managed learning and online learning. In this environment where instructors and learners have limited face-to-face contact, it is extremely crucial that any means of support that is able to increase the learners' academic achievement be given due consideration.

The pre-instructional support workshop conducted in this study is to equip the learners with the basic foundation in mathematics and the equation editor software skills are crucial for online discourses. Based on our findings, we are recommending that this workshop be included as a form of face-to-face support prior commencing the semester. This support should also be added with the continuous supplemental coaching throughout their study phase. In order to achieve these objectives, the tutors should be trained to provide the pre-instructional support to these learners and the tutors should also be encouraged to provide the learners the support services.

For the continuation of this research project, the researchers plan to increase the number of learners for the workshop, to incorporate supplemental instructions criteria whereby the tutors train the chosen students to provide the supplemental support services to the selected learners. Finally, to be able to conduct similar type of workshop consistently throughout all the regional learning centers as part of the current blended-learning model in Open University Malaysia.

References:

Dash, NK, 2004, *Impact of face-to-face workshop on the achievement of distance teacher trainees*, viewed 15 February, 2008, http://www.col.org/pcf3/Papers/PDFs/Dash_Nirod_Kumar.pdf

Dessler, G 2003, *Human resource management*, Prentice Hall, New Jersey

Doty, CS 2003, *Supplemental instruction national data summary, 1998 – 2003*, University of Missouri, Kansas City.

Engelbrecht & Harding, 2004, *Technologies involved in the teaching of undergraduate mathematics on the web*, viewed 18 February, 2008, <http://ridcully.up.ac.za/muti/technologies.pdf>

Hodges, R 2001, 'Encouraging high-risk student participation in tutoring and supplemental instruction', *Journal of Development Education*, vol. 24, no. 3, pp. 2-9.

Lotze, CD 2002, *Online Mathematics and Statistics tutoring: effectiveness and implementation issues*. PhD thesis, American University, Washington DC.

Martin, DC & Arendale, D 1993, *Foundation and theoretical framework for SI*, 2nd edn, National Resources Center for the Freshman Year Experience and Students in Transition, Columbia

Neuhauser, C 2002, 'Learning style and effectiveness of online and face-to-face instructions', *The American Journal of Distance Education*, vol.16, no. 2, pp. 99 – 113.

Phelps, JM 2005, *Supplemental instruction in a community college developmental mathematics curriculum: a phenomenological study of learning experiences*. PhD thesis, University of Central Florida, Florida.

Pillay, Irving and Tones, 2007, 'Validation of the diagnostic tool for assessing tertiary students' readiness for online learning', *Higher Education Research & Development*, vol. 26, no. 2, pp. 217 – 234.

Russell, RP 2006, *A comparison of student achievement and retention in an introductory math course delivered in online, face-to-face and blended modalities*. PhD thesis, Capella University, Minneapolis.

Russell, TL 2001, *The no significant difference phenomenon: a comparative research annotated bibliography on technology for distance education*, International Distance Education Certification Center, Montgomery.

Russell, TL 2005, *No significant difference phenomenon*, viewed 15 February, 2008, <http://nosignificantdifference.wcet.info/index.asp>

Ryan, WJ 2001, *Comparison of student performance and attitude in a lecture class to student performance and attitude in a telecourse and a web-based class*, PhD thesis, Nova Southeastern University, Florida.

Sierpinska, A, Bobos, G & Knipping, C 2007, *Presentation and partial results of a study of university students' frustration in pre-university level, prerequisite mathematics course: emotions, positions and achievement*, viewed 3 March, 2008, <http://www.asjdomain.ca/emotions.html>

Tatum, BD 2000, 'The ABC approach to creating climates of engagement on diverse campuses', *Liberal Education*, vol. 86, no. 4, pp. 22 – 29.

Tinto, V 1987, *Leaving college: rethinking the causes and cures of student attrition*, University of Chicago Press, Chicago.

Weems, GH 2002, 'Comparison of beginning algebra taught onsite versus online', *Journal of Developmental Education*, vol. 26, no. 1, pp. 10-18.

Zieger, LB 2005, *The relationship between student orientation programs that support community building and retention of distance learners*, PhD t