Learner-Centred Teaching Contributes in Promising Results in Improving Learner Understanding and Motivation: A Case Study at Malaysia Tertiary Education

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Abstract: In Malaysia, traditional teaching is still a common approach among many lecturers. There have been many studies reported its limitations and many lecturers have started to adopt more learner-centred teaching approach to promote better learner understanding and learner motivation. Throughout this effort, it is noticed there are lecturers who could not be assured and felt uncertain about this transition because they went through traditional teaching environment during their studies. Due to this, the effort in shifting from traditional teaching to a more learner-centred teaching has been challenging and hard-hitting. Nevertheless, educational and multimedia technology has played an important role in creating a more interesting and engaging learning environments for our digital natives in this 21st century. In this research, a framework is to be proposed based on Weimer's Learner-Centred Teaching model and through the incorporation of educational technology and multimedia technology in the learning environments. This proposed framework describes how this learner-centred teaching environment could promote better learner experiences by increasing retention rate and improving learner motivation. This proposed framework is recommended through the triangulation results from pre-test/ post-test, learning environments surveys and students' written comments, which in turn serves as a guideline for lecturers to identify how they could progressively shift to learner-centred teaching environment.

Keywords: learner-centred teaching, interactive multimedia learning, learner motivation, learner understanding

1 Background Study

1.1 Changing Education Landscape

Educational institutions are facing a greater challenge from today's students who have grown up with technologies (Prensky, 2001). The rapid growth of Information Technology and Communication (ICT) (Vallance, 2008), has resulted in a bigger push for educators to use these technologies in the classrooms (Sivapalan & Wan Fatimah, 2010). As such, the education landscape is rapidly evolving to accommodate the increasing use of these technological tools (McLoughlin & Lee, 2010), and to take advantage of their benefits to teaching and learning on a global scale (Gobbo & Girardi, 2001). Research has also shown that technological advancements have a direct impact on the nature of education, as they bring about changes in the roles of learners and educators alike, as well as on the learning process (Mahajan, 2012).

These changes thus results in enormous pressure for educational institutions to incorporate technology into the classrooms in order to produce skilled 21st century workers (McLaren, 2007; Mahajan, 2012). In more developed countries, such changes have long been incorporated into the educational system. However, in the Asian region, particularly in Malaysia, and where the countries are still developing, these changes are still slow and are still being tested for its effectiveness and readiness (Mitka & Gates, 2010; Hong & Songan, 2011). In addition to this, there is still a lack of confidence amongst educators about the effectiveness of online education (Chung, 2008; Chiang, Chapman & Elder 2010), as research has shown that technology is often used for the wrong reasons, usually due to pressure from school administrators, convenience, and results in the technology being the focus of the learning process, and not the content or learning materials (Herrington & Kervin, 2007). As such there is a definite need to embed sound pedagogies into the creation of learning materials and let these pedagogies be the driver of educational innovation (Koehler, Mishra, Hershey & Peruski, 2004; Raja Maznah, 2004; McCarthy, 2010), in order to engage students in the course content (Tuparov, Tuparova & Peneva, 2004; Chiang, Chapman & Elder, 2010), which consequently formed an integral part of this research's objective and issue.

1.2   Educational challenges in INTI International University

INTI International University (INTI IU) is one such example facing these challenges. Currently INTI IU is making a change to incorporate learner-centred teaching into the curriculum. However, with the lack of confidence in online learning and an absence of a proper teaching framework which incorporates these changes, acceptance and adoption of such learning approaches may become misguided and ineffective. INTI IU followed this encouragement from the Ministry of Education. INTI IU, the management has been promoting e-learning in the campus. With the use of technology in education, it helps INTI IU to start implementing e-learning in course delivery. The first step was INTI IU launched its own learning management system called INTIONLINE. It is an online platform which allows lecturers to upload their lecture notes, coursework specifications, create quizzes, participate in forums for discussion, use dropbin to allow students to submit assignments online and send message or notification to students and classes.

It is not easy at the beginning to convince lecturers to move on to this e-learning because there were some challenges faced by the management, lecturers and students. The challenges are:
- Lecturers are not familiar with e-learning approach
- Lecturers do not have much experience in using Microsoft Office Suite
- There is inconsistency in the design of lecture notes
- Mistakenly thought the use of INTIONLINE achieves e-learning

1.3   Learner-centred Teaching

Learner-centred education entails providing and implementing learning in many forms so that students have the flexibility and option to learn, and it is through doing tailoring programs to meet these needs that learning and motivation are enhanced. When students are allowed to have their own control on the learning materials and learning pace at the same times, the students are experiencing a change in the learning process (Hunter, 2012). Bender (2003) noted that education has gone into new paradigm and more emphasis needs to be put on student engagement. It is very obvious that when technology was introduced for teaching, students can be actually involved on the teaching part, not just on the learning process, because they can discuss the works together with the peers and they can see their peers' works online. This gives them the opportunity to experience different learning environment.

When comparing learner-centred teaching with the conventional teaching, there is one main difference between them. One is allowing the students to have the control on self-directed learning while the latter is putting the responsibility on lecturers to plan the lesson and give instructions to students. A learner-centred teaching environment always carries the following characteristics which describes effective learners as recommended by de La Harpe, Kulski and Radloff (1999): "*they have specific learning objectives, have wide range of learning strategies and know when to use those, use accessible resources in the most effective way, take responsibility for their own learning, have the skills of adapting to learning processes, planning, observing and evaluating, express their feeling in an appropriate way, understand the learning process, and are aware of their strengths and weaknesses*." Weimer (2002) suggested that in order for education programs to effectively promote learning, and thus evolve into learner-centric environments, five key changes need to be incorporated into instructional practices.
1. The role of the teacher
2. The balance of power
3. The function of content
4. The responsibility for learning
5. The process and purpose of evaluation

1.4   Multimedia Learning

There were many discussions before by other researchers about the proper usage of multimedia elements brings great positive impact towards the learning outcomes for students. Why do people use multimedia in education? It is proven that the multimedia has the relation to the learning process of an individual. It encourages more participation and attracts higher attention from the students. Low, Low and Koo (2003) posited that using multimedia in education can help shifting the education environment to different paradigm and students can enjoy the major benefits of multimedia learning. If multimedia learning environment is

introduced with certain level of student control is incorporated, better student understanding can be achieved (Nicholson & Nicholson, 2010).

With the use of multimedia learning modules in the classroom teaching, students are motivated in learning process. The learners are allowed to control when they want to study using the multimedia learning module. The design of the multimedia in the learning module promotes the feeling of ownership because the learners are given full control using the learning module (Shank, 2005; Wang, 2010). The multimedia learning module includes the hyperlinks which allow the students to navigate to other additional sources available in the Internet besides the non-linear form of the learning module. From there, students are encouraged to explore more information and form deeper understanding on the content (Wang, 2010). Gibson, Herbert, Sebastian and Mayhew (1998) posited "*By combining different media we reach a wider variety of learners creating a rich blend of sensory perceptions*" (p. 472). This is again supported by Wang (2010) where multimedia is able to help both slow and fast learners without putting pressure onto the lecturers about which teaching method to be adopted.

1.5   Multimedia Design Principles

Mayer (2001) proposes seven design principles to be considered while designing a multimedia learning application to ensure the positive impact of multimedia is achieved and not to overload the students' brain processing while perceiving an application which is rich with media. With the principles implemented in learning material, it can help to provide a better learning environment and helps to improve learning (Clark & Mayer, 2008).

The following Table 1 summarizes the description for each design principle:

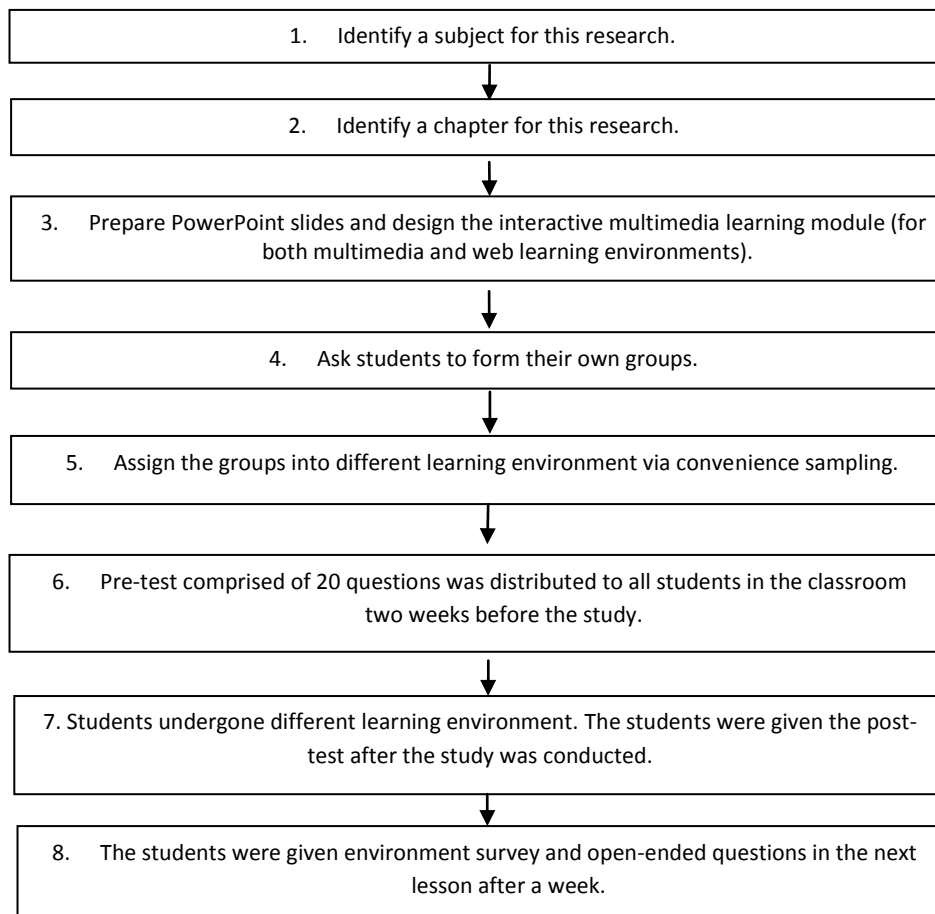**Table 1**: Mayer's seven design principles (Mayer, 2001)

Design Principle	Explanation
Multimedia Principle	Students learn better from words and pictures than from words alone.
Spatial Contiguity Principle	Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.
Temporal Contiguity Principle	Students learn better when corresponding words and pictures are presented simultaneously rather than successively.
Coherence Principle	Students learn better when extraneous words, pictures and sounds are excluded rather than included.
Modality Principle	Students learn better from animation and narration than from animation and on-screen text.
Redundancy Principle	Students learn better from animation and narration than from animation, narration, and on-screen text.
Individual Differences Principle	Design effects are stronger for low-knowledge learners than for high-knowledge learners and for high-spatial learners rather than for low-spatial learners.

2   Methodology

This study followed the experimental research methodology where there was a need to study the "cause-and-effect" relationships among the learning environments and students' learning outcomes. Experimental research is described as "*a study which looks at the effect(s) of at least one independent variable on one or more dependent variables*" (Fraenkel, Wallen and Hyun, 2012, p. 265). The group design in the experimental research for this study was quasi-experimental design. The quasi-experimental design for this research consisted of one control group (C) and two treatment groups (X). The control group was where students were taught using face-to-face teaching approach and PowerPoint was used as the presentation slides (referred as F2F). One of the treatment groups was where lecturer conducted the lecture in face-to-face via the interactive multimedia learning module, and at the same time students were allowed to access the same copy of learning module from the computers (referred as MM). The other treatment group was to allow the students to have their own independent learning by accessing the web-based interactive multimedia learning module (referred as Web). Observation (O) through measurement was administered through pretest before and after the treatment or the conduct of the control group.

This research aims to investigate students' perceptions on each learning environments: face-to-face, multimedia and web. In this research, the author was assigned to teach this subject when it was offered. This research was conducted over two years in two studies due to the offer of this subject did not occur every semester. In both studies, the way students being sampled into different learning environments were consistent. After the enrolment was settled after week 3 in the semester, students were asked to form their own groups for the purpose of their group assignments. Once the groups were formed, the author then assigned a number to each group depending where the groups sat that time in the class starting from the front row. For example, in the case of a total of 15 groups being formed in the class, group 1 to group 5 would be in the control group, group 6 to 10 would be in treatment group 1 (multimedia) and group 11 to 15 would be in treatment group 2 (web). All of the students were independent samples in each learning environments. The conduct of both Study 1 and 2 involving different learning environments is illustrated in Figure 1:

Figure 1: Flow of Study 1 and Study 2

1. Identify a subject for this research.

2. Identify a chapter for this research.

3. Prepare PowerPoint slides and design the interactive multimedia learning module (for both multimedia and web learning environments).

4. Ask students to form their own groups.

5. Assign the groups into different learning environment via convenience sampling.

6. Pre-test comprised of 20 questions was distributed to all students in the classroom two weeks before the study.

7. Students undergone different learning environment. The students were given the post-test after the study was conducted.

8. The students were given environment survey and open-ended questions in the next lesson after a week.

3 Analysis and Discussion

3.1 Student Learning Outcomes

The following Table 2 shows mean scores for the Pre-test and Post-test conducted in the three learning environments for both studies. Pre-test and Post-test consists of full marks of 20.

Table 2 Mean Scores for Pretest and Posttest

	N	Mean	STD	N	Mean	STD
	STUDY 1			STUDY 2		
F2F: Pre-test	14	7.64	2.061	13	6.46	1.984
F2F: Post-test	14	11.64	2.205	13	11.69	3.614
MM: Pre-test	24	8.46	2.813	17	9.82	4.377
MM: Post-test	24	11.92	3.006	17	14.29	3.331
Web: Pre-test	30	8.10	2.496	20	8.50	.919
Web: Post-test	30	12.80	3.253	20	14.40	.884

From Table 2 above, it indicated that in these two studies, the post-test mean score of the web learning was the highest among all and Study 2 has better mean scores compared to Study 1. The Shapiro-Wilk tests have the values of .606 and .485 for Study 1 and 2 which indicated the samples were normally distributed. Table 3 indicates that the results for the differences of pretest and posttest mean scores are significant where the p-value is less than .05 (Field 2009):

Table 3 Paired Sample T-Test

Paired Sample Test								
	Paired Differences							
		Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
	Mean			Lower	Upper			
STUDY 1								
F2F: Pre-test – Post-test	**-4.000**	2.075	.555	-5.198	-2.802	-7.211	13	**.000**
MM: Pre-test – Post-test	**-3.458**	3.538	.722	-4.952	-1.964	-4.788	23	**.000**
Web: Pre-test – Post-test	**-4.700**	3.303	.603	-5.933	-3.467	-7.795	29	**.000**
STUDY 2								
F2F: Pre-test – Post-test	**-5.231**	3.586	.995	-7.398	-3.064	-5.259	12	**.000**
MM: Pre-test – Post-test	**-4.471**	3.448	.836	-6.243	-2.698	-5.346	16	**.000**
Web: Pre-test – Post-test	**-5.900**	1.944	.435	-6.810	-4.990	-13.573	19	**.000**

3.2   Learning Environment Survey Results

The survey was designed with 20 questions, 30 questions and 35 questions to get feedback from the students on the three different learning environments respectively. The survey was adapted from other similar research field, Ashkeboussi (2001), Liaw, Huang and Chen (2007), Kennedy, Petrovic & Keppell (1998), Masiello, Ramberg and Lonka (2005), and Pham (1998). The students responded on a five-point Likert type scale (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree).   Each survey in each environment was different to accommodate the findings on each learning environment. There were few categories or constructs identified for the survey: motivation, understanding, content, role of teacher and web features (this category was only available for the survey used in web learning environment). The following Table 4 summarizes the mean scores for each contributing factor, Learner Understanding and Learner Motivation. (The complete set of surveys is in Appendix).

Table 4: Mean scores for Motivation and Understanding Survey Items

	STUDY 1			STUDY 2		
Understanding	M = 3.52	M = 3.53	M = 3.86	M = 3.50	M = 4.01	M = 4.16
Motivation	M = 3.29	M = 3.59	M = 3.85	M = 3.38	M = 4.09	M = 4.09

Table 5 shows the results of the ANOVA analysis for the factor on learner understanding. It is noted that the difference between the mean scores for understanding is significant among three learning environments where *p* < 0.05. For effect on achieving understanding among the three learning environments, it differed

significantly across all three, where Study 1 is $F(2, 65) = 7.680$, $p = .001$ and Study 2 is $F(2, 47) = 3.661$, $p = .033$.

Table 5 One-way ANOVA analysis on "Understanding"

	Sum of Squares	df	Mean Square	F	Sig.
STUDY 1					
Between Groups	3.079	2	1.539	7.680	.001
Within Groups	13.029	65	.200		
Total	16.108	67			
STUDY 2					
Between Groups	3.303	2	1.652	3.661	.033
Within Groups	21.202	47	.451		
Total	24.505	49			

In terms of the effect on understanding, web learning with multimedia module was significantly different from teaching with PowerPoint and teaching with multimedia module. Tukey post-hoc comparisons for effect on understanding of these three learning environments indicated that web learning with multimedia module ($M = 3.87$, 95% CI [3.71, 4.03]) again had higher ratings than teaching with PowerPoint ($M = 3.52$, 95% CI [3.24, 3.80]), $p = .049$, and also teaching with multimedia module ($M = 3.41$, 95% CI [3.22, 3.60]), $p = .001$ (see Table 6). Similarly, in Study 2, web learning with multimedia module ($M = 4.12$, 95% CI [3.80, 4.43]) also had higher ratings than teaching with PowerPoint ($M = 3.50$, 95% CI [3.02, 3.98]), $p = .035$. As for the comparisons between teaching with multimedia module ($M = 4.04$, 95% CI [3.75, 4.33]) and the other two learning environments were not statistically significant at $p < .05$.

Table 6 Multiple comparison for "Understanding"

Tukey HSD						
(I)	**(J)**	**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
Method	**Method**	**(I-J)**			**Lower Bound**	**Upper Bound**
STUDY 1						
F2F	**MM**	.11409	.15056	.730	-.2470	.4752
	Web	-.34841[*]	.14491	.049	-.6960	-.0008
MM	**F2F**	-.11409	.15056	.730	-.4752	.2470
	Web	-.46250[*]	.12261	.001	-.7566	-.1684
Web	**F2F**	.34841[*]	.14491	.049	.0008	.6960
	MM	.46250[*]	.12261	.001	.1684	.7566
STUDY 2						
F2F	**MM**	-.53922	.24746	.085	-1.1381	.0597
	Web	-.61667[*]	.23928	.035	-1.1958	-.0376
MM	**F2F**	.53922	.24746	.085	-.0597	1.1381
	Web	-.07745	.22156	.935	-.6137	.4588
Web	**F2F**	.61667[*]	.23928	.035	.0376	1.1958
	MM	.07745	.22156	.935	-.4588	.6137

Table 7 above shows the results of the ANOVA analysis on learner motivation. It is noted that the difference between the mean scores for motivation is significant among three learning environments where $p < 0.05$. For effect on motivation among the three learning environments, it differed significantly across all three, where Study 1 is $F(2, 65) = 5.079$, $p = .009$ and Study 2 is $F(2, 47) = 4.514$, $p = .016$.

Table 7 ANOVA analysis on "Motivation"

	Sum of Squares	df	Mean Square	F	Sig.
STUDY 1					
Between Groups	3.288	2	1.644	5.079	.009
Within Groups	21.037	65	.324		
Total	24.325	67			
STUDY 2					
Between Groups	4.605	2	2.302	4.514	.016
Within Groups	23.974	47	.510		
Total	28.579	49			

For the effect of motivation, the difference between the mean scores of teaching with PowerPoint and web learning with multimedia module was .581 and this difference was statistically significant (p = .007) (see Table 8). From the earlier overall ANOVA analysis, the significance found was actually due to the difference of mean scores between only two groups: teaching with PowerPoint and web learning with multimedia module. In summary, Tukey post-hoc comparisons for effect on motivation of these three learning environments for Study 1 indicated that web learning with multimedia module (M = 3.87, 95% CI [3.65, 4.08]) had significantly higher ratings than teaching with PowerPoint (M = 3.29, 95% CI [2.95, 3.62]), p = .007. As for the comparisons between teaching with multimedia module (M = 3.62, 95% CI [3.38, 3.85]) and the other two learning environments were not statistically significant at p < .05. For Study 2, the results indicated that teaching with multimedia module (M = 4.09, 95% CI [3.75, 4.44]) had significantly higher ratings than web learning with multimedia module (M = 4.06, 95% CI [3.72, 4.40]), p = .029 and also teaching with PowerPoint (M = 3.38, 95% CI [2.93, 3.84]), p = .026.

Table 8 Multiple comparison for "Motivation"

Tukey HSD					95% Confidence Interval	
(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
STUDY 1						
F2F	**MM**	-.33095	.19132	.202	-.7898	.1279
	Web	-.58095[*]	.18414	.007	-1.0226	-.1393
MM	**F2F**	.33095	.19132	.202	-.1279	.7898
	Web	-.25000	.15580	.251	-.6237	.1237
Web	**F2F**	.58095[*]	.18414	.007	.1393	1.0226
	MM	.25000	.15580	.251	-.1237	.6237
STUDY 2						
F2F	**MM**	-.70950[*]	.26314	.026	-1.3463	-.0727
	Web	-.67538[*]	.25445	.029	-1.2912	-.0596
MM	**F2F**	.70950[*]	.26314	.026	.0727	1.3463
	Web	.03412	.23561	.989	-.5361	.6043
Web	**F2F**	.67538[*]	.25445	.029	.0596	1.2912
	MM	-.03412	.23561	.989	-.6043	.5361

3.3 Students' Comments

After collecting surveys on learning environments, students' comments from Study 1 and Study 2 were also collected and analyzed to find out the triangulation among pre-test/ post-test, survey and comments (See Table 9, 10 and 11).

Table 9 Students' Comments (F2F)

No	Comments
STUDY 1	
1	*"Difficult to follow."*
2	*"Sometimes will feel boring if lecturer present by a boring way."*
3	*"Some lecturer might having less interaction with the students.* *Some lecturer might teaching too fast, the students might find hard to absord the knowledge. Students might not concentrated during the class."*
4	*"Lecturer was teaching too fast and cauldn't catch up.* *Lecturer was not really clearly explain futher more explaination."*
5	*"Sometimes it make me bored and tired, besides this, it is actually no problem at all."*
STUDY 2	
1	*"I can't remember what lecturer teach sometimes."*
2	*"Sometimes I can't say some idea in class."*
3	*"Too boring, hard to memoried."*
4	*"The complicated of the chapter and sometimes hard to understand."*
5	*"I think sometimes the class so fast sometime I can't understand and some information me expain every learn."*

Table 10 Students' Comments (MM)

No	Comments
STUDY 1	
1	*"What I like about the interactive multimedia learning module is, it is easy to understand."*
2	*"I still can remember what I see in the module."*
3	*"No problem for me, understanding the module easy bcos got pictures and animation."*
4	*"The interactive multimedia learning module was helping me by showing the examples such as the devices, video, and sound."*
5	*"Make learning fun and motivating."*
STUDY 2	
1	*"It's interesting and can understand with easily."*
2	*"It is very intresthing to learnig the multimedia module."*
3	*"I enjoy using this multimedia module."*
4	*"It's fun to learn using the multimedia module than the powerpoint."*
5	*"I learning in this course with many graphic and, very attract me and easily to learn."*

Table 11 Students' Comments (Web)

No	Comments
STUDY 1	
1	*"It was visually and interesting when learning."*
2	*"The using of web module helped in the learning in this course is that it can easily be concentrate."*
3	*"I don't have to worry if I am slow in learning."*
4	*"Can learn in our own place at any time."*
5	*"Can learn with fun and peace mind. So, I can understand very well."*
STUDY 2	
1	*"Can learn by own pace."*
2	*"Web module is very good everything is explainel accordingly."*
3	*"Can find more information and gave some game to play."*
4	*"It can be view many times at an hour."*
5	*"I have some preference in the topic so I can learn better because I search more information."*

4   Conclusion

In conclusion, Study 1 and 2 had obtained similar results from the pre-test/ post-test, survey and students' comments. These three instruments formed the triangulation method in explaining the constructs which were based upon Weimer's model of learner-centred teaching. The use of the multimedia learning module and web learning environment had received good feedback from the students which helped in improving their learning outcomes in terms of motivation, and understanding. This research results presented students could be more independent in their learning, students could train their thinking skills, and multimedia module would be effective in increasing retention rate. On top of all these good recommendations, lecturer's support is still essential throughout the learning process. Table 12 summarizes the findings from this research.

Table 12 Findings from research

	Teaching with PowerPoint	Learning with multimedia module	Web learning with multimedia module
Characteristics	Face-to-face teaching Uses PowerPoint Limited interaction	Face-to-face teaching (with lesser instructions and teaching) Uses interactive multimedia module designed based on Mayer's design principles (students access it during lecture) Some level of students' engagement in the learning process	Student-centred learning Web learning (uses search feature) Uses web-based interactive multimedia module Students are highly engaged in the learning process
Impact of each learning environment on students' understanding and motivation	Student accepted conventional teaching. Learner understanding is achieved but may not have high retention rate Learner motivation is low because feeling boring and sleepy in the class	Students liked seeing multimedia module. Students enjoyed having some time to think or revisit the topic. Learner understanding is improved when they have some level of engagement Learner motivation is increased due to the use of multimedia module	Students enjoyed the web learning. Students appreciated to learn at own pace. Students enjoyed searching for more information. Learner understanding is the highest because they are highly engaged in the independent learning Learner motivation is the highest due to the web features and use of multimedia module

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Appendix

Table 1 to Table 6 show the mean scores, standard deviation, percentages and Cronbach's Alpha for the perception on the three learning environments for Study 1 and 2:

Table 1 Means and Percentages for the Perception on Face-to-face Teaching with PowerPoint (Study 1)

No	Survey Items	Mean (M)	STD	%
1	The presence of the lecturer during this lecture was helpful	4.21	.802	78.6
2	The design of the lecture was suitable for me to learn the content	4.00	.555	85.7
3	The lecturer helped me understand the concepts in the lecture better.	3.86	.663	71.4
4	I enjoyed having the lecturer present to answer any of my questions	3.86	.663	71.4
5	The content was clear and logically organized	3.79	.699	64.3
6	Important information or key concepts were easy to identify	3.71	.914	57.1
7	The content presented in the lecture was relevant to my learning	3.64	.497	64.3
8	I was able to maintain contact with the lecturer at all times	3.57	.852	50.0
9	Text and graphics made understanding the content better	3.57	.646	50.0
10	I was clear about the objectives of the lecture	3.57	.646	64.3
11	The content was easy to understand	3.50	.760	50.0
12	I found that there was just the right amount of information on each screen	3.50	.650	42.8
13	I was able to learn better with the conventional method of teaching	3.50	.760	35.7
14	I know better about the subject after the lecture	3.50	.760	50.0
15	I enjoyed learning with the conventional method of teaching	3.50	.855	42.9
16	I understood the course content after the lecture	3.43	.756	57.1
17	I found the lecture interesting and engaging	3.43	.852	50.0
18	I liked the conventional method of teaching.	3.29	.914	42.8
19	I was interested to learn more about the topic after the lecture	3.14	.663	28.6
20	I was motivated learning with the conventional method of teaching	3.07	1.072	28.6
Cronbach's Alpha		.833		

Table 2 Means and Percentages for the Perception on Learning with Multimedia (Study 1)

No	Survey Items	Mean (M)	STD	%
1	The presence of the lecturer during this module was helpful	3.96	.624	79.2
2	The lecturer helped me understand the concepts in the module better	3.83	.702	66.7
3	The content was clear and logically organized	3.83	.637	70.8
4	The design of the multimedia learning module was suitable for me to learn the content	3.83	.637	70.8
5	I liked the multimedia learning module	3.79	.779	66.7
6	Multimedia made understanding the content better	3.79	.658	66.7
7	I enjoyed learning with the multimedia learning module	3.79	.833	70.9
8	I liked learning with this method than in the traditional classroom	3.75	.676	62.5
9	I liked the use of multimedia to illustrate ideas and concepts	3.75	.794	75.0
10	The buttons and links were easy to understand	3.75	.794	62.5
11	Multimedia made learning fun and motivating	3.75	.676	70.8
12	I enjoyed having the lecturer present to answer any of my questions during the module presentation	3.71	.690	66.6
13	The content presented in the module was relevant to my learning	3.71	.550	66.7
14	Important information or key concepts were easy to identify	3.67	.761	66.6
15	I liked being able to learn with multimedia-oriented modules	3.54	.588	58.3
16	The content was easy to understand	3.50	.834	58.4
17	The interface of the multimedia learning module was clearly structured and appealing	3.50	.659	50.0

18	I liked the multimedia content in the module	3.50	.659	50.0
19	I was motivated learning with the module	3.50	.590	54.2
20	I found learning with the module interesting and engaging	3.50	.834	54.1
21	I was interested to learn more about the topic after going through the multimedia learning module	3.50	.722	54.2
22	The interactive features in the module made learning fun and engaging	3.46	.721	50.0
23	The interactive features in the module motivated me to learn the content	3.46	.721	41.6
24	I was able to follow the navigation easily in the module	3.46	.658	45.9
25	I was able to maintain contact with the lecturer at all times	3.42	.584	45.8
26	I found that there was just the right amount of information on each screen	3.38	.647	37.5
27	I was able to learn better with multimedia content	3.33	.761	41.7
28	I knew better about the subject with the multimedia learning module	3.33	.761	41.7
29	I was clear about the objectives of the multimedia learning module	3.33	.761	41.7
30	I understood the course content in the multimedia learning module	3.25	.737	41.7
Cronbach's Alpha		.878		

Table 3 Means and Percentages for the Perception on Web Learning with Multimedia (Study 1)

No	Survey Items	Mean (M)	STD	%
1	My learning process was better with lecturer's presence in the class.	4.33	.653	90.0
2	I understood the content easily.	4.07	.767	82.9
3	I could easily find out which points were important.	4.06	.832	77.1
4	I could understand the graphics in the web-based multimedia learning module.	4.06	.814	75.7
5	I could understand the instructions in the web-based multimedia learning module.	4.03	.589	87.1
6	I found the content was well organized.	4.01	.771	77.1
7	I enjoyed being able to control the time spent and speed in learning.	4.01	.893	75.7
8	The navigation links and buttons were all correct.	4.00	.851	78.6
9	I liked being able to search information on the web.	4.00	.816	80.0
10	I found this learning environment motivating.	4.00	.868	78.6
11	I liked to learn in this learning environment.	3.99	.732	78.6
12	I liked being able to communicate with my lecturer and classmates via email or other tools.	3.97	.798	75.7
13	I was engaged in this learning environment.	3.96	.770	78.6
14	The information in the module was based on the syllabus.	3.96	.711	78.6
15	I could find answers in the learning module.	3.96	.711	75.7
16	I enjoyed learning through the multimedia contents.	3.96	.924	77.1
17	I could achieve all the objectives for this chapter.	3.96	.788	77.1
18	I understood better through the use of multimedia.	3.94	.866	72.9
19	I was engaged with the help of interactivity in the module.	3.93	.822	71.4
20	I agreed that multimedia could explain the concept easily.	3.93	.840	75.7
21	Multimedia content helped me to learn better.	3.91	.913	67.1
22	I found the overall design of the web-based module to be attractive.	3.91	.697	74.3
23	Web-based module helped me understood the chapter.	3.89	.733	72.9
24	I found the overall design being suitable for learning.	3.89	.772	72.9
25	I had no problem in navigating the web-based module.	3.87	.741	78.6
26	The amount of information on the screen was just right.	3.83	.816	65.7
27	I would want to find out more information about the contents after the lesson.	3.80	.878	68.6

28	The interactivity level was enough.	3.80	.827	64.3
29	This learning environment motivated me.	3.79	.866	72.9
30	I was motivated through the interactivity provided.	3.77	.802	64.3
31	After this web-based learning, I gained much knowledge.	3.77	.820	67.1
32	The objectives were made clearly to me.	3.77	.820	67.1
33	The loading speed was satisfactorily.	3.76	.908	58.6
34	I would want this learning method in future.	3.70	.906	62.9
35	I prefer this learning method than the conventional approach.	3.67	1.003	58.6
	Cronbach's Alpha	.945		

Table 4 Means and Percentages for the Perception on Face-to-face Teaching with PowerPoint (Study 2)

No.	Survey Items	Mean (M)	STD	%
1	Important information or key concepts were easy to identify	3.85	1.144	84.6
2	I was interested to learn more about the topic after the lecture	3.77	.832	69.2
3	I understood the course content after the lecture	3.69	.947	76.9
4	The presence of the lecturer during this lecture was helpful	3.69	1.377	69.2
5	The lecturer helped me understand the concepts in the lecture better.	3.62	1.261	76.9
6	I was clear about the objectives of the lecture	3.62	.961	69.2
7	I was able to learn better with the conventional method of teaching	3.54	.967	61.5
8	I know better about the subject after the lecture	3.54	1.127	61.5
9	I enjoyed learning with the conventional method of teaching	3.54	.877	69.2
10	Text and graphics made understanding the content better	3.54	1.050	69.2
11	I found that there was just the right amount of information on each screen	3.46	.776	46.2
12	The content presented in the lecture was relevant to my learning	3.38	1.044	46.2
13	I was able to maintain contact with the lecturer at all times	3.31	1.182	53.8
14	The design of the lecture was suitable for me to learn the content	3.31	1.032	46.2
15	The content was easy to understand	3.23	1.092	46.2
16	I liked the conventional method of teaching	3.23	1.301	61.5
17	I was motivated learning with the conventional method of teaching	3.23	.832	38.5
18	The content was clear and logically organized	3.23	1.363	61.5
19	I found the lecture interesting and engaging	3.15	1.068	38.5
20	I enjoyed having the lecturer present to answer any of my questions	3.00	1.291	30.8
	Cronbach's Alpha	.956		

Table 5 Means and Percentages for the Perception on Learning with Multimedia (Study 2)

No.	Survey Items	Mean (M)	STD	%
1	I was able to maintain contact with the lecturer at all times	4.24	.831	88.2
2	The content was easy to understand	4.24	.831	76.5
3	The interactive features in the module made learning fun and engaging	4.24	.664	88.2
4	I was interested to learn more about the topic after going through the multimedia learning module	4.24	.752	82.4
5	I liked being able to learn with multimedia-oriented modules	4.18	.809	76.5
6	I was able to learn better with multimedia content	4.18	.636	88.2
7	I enjoyed learning with the multimedia learning module	4.18	.728	82.4
8	I liked the multimedia learning module	4.18	.809	88.2
9	The presence of the lecturer during this module was helpful	4.12	.697	82.4

No.	Survey Items	Mean	STD	%
10	The design of the multimedia learning module was suitable for me to learn the content	4.12	.600	88.2
11	The buttons and links were easy to understand	4.12	.781	88.2
12	The interface of the multimedia learning module was clearly structured and appealing	4.12	.857	82.4
13	Multimedia made learning fun and motivating	4.12	.697	82.4
14	I liked the multimedia content in the module	4.12	.697	82.4
15	I enjoyed having the lecturer present to answer any of my questions during the module presentation	4.06	.659	82.4
16	I found that there was just the right amount of information on each screen	4.06	.827	70.6
17	I understood the course content in the multimedia learning module	4.06	.827	70.6
18	The lecturer helped me understand the concepts in the module better	4.06	.899	76.5
19	I was clear about the objectives of the multimedia learning module	4.00	.707	76.5
20	I was motivated learning with the module	4.00	.707	76.5
21	Important information or key concepts were easy to identify	3.94	.827	64.7
22	The content presented in the module was relevant to my learning	3.94	.899	70.6
23	The content was clear and logically organized	3.94	.748	70.6
24	I liked learning with this method than in the traditional classroom	3.94	.966	64.7
25	The interactive features in the module motivated me to learn the content	3.94	.748	70.6
26	I liked the use of multimedia to illustrate ideas and concepts	3.94	.659	76.5
27	I found learning with the module interesting and engaging	3.88	1.054	64.7
28	I was able to follow the navigation easily in the module	3.82	.883	64.7
29	Multimedia made understanding the content better	3.82	.883	64.7
30	I knew better about the subject with the multimedia learning module	3.82	.809	70.6
	Cronbach's Alpha	.957		

Table 6 Means and Percentages for the Perception on Web Learning with Multimedia (Study 2)

No.	Survey Items	Mean (M)	STD	%
1	Multimedia made learning fun and motivating	4.40	.598	95.0
2	The presence of the lecturer helped me in the learning process	4.35	.671	90.0
3	I was able to search for more information on the topics from the web	4.35	.587	95.0
4	The instructions in the application was easy to understand	4.35	.489	100.0
5	I liked being able to learn at my own pace and time	4.35	.587	95.0
6	The content in the application relevant to the chapter objectives	4.30	.657	90.0
7	Important information or key concepts were easy to identify	4.30	.733	85.0
8	I was able to use chat, email and other web features to help support my learning	4.30	.571	95.0
9	The content was clear and logically organized	4.20	.768	80.0
10	The content presented in the module was relevant to my learning	4.20	.696	85.0
11	I was able to learn better with multimedia content	4.20	.894	70.0
12	I liked the multimedia content in the web module	4.20	.834	85.0
13	The graphics in the multimedia application were clear enough for me to understand	4.20	.768	80.0
14	I find learning with the web interesting and engaging	4.15	.813	75.0
15	I know better about the subject after using the web module	4.15	.875	80.0
16	I was interested to learn more about the topics in the web module	4.15	.745	80.0

17	The content was easy to understand	4.15	.875	80.0
18	I found that there was just the right amount of information on each screen	4.15	.875	80.0
19	I liked the use of multimedia to illustrate ideas and concepts	4.15	.745	80.0
20	I enjoyed learning in the web environment	4.15	.745	80.0
21	The interactive features in the module made learning was fun and engaging	4.15	.933	75.0
22	The buttons and links were easy to understand and brought me to the correct pages	4.10	.788	85.0
23	Multimedia made understanding the content better	4.10	.912	75.0
24	The multimedia application provided sufficient interactivity for me	4.05	.759	75.0
25	The application loads the page in a satisfactory speed	4.05	.945	70.0
26	Interacting with the module motivated me to learn the content	4.05	.759	75.0
27	I was clear about the objectives of the multimedia learning module	4.05	.826	80.0
28	The interface of the web module was clearly structured and appealing	3.95	.826	65.0
29	I was able to search for the answers on the web to questions I have on the content	3.95	.605	80.0
30	I understood the course content in the web-based module	3.95	.826	65.0
31	I was motivated learning on the web	3.95	.887	70.0
32	The design of the web module was suitable for me to learn the content	3.90	.788	75.0
33	I prefer this teaching / learning method in my learning process	3.90	1.119	70.0
34	I was able to navigate easily in the web module	3.90	.852	85.0
35	I liked learning on with this application rather than the traditional classroom	3.80	1.105	65.0
	Cronbach's Alpha	.968		

Table 7 presents survey items for measuring learner understanding and learner motivation for each learning environment:

Table 7 Survey items for learner understanding

F2F	MM	Web
The content presented in the lecture was relevant to my learning	Multimedia made understanding the content better	The content was easy to understand
I was clear about the objectives of the lecture	The content presented in the module was relevant to my learning	I understood the course content in the web-based module
The content was easy to understand	I understood the course content in the multimedia learning module	I was able to learn better with multimedia content
I know better about the subject after the lecture	The content was easy to understand	The content presented in the module was relevant to my learning
I was able to learn better with the conventional method of teaching	I was able to learn better with multimedia content	The content in the application relevant to the chapter objectives
I understood the course content after the lecture	I was clear about the objectives of the multimedia learning module	Multimedia made understanding the content better
	I knew better about the subject with the multimedia learning module	The instructions in the application was easy to understand
		I was clear about the objectives of the multimedia learning module
		I know better about the subject after using the web module

Table 8 Survey items for learner motivation

F2F	MM	Web
I enjoyed learning with the conventional method of teaching	I liked the multimedia learning module	I find learning with the web interesting and engaging
I found the lecture interesting and engaging	I enjoyed learning with the multimedia learning module	I enjoyed learning in the web environment
I liked the conventional method of teaching.	I liked learning with this method than in the traditional classroom	Multimedia made learning fun and motivating
I was interested to learn more about the topic after the lecture	Multimedia made learning fun and motivating	I liked being able to learn at my own pace and time
I was motivated learning with the conventional method of teaching	I liked being able to learn with multimedia-oriented modules	The interactive features in the module made learning was fun and engaging
	I liked the multimedia content in the module	I liked the multimedia content in the web module
	I was motivated learning with the module	I was motivated learning on the web
	I found learning with the module interesting and engaging	I was interested to learn more about the topics in the web module
	I was interested to learn more about the topic after going through the multimedia learning module	I prefer this teaching / learning method in my learning process
	The interactive features in the module made learning fun and engaging	Interacting with the module motivated me to learn the content
	The interactive features in the module motivated me to learn the content	I liked learning on with this application rather than the traditional classroom