ASSESSING THE EFFECTS OF USING GAGNE'S EVENTS OF INSTRUCTIONS IN A MULTIMEDIA STUDENT-CENTRED ENVIRONMENT: A Malaysian Experience

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ABSTRACT

The inclusion of digital multimedia into teaching and learning has changed instructional strategies in the classroom. While this course has been traditionally given in lecture-based environment, an attempt was made to move it towards a more multimedia-mediated environment to provide a student-centred approach in teaching the principles of animation.

The aim of this project is to incorporate Gagne's 9 Events of Instructions in a multimedia-mediated student-centred learning environment to teach an animation course and to study its impact on student learning.

The study assesses the effects the learning environment has on the students' learning outcome as well as their perceptions in this learning environment. Therefore, data was gathered through various research instruments including surveys and questionnaires to garner their perceptions and their feedback on the learning environment. Furthermore, tests were administrated to the students to gauge their learning outcome. The results were later analysed using a paired t-test.

The results were positive and encouraging. They show that the students were motivated and were actively pursuing their learning at their own pace. They enjoyed this self-directed learning approach and liked using multimedia to stimulate and enhance their learning process.

The paper also provides evidence that will benefit those wanting to switch from traditional classroom to a more technological and multimedia oriented student-centred learning environment as this learning environment proves to be a viable alternative teaching approach to learning the principles of animation.

Keywords: **Gagne, Multimedia, Student-centred, learning environment**

INTRODUCTION

The inclusion of digital multimedia into teaching and learning has changed the instructional strategies in the classroom. The passive teacher-centred learning approach has now shifted focus towards students' role and their active participation in the learning process. It is an undisputed fact that many learning institutions are finding new means to traditional methods in order to bridge learning efficiency with technology. Franklin and Peat (2001) stated that *"Universities today are in transition. Much of the change we see is driven by economic pressures and demands for graduates who will be able to function in a knowledge society."*

The growing awareness amongst educators has thus resulted in the greater diversification of learning and teaching methods within these changing times. Steps are being taken by educators to move away from traditional teaching and learning to a more student-centred approach through the use of technology (Damoense, 2003).While many still employ the traditional method of teaching, with the availability of multimedia tools and faster PCs, educators are venturing out to change their classroom into a more technology-oriented environment. Though traditional face-to-face teaching has its merits, it does not provide the skills necessary in today's fast-paced environment (Siaw, 2000).

Students in such a learning environment do not have the opportunity to participate in their learning process. Students are passive while the teacher has total control over the content, structure and pace of the classroom. Multimedia has managed to stimulate and motivate students' interest and if used as a complementary source of information, it enhances learning (Nooriafshar & Todhunter, 2004). Learning with computer and multimedia enable learners to interact with the learning module and the information presented.

As such, research suggests that when such learning interaction occurs, a learner's attention and comprehension of the learned subject increases (Brown, 2001). With interactive multimedia modules, students are able to navigate through the module at their own pace and interact with the content (Sims, 2000) thus, causing a fundamental change in learning from the traditional passive lectures by participating in student-centred activities. Student-centred learning derived its meaning where knowledge is built and achieved by means of student's participation through the learning activities.

As Morón-García (2002) suggests student-centred methods are linked to deep learning approaches in students that in turn are linked to better learning outcomes. Gibbs (1992, p.23) defined student-centred learning as that which, *"gives students greater autonomy and control over choice of subject matter, learning methods and pace of study"*. Edward (2001) derived the concept of student-centred learning based on choice learning. This suggests that learners can dictate their own learning relevant to their own approaches. Student-centred learning gives active roles to the students and "communicating course materials does not solely rest on the shoulders of the teacher" (Kurhila, Miettinen, Nokelainen, & Tirri 2007). If teachers were information keepers in a traditional classroom, in a student-centred concept, students are active information seekers.

Therefore, researchers have defined student-centred learning as active learning, learning of "doing" rather than of passive watching or listening.

> ***"An important implication of this definition is the need for students to assume a high level of responsibility in the learning situation and be actively choosing their goals and managing their learning.***
>
> ***They can no longer rely on the lecturer to tell them what, how, where and when to think"*** **(Sparrow, Sparrow & Swan, 2000, p.2).**

Therefore, the use of multimedia-mediated environment is now being integrated into the classroom.

Designing the environment

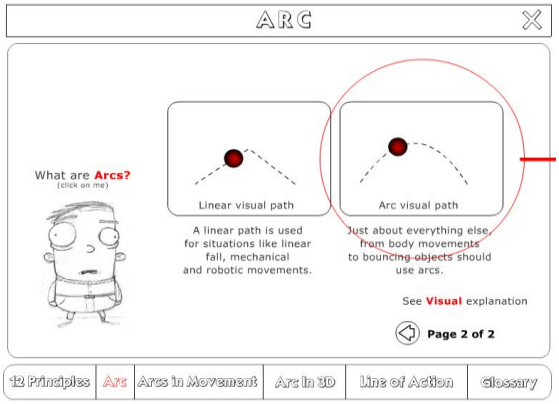
To facilitate this multimedia-mediated student-centred learning environment was created. In this learning environment, the lecturer developed the multimedia environment on a subject matter that contained multimedia elements to represent concepts and ideas as well as interactive functions that provided the learner with the ability to navigate and explore on their own and at their own pace (Neo, 2004). The learning environment was designed and developed using Gagne's theoretical framework which was based on the cognitive perspective of learning and emphasized largely on the effectiveness of the instructional design. In his theory, he has correlated the Nine Events of Instructions with the associated internal mental processes and formulated these events as elements of a good lesson which promote effective learning (Gagne, Briggs, & Wagner, 1992; Shachak, Ophir &Rubinz 2005). Hence, the development and creation of the learning environment in this research incorporated Gagne's Nine Events of Instructions, shown in Table: 1.

Table: 1
Gagne's 9 Events of Instructions as reflected in the learning environment

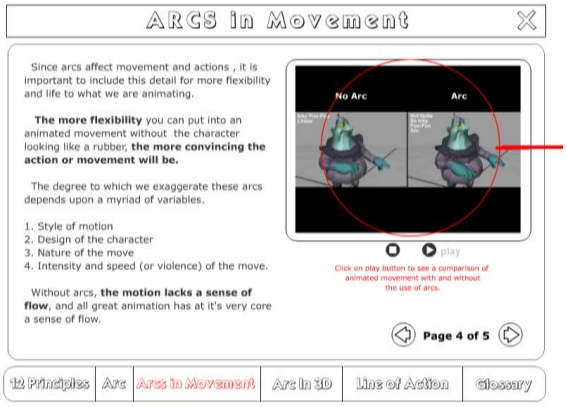
Event of Instructions	Features of the multimedia learning environment
Event 1: Gain attention	Images, textual information, sound and contrasting colours as background were used to draw and attract learner's attention. Animation was added as part and parcel of the course as well as to stimulate learners' attention (see Figures 1(a) and 1 (b)).
Event 2: Inform learners of the objectives	A page stating and explaining the objectives of the study was included. Thus, the students were informed of the objectives prior to given the environment. The title of the lesson was also stated which provided input to the content which, in this case, was the topic "Arcs." (see Figures 2 (a) & (b)). A pre-test was also given to the students prior to using the multimedia learning environment.
Event 3: Stimulate recall of prerequisite learning	To learn the content, students needed to have prior knowledge in the multimedia and animation in general. Hence, they needed to know what multimedia and animation were in order to understand the topics given in the learning environment (see Figure 3).

Event 4: **Presenting the content**	**Simple and clear language was used to present the content. The explanations were kept brief and to the point. In addition, the learning environment presented a media-rich environment using images, sound, video and animation elements to illustrate ideas and demonstrate the content (see Figures 4(a) & (b)).**
Event 5: **Providing learning guidance**	**Examples, guided instructions, concepts, analogies, graphical representations and case studies were provided in the learning programme to give additional guidance to assist learning. Images, video, sound, and animation were also available for the students to use and understand the content being presented. Clear instructions were given to the students as well as directions to help students to explore and learn on their own (see Figures 4 (a) and (b)). .**
Event 6: **Eliciting the performance**	**A drawing board was created to provide the students with a learner activity. This activity was built into the learning environment for the students to interact with (see Figure 5). Through the repetitive exploration of the learner's activity, the students will be required to demonstrate their understanding of the use of "Arcs" in the animation process.**

Event 7: **Providing feedback**	**Any responses from the students were provided with immediate feedback and information; for example, the students were able to view an example of how the animation principle could be applied (see Figures 6 (a) & (b)). Also, if the students had any questions regarding the content or the use of the multimedia environment, the students could easily access the teacher in person to obtain feedback and guidance.**
Event 8: **Assessing performance**	**The students were also given a post-test to see if they understood the content that was presented to them. In addition, hands-on projects were also assigned to the students throughout the semester to assess if they were able to apply what they had learnt in a new situation. Also, the students were later assessed via critique sessions in front of a panel of lecturers and peers to demonstrate their understanding of the animation principles by creating an animation movie reflecting the principles learnt.**
Event 9: **Enhancing retention and transfer**	**The students had to apply what they had learnt in doing a final independent project for the Animation degree. Students must exhibit the principles learnt to the actions in their animation. By apply the principles in their assignments they would show that they understood the principle and were able to transfer the skills learnt to a new situation.**



(a)



(b)

Figures 1

(a) & (b) Multimedia elements were used to gain the students' attention

(a) **(b)**

Figures 2

(a) & (b) Students were informed of the title and the objectives

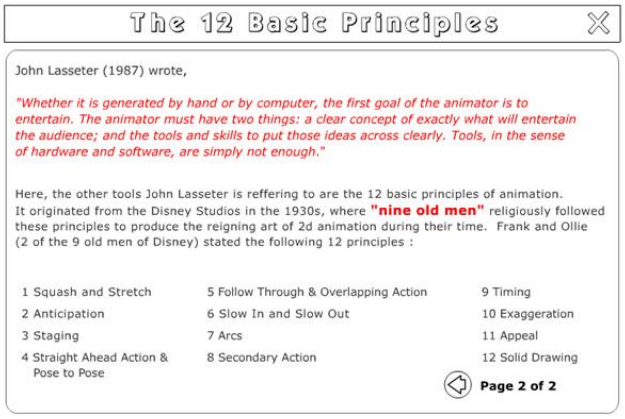
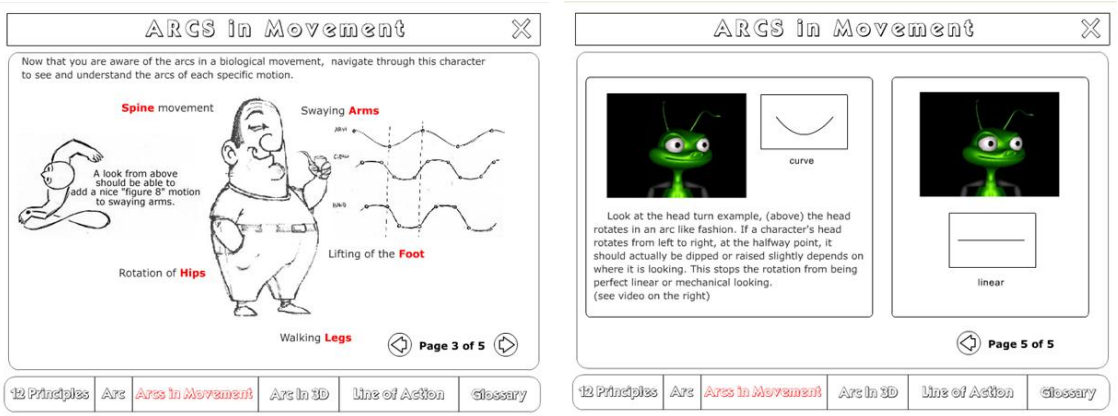


Figure 3
The animation principles of that the students are about to learn



(a) **(b)**

Figures 4
(a) & (b) Graphics, Images and navigational tools are provided and presented to the students

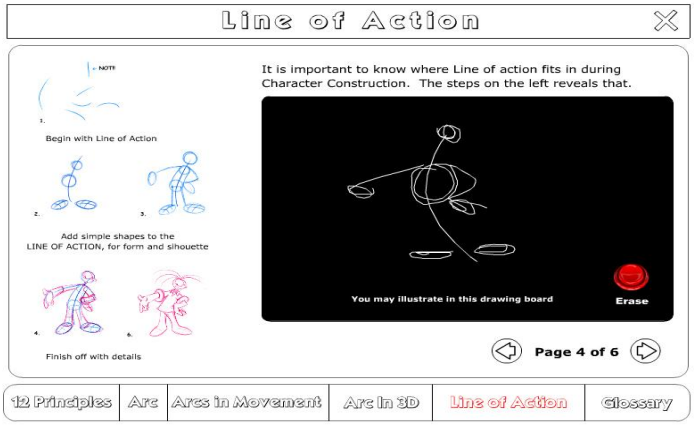
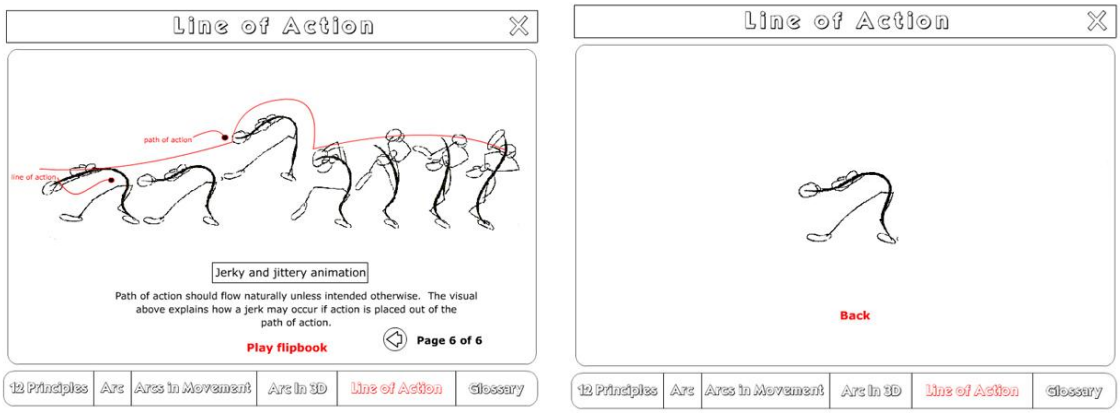


Figure 5
Learner activity was used for the student to interact with



(a) **(b)**

Figures 6
(a) & (b) Example of how the principle is applied in an animated object

Conducting the course

The course spanned across fourteen weeks. The initial course structure contained weekly lectures, one-on-one tutor discussions and critique sessions. However, to achieve the aims of this research project, the learning environment was integrated in as a substitute to the weekly chalk and talk lectures. Although the implementations of the treatment were over fourteen weeks, there were significant time periods in between allocated for assessments and independent self-learning in this learning domain. Students were exposed to self-regulated learning, otherwise not available in the existing method of learning and teaching. The content on the Principle of Arcs began in the fourth week of the trimester. Students participated in self-learning strategy in the computer laboratory. Students were directed to learn the content independently. Forty one students participated in the study (n=41). All of them were students from the second year Film & Animation course of MMF 2013 and the general age range was 19-24 years. These students had pre-requisites in design, multimedia and computer authoring subjects obtained from the first year course programme.

DATA AND ANALYSIS

Surveys and Questionnaires

Five point likert-type scales and closed-ended questions were used as a tool for survey assessment. The survey containing 19-items was adapted from *CAL Evaluation, Gregor Kennedy, University Of Melbourne (1998).* The Likert scale used in this survey was from 1 to 5 (1=Strongly Disagree, 2= Disagree, 3=Undecided, 4=Agree and 5=Strongly Agree).

The purpose of the survey was to ascertain the attitudes on this learning environment from the student sample. In addition to the survey, a set of questionnaires were constructed. The questionnaire is one which was scripted to attain information towards the effective learning of the learning environment. These open-ended questions enabled students to express their views in fuller statements and at the same time add comments which were not pre-ordained by the researcher. The questionnaire was structured in the following priorities:

- **Motivation and Learning Objectives**
- **Content Organisation**
- **Navigation and GUI**
- **Multimedia and Interactivity**

Table: 2
The results of the survey given to the students

		Mean	Std Dev	%
	MOTIVATION AND LEARNING OBJECTIVES			
1	I find learning interesting and engaging.	4.07	0.721	82.9
2	I found the environment useful for learning.	4.27	0.593	92.6
3	From the start it was clear what I was going to do in the environment	4.02	0.821	78.1
4	From the start it was clear what the objectives of the environment were	4.20	0.511	95.1
5	I know better about the subject after using the environment.	4.05	0.740	85.4
	CONTENT			
6	Generally there was just the right amount of information on each screen.	3.90	0.700	80.5
7	Important information or key concepts were easy to identify	4.22	0.652	87.8
8	Generally the content was clear and logically organised	4.27	0.501	97.6
	NAVIGATION & GUI			
9	I found it easy to locate pieces of information I had previously used.	4.05	0.669	85.4
10	I found the interface clear, structured and appealing.	4.12	0.678	87.8
11	I always knew where to go next.	4.15	0.727	85.4
12	I found it easy to navigate my way around the environment.	4.29	0.642	90.2
13	The buttons and links were easy to understand.	4.34	0.728	90.2
	MULTIMEDIA & INTERACTIVITY			
14	I found the graphics and multimedia useful in visualising the concepts.	4.37	0.623	92.7
15	The environment provided responses that were meaningful to me.	4.15	0.691	87.8

Table 2 stated the mean (m) of result of the statement as well a the percentage of students who agree and strongly agree with the statements (%). The items in the results were divided in the constructs as stated above.

As for reliability of the survey, according to Lim, Khine, Hew, Wong, Shanti, & Lim (2003), a reliability of above 0.6 is deemed to have satisfied the reliability of the survey. The overall reliability of the survey questionnaire or the Cronbach's Alpha was 0.928. Thus, this survey is deemed reliable. By looking at the survey items, the results were very positive.

The means ranged from 3.78 to 4.68 with respondant rates ranging from 78.1% to 97.5% in agreement with the survey items.

From the results shown in Table 2, all the items under the motivation and learning objectives showed that the students were very motivated while learning in this environment and understood the learning objectives of this learning environment. They found this learning strategy to be engaging and useful.

They were clear on what they were learning and knew what the objectives of the subject matter were. They found learning in this manner improved their understanding of the subject matter.

These findings were further validated from their feedback taken from the survey containing open-ended questions. The overall feeling from the students' feedback was that they enjoyed learning in this fashion and were motivated in this environment. Such comments from the students shown in Table 3 provided greater assurance that they were motivated in their learning:

Table: 3
Students' feedback on motivation

- **Motivated because it guides me through the subject without any other irrelevant subjects.**
- **I think it is way better than the conventional way of conveying a lecture.**
- **Enjoyable because can play around with the multimedia interactive.**
- **Fun interactive, easy to read and graphical example that easy to remember.**
- **I am motivated. If there were more examples, it would be better!**
- **The learning environment provides instant load of information plus beautiful and interactive interface.**

When looking at the content that was in the learning environment, the results in Table 2 shows that the students strongly agree there was the appropriate amount of information on screen of which they could easily identify the key concepts and they found the organisation of the information clear and well-organised.

To further strengthen the findings, the students' feedback were noted. According to the students feedback shown in Table 4, they found the information was written in simple easy to understand English, focussing on the main points while keeping the concept clear and concised. This helps in their understanding and readability of the content.

Table: 4
Student feedback on Content

• **In a way it's cool. Knowledge wise it is absorbable to the mind thanks to the simple language, brief but concise concept.**
• **Makes things or learning easier because the content is already summarized and highlighted.**
• **Simple English and the points were short and straight to the point.**
• **Yes I understand cause of the clear information and the graphic representation of the info.**
• **Easy to understand because it is already summarize and it is only focus on key point.**
• **All the key factors and main points were there. Visualisation through movies helps a lot.**
• **Very clear. Focused and detailed.**

As for the navigational structure as well as the graphical user interface (GUI) of the learning environment, the results in Table 2 indicates that the students had no problems navigating through the environment on their own and explore the content by themselves. They also liked the interface and knew where they were going to or where they have been. The student feedback shown in Table 5 also reinforces this finding. They also stated that learning on their own pace was effective as they could relook at the content as long as they wanted. However, the navigational structure was enough and they would not get lost in the learning environment. Also, one student commented that they found the navigational items fun and motivating. As for the design of the GUI of the learning environment, the results indicate that the students liked the design of the interface and found the graphics used "eye-catching".

Table: 5
Student feedback on Navigation and GUI

• **Was able to understand. Cause the content is shown out with simple navigation and design.**
• **The navigation is suitable and easy to follow. It was quite clear where everything was.**
• **I like the text arranged well, navigation and user interface looks simple. Nice to see.**
• **The navigation was suitable. Because the main factors in it are hugely buttoned and it does not link incessantly. Because incessant learning makes me lost. But this way was tight linking.**
• **The next button motivates me; it looks fun to be clickable. There's encouraged there to see what's next.**
• **The graphics catch my attention and the navigation got me to stick to it and explore what's inside.**
• **I am able to learn because it is interactive, full of information and I can go back and forth anytime I want. It give me control of my own learning**
• **It gives me time to read and understand because not everybody can pickup fast. Sometimes he or she has to read again and again to understand clearly.**

When it came to the use of multimedia and interactivity in the learning environment, the results shown in Table 2 indicate that it greatly enhanced the students learning process and made the learning process fun. The use of graphics, video and text allowed the students to visualise the content especially in the field of animation. The media elements such as video and animation clips provided the students with meaningful learning as they could see examples.

With the use of interactivity and user interaction, students were able to interact with the content as well as the allowed the students to participate in their learning through the learner's activity which was built into the learning environment for the students to practice their skills and to reinforce what they learnt. This feature found was very conducive to their learning the content especially, animation, as it provided them an activity whereby the students could practise to draw what they understand of the the principles of using "Arcs" in animation.

In addition, the student feedback in Table 6 provided greater insight to why they felt that way. The students repeatedly stated that the visualisation aspect of multimedia was very helpful in their learning process as it gave them a better understand of the concepts presented to them

Table: 6
Student feedback on Multimedia & Interactivity

- **I personally like the part where I could draw on it. It's engaging and easy to remember.**
- **MM surely makes learning easier, practising what we learnt on the spot (action line) helped to memorize the information given.**
- **MM elements really meaningful to me. Because it visualise the movement of the action.**
- **The idea of using MM elements is great! Rather than just showing plain text, it visualizes the examples and really makes it easier for me to understand.**
- **Helpful. The videos and sketches make me understand more as it visualises the text.**
- **The interactive features give a sense of participation for the user.**
- **Using multimedia elements is engaging and fun.**
- **I enjoyed it. With all the interactive buttons accompanied by visual aids I couldn't find a better method of learning.**
- **Fun interactive, easy to read and graphical example that easy to remember.**
- **Animated points and examples make learning fun.**
- **The multimedia elements can help viewers to visualise properly rather than self-visualising.**
- **I was very entertained especially with the interactive drawing thing.**

Analysis of learning score

Besides soliciting the students attitudes and feedback on the learning environment, the students were tested on the content. Pre- and post-tests were administered to assess the student learning of the content.

Pre-tests were taken at the start of the trimester prior to the commencement of the first lecture. This was followed with a post-test which was administered after each treatment to assess the knowledge transfer and the effectiveness of knowledge retention. Each test contained 15 multiple choice questions. The raw results of the pre and post tests are shown in Table: 7.

Table: 7
The means of the pre- and post-test of the students

Number	Mean Pre-Test	Mean Post-Test	Mean Difference	% of Change
41	6.29	11.15	4.86	77.26

The students obtained a mean of 11.15 in post-test that was given after the use of the multimedia environment. In the pre-test scores, an average mean of 6.29 was recorded.

After implementation, the result showed an increase of 4.86 in post-test scores resulting in 77.26% of change in their tests scores. Further analysis was performed on the results of the pre- and post-tests. A paired t-test was performed on this to ascertain the significance of the outcome. The results of the analysis are shown in Table 8.

Table: 8 Results of a paired sampled t-test

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pre-test-Post-test	-4.854	3.175	.496	-5.856	-3.852	-9.790	40	.000

The difference in post-test and pre-test was very significant as p=0.000 at 95% confidence level ($p<0.05$), indicating that the students learnt the material presented. This further strengthens their survey results and their feedback pertaining to this learning environment. Moreover, the effect size found was 1.53 which is a very strong indication that the students learnt the material in this learning environment. Thus, these results were strongly supported by the student survey, comments and the learning score above.

DISCUSSION

From the findings of this study, there were several effects that could clearly be observed when the students were exposed to the learning environment. The following discussion presents some of the prominent aspects which influenced greatly the student learning process:

- **In this learning mode, students were actively pursuing their learning on their own while the teacher acted as a guide to facilitate their learning. They were able to explore and interact with the content in the multimedia environment. They set their own pace in their learning process and the majority of them expressed that they found this mode of learning enjoyable and fun. They did not have problems with the navigations and enjoyed using the navigational tools provided in the learning environment.**

- **In this learning environment, the students perceived that multimedia images such as graphics, animation and videos which were used to present the instructional content helped them visualise concepts and ideas. With animation and videos included, students were able to see examples of how the principle of arcs was applied in an animated sequence. The results were highly supported in the surveys as well as the student feedback. The visualisation of the concepts enhanced their understanding of the content. They expressed strongly that those multimedia images in the learning environment increased their motivation to learn and kept them actively engaged in their learning. Looking at the survey, the use of video and animation was rated the highest means by the almost all the students who participated in this study.**
- **The presence of interactivity provided the students with a navigation system which allowed students to dictate the pace of learning as well as control the flow of information by using the interactive features provided by the learning instructions in the computer. In other words, it allowed students to enjoy self-paced learning. These interactivity features provided the students the opportunity to interact and implement their learning of the concept of "Arcs". This enhanced their understanding and learning and engaged them in their learning process. From the student surveys, interviews and feedback, it was evident that students liked their freedom in their learning process and found that this learning process was interesting and engaging, useful and increased their understanding of the subject matter.**
- **In this mode of learning, it could be observed that students found the presence of the teacher in the lab useful and helpful to their learning whenever they needed assistance and guidance in their study. Hence, students still regarded the teacher as an important part of their learning process.**

CONCLUSION

From the results of the research, it was very clear that the students managed to learn the content in the learning environment and had fun doing so. This was shown in the paired t-test analysis which were significant and the effect size of the learning score which was also very strong.

The increase in test scores, and results of the survey and student feedback, proved that this learning environment was an effective instructional method which could be used to enhance and increase students' understanding of the subject matter and engage them actively in their learning process.

Thus, this technology-enhanced learning mode has a positive impact on student learning and can serve as an effective method to deliver instructions to learners.

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