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The Effect of Interactive Multiple Intelligences Activities Flip Module: Its Effects on Students' Multiple Intelligences

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Abstract*: This study aims to test an interactive pedagogical tool using a computer-based learning approach. The purpose of building Multiple Intelligences Activities Flip Module is to increase students' potentials through their multiple intelligences. The true-experimental study design is used and the samples are randomly selected as control and treatment groups. Pre and post tests are used to measure the effectiveness of this interactive flip module in relations to multiple intelligences significant differences. The findings of the study reveal that the interactive Multiple Intelligences Activity flip module has a high degree of reliability whereby the average measure for Intra-class Correlation Coefficient is .771 with a 95% confidence interval from .520 to .931 ($F(9,486)= 4.644$, $p<.000$). Based on MANCOVA test analysis, the researchers have rejected the null hypothesis. The study has demonstrated that the Multiple Intelligence Activity flip module has increased the scores of multiple intelligences tests for treatment groups.

***Index Terms*: Multiple Intelligences, MANCOVA, Innovation, Multiple Intelligences Activity Flip Module, Experimental**

I. INTRODUCTION

The rapid progress in science and technology has inspired many constructive and practical scientific learning tools that accentuate the significant use of multimedia. Basically, multimedia comprises various elements such as text, graphics, animation, audio, video and inter-activity [2]. The teaching media is defined as the identified, constructed and adapted (innovate) media source or material (software) that supports or acts as catalysts to the teaching and learning process [1]. The teaching media helps to enrich learning contents and teaching methods and also to extend learning paths [1].

2. The Conceptualization of Interactive Multiple Intelligences Activities Flip Module

Multiple Intelligences Activity Flip Module is an interactive pedagogical tool using multimedia elements such as text, graphic, audio, visual and animation. It is developed based on computer-based learning strategies to stimulate seven multiple intelligences. All the seven multiple intelligences are measured through problem solving activities based on the learning outcomes that are clearly stated for each unit. This application contains seven units representing seven multiple intelligence types. Every activity developed is based on Multiple Intelligences Theory [3]. The developed problem-solving activities are based on verbal linguistics intelligence, mathematical logic intelligence, visual spatial intelligence, kinesthetic intelligence, musical intelligence, interpersonal and intrapersonal intelligence. The activities are organized according to the constructive alignment and outcome-based education which measures the learning outcomes, learning activities, materials needed, activity feedback and conclusions. The applications are developed using the Flip PDF Professionals Application based on ADDIE model [4]-[11]. This ADDIE model involves five phases namely analysis, design, development, implementation and evaluation.

II. LITERATURE REVIEW

A. Gardner's Multiple Intelligence Theory

Developing human potential is one of the aspects clearly stated in the National Education Philosophy. Teachers are encouraged to diversify their teaching and learning activities in order to optimize students' potentials. Several studies have documented the strong relationship between talents and nature. According to [5], [3], potentials can be indicated and measured in degrees of intelligence. Accordingly, multiple intelligences theory founded by [3] aims to explain that mankind has not only one intelligence but at least seven intelligences at different levels. The variety of intelligence expressed by [3] in his book entitled "frames of mind" explains intelligence through various aspects of capability, ability, talent or skill that naturally exists. The types of intelligence identified are verbal linguistic, logic math, visual spatial, kinesthetic, musical, interpersonal and intrapersonal. According to [15] the first type of intelligence is that verbal linguistic are students' ability to communicate and the ability to use language at a high level. The second type of intelligence is logic math. It is a rational, scientific and abstract thinking ability. Next is visual spatial intelligence which is an advantage in terms of understanding and using information in visual and spatial form. Kinesthetic is the fourth type of multiple intelligences where an individual has the ability to solve problems or create objects using body movements.

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Sensitivity to the elements related to sounds and music is musical intelligence. Interpersonal is the ability to communicate, understand and cooperate with others. The last intelligence is intrapersonal, which is the ability to understand aspects of oneself and apply knowledge to succeed in life. Intelligence is an abstract concept. The concept is dynamic and contains many dimensions that are intertwined with each other. Intelligence also refers to the ability of individuals to benefit from new [15]. According to [18], each individual has all the intelligence, however, not all intelligence develops in balance and usually each individual has at least one or more prominent intelligence than any other intelligence. [16], on the other hand, asserted that every human being has a unique intelligence of their own.

Computer Based Learning

Computer based learning (CBL) refers to learning programs that use computers as the main basis. The CBL approach offers the use of interactive elements of computer software, along with the computer's ability to present various types of media [2]. There are several potential advantages of computer-based learning programs and this includes home-based learning that promotes self-independent learning. The use of computer-based learning that implements multimedia technology in teaching pedagogy helps teaching and learning process [6]. Interactive teaching materials that use computer-based learning approach can create a fun environment for students [7]. According to [6] the level of learning mastery is improved when interactive multimedia is used as more senses are involved in the learning process [8]. At present, the use of technology is no stranger to our everyday life that this generation is called "Digital Native" [20]. This has led to changes in the ways of teaching and learning [19]. In relation to that, one of the branches of multimedia technology is seen to be able to make a positive impact especially in education based on recent research conducted by [23]. Meanwhile, [19] define multimedia as a combination of various media elements into a tool that generates user benefits. Among the multimedia elements that are often used to create an application are text, pictures, graphics, animations, sound and video [19]-[20]-[21]. The application of this multimedia has helped to create the latest pedagogical tools. According to [17], multimedia is integrated into learning when conventional teaching methods (chalk & talk) are no longer effective in stimulating learning. The application of multimedia produces simulations, animations and visuals to help students get abstract information into real information [21].

B. Hypotheses

Ho: Multiple Intelligences Activity Flip Module is not a factor in the improvement of the post test scores of verbal linguistic intelligences, logic math, visual spatial, kinesthetic, musical, interpersonal and intrapersonal test scores when the pre-tests of the verbal linguistic intelligence, logic math, visual spatial, kinesthetic, musical, interpersonal and intrapersonal are controlled.

III. METHODOLOGY

This study used a true-experimental research design conducted on three schools in the Eastern region of Malaysia. A total of 20 students have been randomly assigned to the control and treatment groups. Data collection was conducted quantitatively and MANCOVA test analysis was used to test the hypothesis [9].

A. Sampling Design

60 students from three schools have been randomly selected as the control and treatment groups. These Form Two students are at the age of 14 years old. Table 1 illustrates the distribution of the selected sample.

TABLE 1: SAMPLE OF THE STUDY

School	Control Group	Treatment Group	Total
School A	20 students	20 students	40
School B	20 students	20 students	40
School C	20 students	20 students	40
Total	**60**	**60**	**120**

B. Instrument

The pre and posttests consisted of multiple intelligences tests. The instrument was adapted from [13] and it has been modified and translated into Malay Language. The instrument has a high reliability value of .80 [9].

The instrument for multiple intelligences was adapted from [29]. Modified and translated into Malay. Translation of this inventory has been adopted in the study by [30] with high reliability values of .85 and .80. There are eight categories of intelligence in this survey and each category has 10 items. Respondents were to put a "√" mark on the item that correctly describes them. The number of "√" marks for each category of intelligence can exceed one. The total score for each category was 100% where each item carries 10%. Scoring was given based on the number of items that respondents agreed to with the "√" sign. High scores indicate that respondents have a high level of intelligence for the intelligence. Respondents are likely to have very high levels of intelligence. The linear data transformation process that has been used involved multiplying the number of scores for each intelligence by a value of 10 (Refer to Table 2). The method of data transformation involving the multiplication of value 10 refers to the method proposed by [29]. Meanwhile, the classification of scores by four categories of range was based on modifications to classifications that have been carried out in previous related studies [31]. The respondents' multiple intelligence levels were then categorized according to the following levels of intelligence after summing up all categories of intelligence:

(i) 90% - 100% represents very high
(ii) 70% -80% represents high
(iii) 50% -60% represents average
(iv) 0% -40% represents low

EXAMPLE:

Intelligence 1 (Verbal- Linguistic)

___ √___ I like reading activities.
____√___ Taking notes helps me to memorize something.
____√___ I keep in touch with friends by letter or e-mail.
____√___ It is easy for me to explain ideas or opinions through conversations with other people.
____√___ I write a personal journal.
_____ Crossword puzzle activity is fun.
_____ I like to write essays, articles or reviews.

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_____ I enjoy playing games that involve words such as crossword puzzles, alphabetizing or forming words.
_____ Games involving foreign languages such as English interest me.
_____ I like to get involved in activities such as presentations, interviews, discussions, debates or speeches.

___5____ Total "√" for Intelligence 1

The above answer shows that this study sample has 5 agreed items on verbal-linguistic intelligence so the total score obtained for verbal-linguistic intelligence is 5 X 10 = 50%. This score shows that the study sample has moderate verbal-linguistic intelligence. Table 2 shows the framework of total scores for each type of sample intelligence.

TABLE 2: TOTAL MARKS FOR EACH TYPE OF INTELLIGENCE

Multiple Intelligences	Total "√"	Multiply	Score
Verbal-linguistic		X10	
Logic Math		X10	
Visual Spatial		X10	
Kinesthetic		X10	
Music		X10	
Interpersonal		X10	
Intrapersonal		X10	
Naturalist		X10	

C. Face and Content Validity

Face validity and content validity have been performed on all pre-test and post-test items. This validation was done by senior lecturers in English and Malay Language to ensure that the meaning of the translated item was consistent with the original item's meaning in English. The purpose of face and content validity is to ensure that each item measures what to measure and is consistent and does not deviate from the original intent of the item in English [14].

D. Data Collection Procedures

A true-experimental research was conducted after the Multiple Intelligences Activity Flip Module had obtained a high value of agreement from the panel of experts. In the first month of the study, all respondents (both in control and treatment groups) were given pre-tests of multiple intelligences. The respondents from the treatment group underwent an enrichment program that utilized the interactive Multiple Intelligences Activity Flip Module for two months and directly after completing this program, the respondents (both in control and treatment groups) were given post-tests of multiple intelligences.

IV. FINDINGS

A. Demographic Data

Gender

Table 3 below shows that out of 120 respondents, 40 of them were male (33.33%) and 80 of them were female (66.67%). These statistics show that female respondents outnumbered male respondents by 33.34%.

TABLE 3: SAMPEL BASED ON GENDER

Gender	*f*	%
Male	40	33.33
Female	80	66.67
Total	120	100.00

B. Multiple Intelligences Profile

Table 4 below shows the profiles of students for various intelligences prior to treatment. For verbal-linguistic intelligence, 36 people (30.0%) of all respondents achieved a low score of 0 to 40, 55 (45.8%) achieved an average level of 50 to 60, 26 (21.7%) achieved a high score of 70 to 80 and 3 (2.5%) achieved a very high score of 90 to 100. Whereas for logic math intelligence, 13 (10.8%) of the total respondents achieved a low level of 0 to 40, 64 (53.3%) achieved an average level of 50 to 60, 36 (30.0%) achieved a high score of 70 to 80 and 7 (5.8%) achieved a very high score of 90 to 100.

Consequently, for visual space intelligence, 28 people (23.3%) of all respondents achieved a low level of 0 to 40, 49 people (40.8%) achieved an average level of 50 to 60, 29 (24.2%) achieved a high score of 70 to 80 and 14 people (11.7%) achieved a very high score of 90 to 100. While for kinesthetic intelligence, 14 (11.7%) of the total respondents achieved a low score of 0 to 40, 38 (31.7%) achieved an average level scoring from 50 to 60, 42 (35.0%) achieved a high score of 70 to 80 and 26 (21.7%) achieved a very high score of 90 to 100. Moving on, for music intelligence, 34 (28.3%) of the total respondents achieved a low score of 0 to 40, 47 people (39.2%) achieved a moderate level of 50 to 60, 29 (24.2%) achieved a high score of 70 to 80 and 10 (8.3%) achieved a very high score of 90 to 100. Meanwhile, for interpersonal intelligence, 22 people (18.3%) of all respondents achieved a low level of 0 to 40, 34 (28.3%) achieved a moderate level of 50 to 60, 56 (46.7%) reached a level a high score of 70 to 80 and 8 people (6.7%) reached a very high score of 90 to 100.

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TABLE 4: STUDENTS' MULTIPLE INTELLIGENCES PATTERN

Multiple Intelligences	Low (0-40)	Average (50-60)	High (70-80)	Very high (90-100)	Total
Verbal Linguistic	36 (30.0%)	55 (45.8%)	26 (21.7%)	3 (2.5%)	120 (100.00%)
Logic Math	13 (10.8%)	64 (53.3%)	36 (30.0%)	7 (5.8%)	120 (100.00%)
Visual Spatial	28 (23.3%)	49 (40.8%)	29 (24.2%)	14 (11.7%)	120 (100.00%)
Kinesthetic	14 (11.7%)	38 (31.7%)	42 (35.0%)	26 (21.7%)	120 (100.00%)
Musical	34 (28.3%)	47 (39.2%)	29 (24.2%)	10 (8.3%)	120 (100.00%)
Interpersonal	22 (18.3%)	34 (28.3%)	56 (46.7%))	8 (6.7%)	120 (100.00%)
Intrapersonal	13 (10.8%)	25 (20.8%)	45 (37.5%)	37 (30.8%)	120 (100.00%)

C. Reviewing and Refining of Study Data

According to [24], the first step to perform in the analysis of statistical inference statistics is to review and refine the actual study data. The purpose of reviewing and refining is to ensure normality in the data used. Therefore, researchers used Skewness and Kurtosis statistics for the purpose of reviewing and filtering data. The analysis results using Skewness and Kurtosis can be found in Table 5.

The skewness and kurtosis (data distribution) values for the multiple intelligence tests ranged from .052 to 2.37. According to [25] the zero value for *Skewness and Kurtosis* shows a normal 100 percent distribution of data. In this study the recommended values are within ± 2.0 for Skewness and ± 2.0 for Kurtosis can be accepted [24]-[25]. The above data distribution is considered normal because both values for Skewness and Kurtosis are located within ± 2.0.

TABLE 5: SKEWNESS AND KURTOSIS ANALYSIS

Multiple Intelligences	Skewness	Kurtosis
Verbal Linguistic	-.052	-.149
Logic Math	-.609	2.370
Visual Spatial	-.360	.303
Kinesthetic	-.716	.221
Musical	-.132	.077
Interpersonal	-1.170	1.215
Intrapersonal	-1.246	1.687

Finally, for intrapersonal intelligence, 13 (10.8%) of the total respondents achieved a low score of 0 to 40, 25 (20.8%) achieved an average level of 50 to 60, 45 (37.5%) achieved a high score of 70 to 80 and 37 (30.8%) achieved a very high score of 90 to 100.In Table 6 the results of the Levene's Test begin with multiple intelligence Verbal Linguistic [F(1,118)=3.79,P>.05], Logic Math [F(1,118)=1.05,P>.05], Visual Spatial [F(1,118)=.071,P>.05], Kinesthetic [F(1,118)=3.645,P>.05], Interpersonal [F(1,118)=.010,P>.05], and Intrapersonal [F(1,118)=.010,P>.05].

TABLE 6: HOMOGENITY OF VARIANCE

Pretest	F	df1	df2	Sig.
Verbal Linguistic	3.791	1	118	.054
Logic Math	1.057	1	118	.306
Visual Spatial	.071	1	118	.791
Kinesthetic	.015	1	118	.902
Musical	3.644	1	118	.059
Interpersonal	.100	1	118	.753
Intrapersonal	.000	1	118	.985

A. Multiple Intelligences Activity Flip Module Inter Rater Reliability

The Multiple Intelligences Activity Flip Module was rated by 10 experts from various academic fields namely the curriculum and instructions, psychology, measurement and evaluation, instructional technology, language and mathematics. The Multiple Intelligences Activity Flip Module had obtained a high degree of reliability from the raters (Refer to Table 4). The average measure for ICC was .771 with a 95% confidence interval from .520 to .931 (F (9,486) = 4.644, p<.000). This finding indicated that there was an almost perfect agreement among the raters on of the introduction of content, learning activities and assessments of the Multiple Intelligences Activity Flip Module.

B. MANCOVA Test Analysis Findings

Based on Table 8, Multivariate Pillai's Trace test results revealed that there was a significant impact for the independent variable GROUP [F (7,105) = 3.95, p <.05]. However, there was no covariate effect of logic math intelligence pretest [F (7,105) = 3.30, p> .05], kinesthetic intelligence [F (7,105) = 1.20, p> .05], musical intelligence [F (7,105) = 1.57, p> .05], and interpersonal intelligence [F (7,105) = 1.32, p> .05] against dependent variables.

On the other hand, there was a covariate effect on verbal linguistic intelligence pretest [F (7,105) = 3.29, p <.05], visual spatial intelligence pretest [F (7,105) = 2.34, p <.05], intrapersonal intelligence pretest [(7,105) = 2.41, p <.05] toward the dependent variable. Based on the MANCOVA test analysis, the null hypothesis was rejected. Hence, the Multiple Intelligences Activity Flip Module was evidently a factor in the improvement of the multiple intelligences test scores for the treatment group.

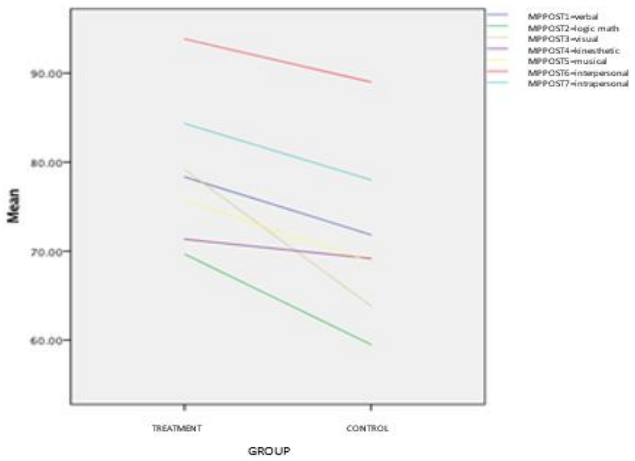
TABLE 7: INTRA-CLASS CORRELATION COEFFICIENT

	Intra-class Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.058[a]	.019	.196	4.644	9	486	.000
Average Measures	.771[c]	.520	.931	4.644	9	486	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.
a. The estimator is the same, whether the interaction effect is present or not.
b. Type A intraclass correlation coefficients using an absolute agreement definition.
c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

TABLE 8: MULTIVARIATE TEST RESULTS FOR MULTIPLE INTELLIGENCES

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.643	27.025[b]	7.000	105.000	.000
Verbal linguistic Intelligence pre test	Pillai's Trace	.180	3.292[b]	7.000	105.000	.003
	Wilks' Lambda	.820	3.292[b]	7.000	105.000	.003
Logic Math intelligence pre test	Pillai's Trace	.070	1.123[b]	7.000	105.000	.355
Visual spatial intelligence pre test	Pillai's Trace	.135	2.335[b]	7.000	105.000	.030
Kinesthetic intelligence pre test	Pillai's Trace	.073	1.189[b]	7.000	105.000	.316
Musical intelligence pre test	Pillai's Trace	.095	1.566[b]	7.000	105.000	.154
Interpersonal intelligence pre test	Pillai's Trace	.081	1.317[b]	7.000	105.000	.250
Intrapersonal intelligence pre test	Pillai's Trace	.138	2.408[b]	7.000	105.000	.025
Group	Pillai's Trace	.209	3.955[b]	7.000	105.000	.001



The line graph above shows the tests for verbal linguistic intelligence, logic math intelligence, visual spatial intelligence, musical intelligence, interpersonal intelligence and intrapersonal intelligence of the treatment group over control group. On the other hand, for kinesthetic intelligence, the control group overrides the treatment group.

I. DISCUSSION AND CONCLUSION

The findings of this study have evidently proven that students' multiple intelligences can be nurtured, stimulated and developed through several computer-based learning enrichment activities [5]-[3]. This study also recommends that vast opportunities should be given to the development of problem-based enrichment activities that can examine and support students' multiple intelligences [10]-[13]. Creative and innovative computerized multimedia learning materials should be widely used in unfolding and nurturing students' potentials. The Multiple Intelligences Activity Flip module that integrates multimedia elements of text, video, audio, graphics and animation may be used extensively in the classroom. Integrating multimedia in teaching and learning may also aid the contextual learning.

Computer based learning has the potential to totally transform the education process and remarkably improve the efficiency of learning by providing great motivation to students. Through multimedia students can learn the abstract concept more easily. Therefore, the use of technology will be balanced with guidance and supervision by teachers to enhance the transformation of education among students. In conclusion, learning materials that use multimedia and computer-based learning can support teachers to create a good learning activity based on students' multiple intelligences. The intra-class results indicated that all 10 expert panels had produced high reliability values of .77. This demonstrates that the Multiple Intelligences Activity Flip Module is structured in accordance with the principles of multimedia learning application development that need to be formulated through tests that take into account the evaluation, opinion and expert opinion of building an application for learning purposes [17]-[22]. Findings by the line graph show that treatment groups improved their intelligence scores compared to control groups. Nevertheless, kinesthetic intelligence shows that control group scores precede treatment groups. This suggests that enrichment activities for kinesthetic intelligence need to be further strengthened so that further studies can have a better impact on treatment groups. This can be understood that the enrichment activities in the Multiple Intelligences Activity Flip Module need to emphasize the movement and use of the body to solve problems. This finding is consistent with the findings of the study conducted by [28] which shows that the study conducted show the highest score among financial students is an interpersonal (M=29.54) and lowers score is logic math intelligence (M=22.44)The Multiple Intelligences Activity Flip Module is designed as an interactive module of enrichment activities to unlock the potential of teenagers through problem solving activities based on seven different types of intelligence. This is because multiple intelligences aspects play an important role in giving students the freedom to explore and learn in various ways through the tendency of dominant multiple intelligences in students. While the integration of multiple intelligences enables educators to help students understand and appreciate the power through the variety of intelligences that they have [26]. Therefore, the Multiple Intelligences Activity Flip Module is designed to identify students' potential through real-world activities that will stimulate future learning [26]. Patterns of multiple intelligences showed very high study sample in kinesthetic intelligence (21.7%) and weak in musical intelligence (28.3%). According to [18], there are differences in the types of intelligence among school students. This is in line with the findings of [27] that showed that MARA Junior Science College students' multiple intelligences patterns tend to be excellent in interpersonal, intrapersonal and logic math intelligences.

In conclusion, the diversity of students' multiple intelligences can be enhanced through enrichment activities as contained in the Interactive Multiple Intelligences Activity Flip Module. The results of this study inform teachers that learning through a variety of intelligence can help students enhance their dominant intelligence and at the same time improve their latent intelligence.

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