Students' Perceptions Of Learning Mode In Mathematics

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ABSTRACT

Blended courses or hybrid courses have gained popularity over the years because of their flexibility and convenience. Technology use in the online component of the blended/hybrid courses is another influence particularly to the younger generation of learners who enjoy learning interactively in a virtual environment. However, depending on the subject matter and the type of learners, traditional classroom learning may be preferred to hybrid learning. This study looks at student perceptions of the face-to-face component and the online component in a hybrid mathematics course. Analysis shows that the students in this study preferred the face-to-face learning mode. In particular, they are more comfortable interacting with their peers and the instructor in the face-to-face learning mode and they find the face-to-face instruction enables them to learn and understand the mathematics concepts better. Future study will look into gathering qualitative type of responses to students' preference of the learning modes.

Keywords: *face-to-face, hybrid courses, learning environment, online*

INTRODUCTION

Mathematics teaching and learning has evolved over time with changes in the epistemology, assessment and technology advancement. The primary transformation means that teaching and learning is no longer a one way process but is a shared responsibility between the instructor and the students.

Learning is an active process that requires student participation, engagement and involvement in the learning process. Along the way, the teaching and learning environment has changed from face-to-face mode in a traditional classroom to online mode in a virtual classroom to a combination of both in a hybrid learning mode.

Existing studies showed little to no significant differences in the effectiveness of the different learning modes and students' perceptions of these learning modes, namely the traditional, online and hybrid modes (Burns, Duncan, Sweeney, North & Ellegood, 2013). Vernadakis, Giannousi, Tsitskari, Antoniou, and Kioumourtzoglou (2012) also found mixed results in comparing students' satisfaction with the traditional and the online learning modes. However, studies comparing students' satisfaction in the traditional learning mode and the blended learning mode are found to be limited. Still, the few existing studies showed conflicting outcomes (e.g., Larson & Chung-Hsien, 2009; Melton, Graf & Chopak-Foss, 2009).

Literature Review

The online learning or e-learning mode has been a major trend in higher education (Yen & Lee, 2011). The most recognized advantage of online learning is convenience especially in terms of time, flexibility and accessibility (Callaway, 2012). This is particularly relevant to the adult learners who are unable to access a traditional classroom education (Ilgaz & Gulbahar, 2015). In addition, an online learning environment allows more interaction in a virtual learning environment, and both horizontal (i.e., peer-to-peer) and vertical (i.e.,

student-to-instructor) communication at the same time (Schwartz, n.d.). Hence, students are found to be more collaborative and reflective, and are better able to apply the acquired knowledge.

On the other hand, lack of student discipline and low retention rates are some of the disadvantages of online learning (Cole, Shelley, & Swartz, 2014). The structure, delivery method and monitoring system of an online learning environment need to be carefully thought out in order to manage technical problems, feelings of isolation and lack of classroom contribution among the students (Schwartz, n.d.). Online learning in higher education also results in dissatisfaction among students caused by ICT-related high frustration levels, lack of interaction, feelings of isolation and unclear course expectations (Callaway, 2012; Yen & Lee, 2011). Ilgaz and Gulbahar (2015) too agree that online learning creates dissatisfaction in those students who lack ICT skills and have low level of perceived self-efficacy.

Hybrid courses otherwise known as blended courses maximize the advantages of both the traditional classroom and technology use in the virtual classroom (Vernadakis et al., 2012). Instruction takes place mostly in a traditional classroom setting but is strengthened by online activities that replace some of the class face-to-face time (Scida & Saury, 2013). According to Vernadakis et al. (2012), researchers found that the hybrid or blended learning environment enables students to be more involved in their learning process, thus improving their learning. In addition, hybrid courses provide flexibility in terms of time and location, make courses more accessible and interactive, increase students' interest and self-exploration, and accommodate students' varied learning needs.

Scida and Saury (2013) pointed out that the success of any hybrid course depends on two factors. The first, online activities and the use of computer should be realistic in the topics that allow concrete and positive use of technology. Second, students must take more responsibility over their learning by reading the materials provided prior to the lessons. In particular, the online activities should provide students with opportunities to communicate effectively with their instructor, promote active learning, and allow application of knowledge and effective student interaction (Dell, Law, & Wilker, 2010). Additionally, instructors should understand the learning process well and be skilled in designing online instruction. They must also be able to facilitate higher order thinking skills through problem-based activities (Dell et al., 2010).

The study conducted by Ugur, Akkoyunlu, and Kurbanoglu (2011) on university students' perceptions of blended learning showed that the students gave highly positive opinions. The students found that blended learning is an easy and effective way to understand the lessons, provides them with opportunities to participate in forum discussions and enable them to remember most of the lesson contents without memorization. Accoridng to Vernadakis et al. (2012), although literature shows that blended learning has positive influence on learning, the disadvantage of the blended learning mode did not go unnoticed. In comparing the traditional and the online mode, different opinions have been observed. In their own study, Vernadakis et al. (2012) found the students to be more satisfied with the blended learning environment.

METHODOLOGY

Research Design

This study employs a quantitative research design in the data collection and analysis procedure. The objective of this study is to investigate students' perception of the face-to-face mode and the online mode in a hybrid mathematics course. Data have been collected from 56 degree students at a private international university in Malaysia. The participants are made up of students from two mathematics courses namely a course in Calculus and a course in Engineering Mathematics.

Instrumentation

The questionnaire used in this study has been adopted and adapted from Fortune, Spielman, and Pangelinan (2011) (see Appendix). The instrument used in this study is a five-point Likert-scale questionnaire (1 - Strongly Agree, 2 - Agree, 3 - Neutral, 4 - Disagree, 5 - Strongly Disagree). Students were made aware that the survey is anonymous and is on voluntary basis. Apart from the demographic details, the

questionnaire consists of four constructs which are: (a) Learning Environment (5 items), (b) Face to Face (5 items), (c) Online/Technology (6 items), and (d) Preferences (4 items) with 20 items in total.

DATA ANALYSIS AND RESULTS

Descriptive analysis of the data was carried out using the Statistical Packages for the Social Sciences (SPSS) while the radar charts have been plotted using Microsoft Excel. Descriptive analysis basically involves the percentages of the frequencies. Meanwhile, the radar charts are generated using the distribution of mean responses to show students' average responses to the items in the instrument.

Table 1 displays the demographics of the students in this study in terms of gender and the type of students. Table 2 displays the frequencies for the 20 items in the questionnaire whereby the codes used are SA – Strongly Agree, A – Agree, N – Neutral, D – Disagree and SD – Strongly Disagree. Meanwhile, Table 3 shows the mean distribution of data for the items in the instrument that was used to plot the radar charts displayed in Figure 1 to Figure 4.

Table 1. Demographics

Item		Number	Percentage
Gender	Male	44	78.6%
	Female	12	21.4%
Type of student	Local	43	76.8%
	International	13	23.2%

Table 2. Frequencies

Component	Item	Options				
		SA	A	N	D	SD
Learning Environment	LE1	46.4	33.9	17.9	1.8	-
	LE2	3.6	23.2	57.1	12.5	1.8
	LE3	35.7	51.8	10.7	1.8	-
	LE4	7.1	21.4	41.1	21.4	7.1
	LE5	37.5	35.7	19.6	5.4	1.8
Face-to-face	F2F1	42.9	42.9	10.7	3.6	-
	F2F2	35.7	53.6	8.9	1.8	-
	F2F3	33.9	44.6	16.1	5.4	-
	F2F4	28.6	51.8	14.3	5.4	-
	F2F5	39.3	37.5	19.6	3.6	-
Online/ Technology	OT1	3.6	28.6	46.4	16.1	5.4
	OT2	-	26.8	46.4	21.4	3.6
	OT3	5.4	37.5	32.1	17.9	3.6
	OT4	5.4	30.4	41.1	17.9	5.4
	OT5	5.4	37.5	39.3	14.3	3.6

	OT6	10.7	30.4	42.9	8.9	7.1
	P1	14.3	48.2	28.6	8.9	-
Preferences	P2	3.6	16.1	50.0	23.2	7.1
	P3	1.8	19.6	41.1	28.6	8.9
	P4	19.6	42.9	25	7.1	3.6

Table 3. Mean Response

Learning Environment		Face-to-Face		Online/Technology		Preferences	
LE1	1.75	F1	1.75	OT1	2.91	P1	2.32
LE2	2.85	F2	1.77	OT2	3.02	P2	3.14
LE3	1.79	F3	1.93	OT3	2.76	P3	3.23
LE4	3.00	F4	1.96	OT4	2.87	P4	2.31
LE5	1.98	F5	1.88	OT5	2.73		
				OT6	2.71		

Learning Environment

Table 2 shows that students are more comfortable communicating and having discussions in a classroom environment compared to the online environment. In particular, 80.3% of the students are comfortable communicating with their instructor in a classroom environment whereas 87.5% of the students are comfortable communicating with their classmates in a classroom environment. Further, it was found that 73.2% of the students are more comfortable having classroom discussions than online discussions. This result is supported diagrammatically by the radar chart in Figure 1 which shows that items LE1, LE3 and LE5 have mean responses between 1.5 and 2.0, indicating students are in favor of the classroom learning environment. On the other hand, items LE2 and LE4 have mean responses between 2.5 and 3.0 indicating less agreement with the online learning environment.

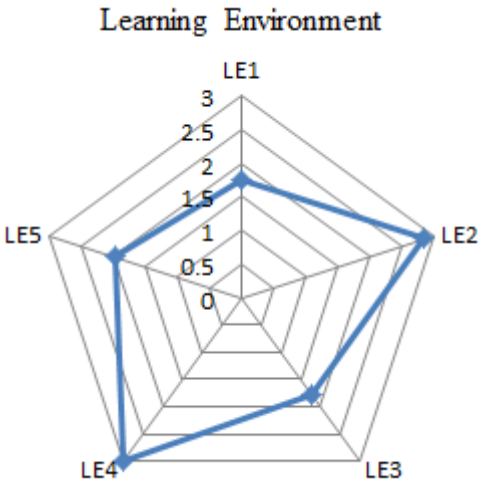

Figure 1. Radar diagram for Learning Environment component.

Face-to-Face

The finding for the Learning Environment construct is supported by the results of the Face-to-Face construct. Analysis of data for the five items in the Face-to-Face construct shows that the students on the whole agree that face-to-face instructions are a better mode of learning for mathematics. In particular, 85.8% of the students feel that face-to-face instructions help them learn better and 89.3% of the students agree that they understand the mathematics concepts better with the face-to-face instructions. Meanwhile, 80.4% of the students agree that face-to-face communication improves their ability to learn mathematics, while 78.5% of them feel that face-to-face instruction would be better for the courses they are taking and 76.8% prefer face-to-face instructions in learning mathematics.

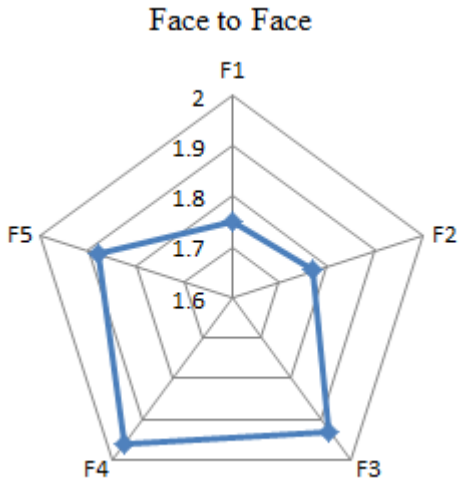

Figure 2. Radar diagram for Face-to-Face component.

As shown in Figure 2, items F1 and F2 have mean responses between 1.7 and 1.8 while items F3, F4 and F5 have mean responses between 1.9 and 2.0. This indicates that although students have higher agreement that face-to-face instructions help them understand and learn mathematics better, there is lower agreement in terms of whether face-to-face is a better way (than online) for their respective courses and if they prefer the face-to-face instructions.

Online/Technology

As shown in Table 2, the percentage of students in favor of the online learning is less than 50% whereby only 41.1% of the students value the use of technology in their mathematics courses. Moreover, only 21.5% disagree that technology use poses a barrier in completing their coursework. Further, the percentage of students who agree it is easier to communicate with their instructor in an online environment is 32.2% while the percentage of students who agree it is easier to communicate with their classmates in an online environment is 26.8%. Meanwhile, the percentage of students who agree that they are able to understand mathematics concepts better in the online environment is 35.8% and the percentage who agree that online materials improve their ability to learn mathematics is 42.9%.

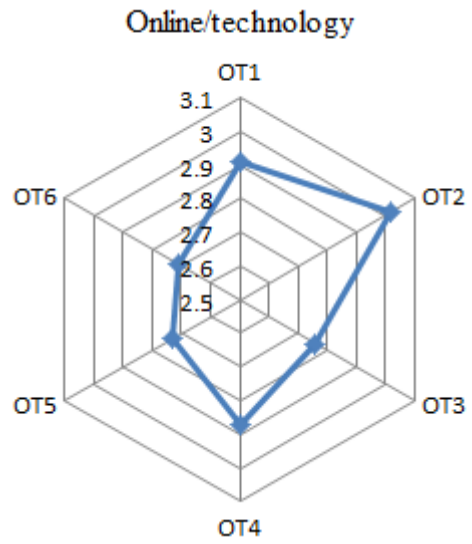

Figure 3. Radar diagram for Online/Technology component.

Figure 3 shows that items OT3, OT5 and OT6 have mean responses between 2.7 and 2.8. This shows that although students find that technology use poses a barrier in completing their coursework, the online materials improve their ability to learn mathematics and thus they value technology use in their respective mathematics courses. On the other hand, there is less agreement that using technology facilitates communication or that it improves their mathematics learning ability as suggested by the mean responses of items OT1, OT2 and OT4 which are between 2.8 and 3.1.

Preferences

Overall, the findings from the previous three constructs indicate that students prefer learning mathematics in a classroom instead of an online environment. Additionally, analysis of data for the Preferance construct shows that only 19.7% of the students preferred to work online with their classmates and only 21.4% agree that they preferred the online environment. Likewise, most students (62.5%) preferred the traditional classroom assessment instead of being assessed online. However, 62.5% of the students agree that the mathematics course should be taught as a hybrid or combination of the face-to-face and online instruction.

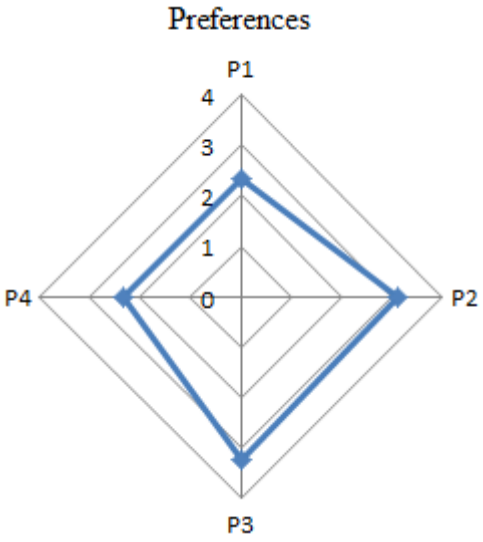

Figure 4. Radar diagram for Preferences component.

As shown in Figure 4, items P1 and P4 have mean responses between 2.0 and 3.0 while items P2 and P3 have mean responses between 3.0 and 4.0. It appears that although students prefer the online learning environment, they feel the course should be taught in the hybrid mode. Further, although the students prefer the online mode in the learning of mathematics, they prefer the traditional mode when it comes to assessment.

DISCUSSION AND IMPLICATIONS OF STUDY

Hybrid learning or blended learning combines the benefits of both the traditional and the virtual learning environment and thus provides teachers and students with opportunitites to collaborate in solving mathematical problems (Yen & Lee, 2011). Although the responses to hybrid learning are largely positive, negative perceptions have been observed as well (Vernadakis et al., 2012). This study investigated students' perceptions toward the two components of hybrid learning, namely the face-to-face component and the online component. Quantitative data were gathered using a five-point Likert-scale questionnaire.

In general, the questionnaire used in this study has a Cronbach alpha value of .743 and thus is found to be reliable. Individually, the constructs Face-toFace and Online/Technology have a Cronbach alpha value of .918 and .896 respectively. On the other hand, the constructs Learning Environment and Preferences have a Cronbach alpha value of .322 and .507 respectively (below the acceptable value of .70). However, when items LE2 and LE3 are removed from the construct Learning Environment and item P4 is removed from construct Preferences, the Cronbach alpha value of more than .70 is achieved.

Results of analysis revealed that students preferred the face-to-face learning mode for communication, discussions, understanding of mathematics concepts and in improving their learning of mathematics. However, despite their inclination to the face-to-face learning mode, more than half of the students believed that the mathematics courses should be taught in a hybrid mode. The results of this study could be influenced by factors such as students' learning habits, the mathematics curriculum in schools prior to the students' post secondary education and the learning culture (Krishnan, 2015). Other studies such as Yen and Lee (2011) have also showed the influence of gender on attitude toward blended learning.

CONCLUSION

Studies on perceptions of students in higher education toward hybrid or blended learning have revealed varying results. For instance, while Gecer and Dag (2012) found that freshmen in a mathematics department responded positively to the blended mode, Ashby, Sadera, and McNary (2011) revealed that college students taking a blended mode algebra course performed the worst compared to those in the face-to-face and the online learning modes. Students in the Gecer and Dag (2012) study were experiencing blended mode for the first time and found that blended learning mode supports active participation, the course materials are interesting and useful, and that the hybrid mode increased their learning responsibilities.

This study is unique in the sense that it investigates the two learning modes, namely the face-to-face learning mode and the online learning mode, *in* a hybrid mathematics course. Students in this study are found to prefer the face-to-face traditional method in mathematics teaching and learning. Lack of experience in learning mathematics in a non-traditional manner could possibly be one of the main reasons for their reservations toward online learning. However, the study did reveal that the students are in favor of the hybrid mode. Future study will look into the removal of items in the constructs to improve the condition of reliability and to collect qualitative type of data on students' responses to the items. The influence of gender (Yen & Lee, 2011) and students' different learning styles (Ugur, Akkoyunlu, & Kurbanoglu, 2011) are also possible areas of future exploration.

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APPENDIX

I understand this survey is anonymous and voluntary. I give consent to use the data in this survey for any academic purposes.

Student's signature: _____

PART A Demography

Please tick ✓ on **(only) one** of the options.

1. Gender
   Female ☐ Male ☐
2. Local or international student?
   Local ☐ International ☐
3. How good is your command of English?
   Spoken : Not good ☐ Fairly good ☐ Very good ☐
   Written : Not good ☐ Fairly good ☐ Very good ☐

PART B Survey

Please tick ✓ on **(only) one** of the options.

Learning Environment					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am more comfortable communicating with my instructor in a classroom environment.					
I am more comfortable communicating with my instructor in an online environment.					
I am more comfortable communicating with my classmates in a classroom environment.					
I am more comfortable communicating with my classmates in an online environment.					
I am more comfortable discussing in class than online.					

(next page)

Face to Face					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Face-to-face instructions in class help me learn better.					
Face-to-face instructions help me understand mathematics concepts in this course better.					
Face-to-face instructions would be the better way for this course.					
Face-to-face communication in class improves my ability to learn mathematics.					
I prefer face-to-face instructions in learning mathematics.					
Online/technology					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Online access makes it easier to communicate with my instructor.					
Online access makes it easier to communicate with my classmates.					
The use of technology poses a barrier in completing the required coursework.					
Online learning helps me understand mathematics concepts in this course better.					
Online materials improved my ability to learn mathematics.					
I value the use of technology in learning mathematics for this course.					
Preferences					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The course should be a hybrid that is a combination of face-to-face and online instructions.					
I prefer to work online with my group members.					
I prefer the online learning environment more than a face-to-face format.					
I prefer to be assessed in the traditional manner (e.g. in class quizzes, tests) than assessed using technology (e.g. online quiz, forum, wiki).					

Thank you so much for participating in this survey