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Effectiveness Of Multimedia Projector-Based Instructional Methods In Enhancing Students' Learning Of Science

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ABSTRACT

Multimedia-based instructional strategies play an important role in enhancing students' performance as well as students' motivation towards the learning of science. The aim of this study was to determine the effectiveness of the use of multimedia projectors in enhancing students' learning of science and students' motivation towards multimedia in learning vs traditional chalk-and-board method. A quasi-experimental research design was used to investigate the performance and motivational effect of the usage of multimedia projector. A convenient sample of 30 students in grade eight was used in this study. The experimental group of 15 students were taught using a multimedia projector and the control group of 15 students were taught the same science lessons using traditional chalk and board method. Students' performance was evaluated using a pre-test and a post-test. The motivational scale based on the Keller's ARCS model of motivation was administered on the experimental group to study the degree of motivation displayed in the use of the multimedia projector for instruction. The findings of this study supported the hypothesis that the use of multimedia-based instruction is more effective than the traditional methods in students' learning of science. Further, it was found that the students' motivation was also high in the use of the multimedia projector to teach science.

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1. INTRODUCTION

The country needs individuals with competencies in science to produce new knowledge which is an important requisite in the national development. The education system must ensure that students receive a sound knowledge and skills in science to reach that target. Therefore, science is an important subject in the school curriculum. Effective instructional strategies are required, and is a challenge, to help students develop scientific concepts and practical use of science to solve authentic problems (Bukoye, 2019). Therefore, productivity of instruction could be enhanced by integrating ICT into the current instructional practices in the school curriculum (Perera, 2011).

Sri Lankan government has taken steps to integrate ICT into the school curriculum since 2006, but the time allocation in the school system predominantly to teach ICT as a separate subject only (Perera, 2011). Researchers have found that computer-based multimedia has the capability to enhance students' performance and motivation in learning because audio, video including movies and animations and images along with text, would create sound levels of interactivity inside the classroom rather than teaching which is limited to traditional methods (Mayer, 2002; Cook, 2006). Well-developed multimedia-based instructional materials increase the potential of pedagogical value in the classroom in several ways (Kapri, 2017; Erwin & Rieppi, 2013). The use of multimedia projectors in instruction is one of the effective choices in teaching science. Hence, teachers should be encouraged to use multimedia projectors to make learning interesting (Ojelade & Gbemisola, 2020).

For Sri Lankan students, science is difficult due to the lack of suitable instructional materials in the teaching-learning process, which restricts the intellectual reasoning capacity of the learners. The national report presented by the National Education Research and Evaluation Centre (2017) has shown the patterns and trends in science subject achievements in 2016 of Grade 08 students in Sri Lanka. It was pointed out that national level mean value of science achievement of Grade 08 students in Sri Lanka was 41.76 while the median was 39.00. Therefore, it is worthwhile to use multimedia as an instructional resource to overcome learning problems in science education in the Sri Lankan secondary education.

1.1 ARCS model of motivation

Motivation to learn is an important aspect in designing instruction. John Keller developed an instructional model, which is called the ARCS model of motivation (Keller, 2015) to theorize students' motivation in learning. There are four key elements in the learning process which can encourage and sustain learners' motivation: attention, relevance, confidence, and satisfaction. Attention refers to the arousal of curiosity to learn while making an interest to learn. Relevancy could be established by making lessons meaningful to students in their real life and expected future careers relevant to the learner. Confidence to learn is to convince students that they can succeed in learning by using their potential. Satisfaction refers to the feeling of happiness students derive by being successful in learning (Keller, 2015). In this study it was investigated whether the use of a multimedia projector would enhance students' motivation to learn.

1.2 Objectives of the study

In the view of above explanation, objectives of the study were:

1. To investigate the effectiveness of using multimedia projectors as an instructional resource in learning science at secondary classes, to enhance students' academic achievements in comparison to traditional teaching methods.

2. To examine students' motivation in learning science through multimedia projector assisted instruction.

1.3 Hypotheses of the study

Hypothesis 1:

There is a significant difference in performance between Grade 8 students who are taught science using multimedia projector and those who are taught science in traditional chalk and board mode.

Hypothesis 2:

Grade 8 students who are taught using a multimedia projector show high level of motivation to learn as per the ARCS model of motivation.

2. METHODOLOGY

2.1 Research Design

To study the effectiveness of the use of multimedia projectors in enhancing students' learning of science, a quasi-experimental research design was used. The research approach was mixed mode where both quantitative and qualitative data were collected to test hypotheses and arrive at conclusions.

2.2 Sample and Instruments

The research was conducted at a private school in the Colombo district. Convenient sampling method was used to select participants for the research. Two intact groups (two Grade 8 classes of 15 each) were selected and randomly assigned classes to the experimental group and the control group.

The instruments used were a pre-test and a posttest question paper, to test students' performance. Scale based on ARCS model of motivation, which had responses in Likert's scale, was used to measure students' motivation and field book to record observations. The motivation scale was meant to inquire into the level of motivation experienced by the students during the use of multimedia projector.

2.3 Method of data collection and analysis of data

Permission was obtained from the principal of the school and the class teachers of the two Grade 8 classes. Then the pre-test was conducted for both experimental group and the control group at the same time and . The selected science lesson of 40 minutes duration was taught to the experimental group using multimedia enriched content that was projected using the multimedia projector. The same science lesson was taught for 40 minutes to the control group using traditional chalk and board method. During the lessons, experimental group students' behavior was noted and recorded in a field book. Soon after the completion of the lessons, the post-test was conducted for both groups at the same time. The questions of both tests were the same, but the order was different. The motivational scale was administered to the experimental group only.

3. DATA ANALYSIS

Mean and the standard deviation of pre-test scores and post-test of both groups were calculated. Table 1 illustrates the results.

Table 1

Results of pre-test and post-test

Group	Pre-test		Post-test	
	Mean	SD	Mean	SD
Experimental	3.46	1.29	9.73	0.37
Control	3.43	0.94	6.10	0.85

As the sample size was less than 30 in each group, Mann-Whitney U Test (https://www.socscistatistics.com/tests/mannwhitney/default2.aspx) was used to test whether the differences

in means between experimental group and control group in the pre-test and in the post-test are statistically significant. The significance level applied was p=0.05, two-tailed.

In the case of the pre-test, the U-value is 110. The critical value of U at $p < 0.05$ is 64. Therefore, the result is not significant at $p< 0.05$. Additionally, the z-score is 0.08296. The p-value is 0.93624. The result is not significant at $p < 0.05$.

In the case of post-test, the U-value is 0. The critical value of U at $p < 0.05$ is 64. Therefore, the result is significant at $p < 0.05$. Additionally, the Z-Score is -4.64554. The p-value is < 0.00001. The result is significant at $p < 0.05$.

3.1 Limitations of the study

To improve the generalizability of the findings a larger sample size is needed, along with longer contact hours of instruction and a variety of lessons Convenience sampling and the use of intact groups also affect the findings. Another aspect worthy of investigating into is the comparison of retention power of the students regarding the lessons learned, between the cases where multimedia projector used, and traditional methods of instruction used. On the other hand, the assumption that the students of both groups are similar in IQ could also affect the conclusions.

3.2 Analysis of the results of the motivational scale

Table 2 illustrates the structure and the content of the motivational scale. The ordinal values of the Likert's scale were considered to be of the interval scale and mean values were calculated for each aspect of motivation - attention, relevance, confidence and satisfaction- using the weightages 5,4,3,2 and 1 for the range of choice from strongly agree to strongly disagree. For the convenience of comparison, the values are represented as percentages.

Table 2: Analysis of responses for the motivational scale

Aspect	Item	Strongly agree	Agree	Mean
Attention	Lessons were prepared attractively	14	1	96.3%
	Nice pictures, videos and audio were used in the lessons	9	6	
	Multimedia help to pay attention to the lesson	13	2	
	Multimedia helped to learn the lesson	13	2	
Relevance	Pictures, videos, and audios clearly explain the lesson	12	3	96%
Confidence	My memorizing power increased when I used multimedia-based teaching more than general teaching	8	7	94.6%
	Multimedia helped me to develop the creativity in my learning	12	3	
	I was motivated by multimedia-based learning more than general teaching	13	2	
Satisfaction	I like to learn with multimedia	15	0	98.3%
	It is good if I get more chances to learn with multimedia	12	3	
	I like to learn with multimedia tools more than the whiteboard	14	1	
	Impatient to get an opportunity to learn from computer	14	1	

The overall motivation mean score is 96.6%

3.3 Analysis of observations of the participants who learned with the multimedia projector-based instruction.

Students' attention was on the learning process except occasional deviations. Over 75% of the students requested "Please play the video again there is so much to learn". Students continued to learn without disturbing any other student. Their participation in the lesson such as by answering questions was highlighted. Their physical behavior

was also displayed signs of interest to learn. “Can we have the projector for other lessons too?” was a request came from the participants. Further, they commented “We could have learned the previous lessons better if multimedia projector has been used”.

4. CONCLUSIONS

Since there was no significant difference between the mean of the pre-test scores of the experimental group and the control group, both groups can be considered to be similar in terms of the initial knowledge of the lesson that was taught to both groups. Therefore, any increment in the knowledge of the content can be attributed to the intervention. Due to the significance difference between the post-test mean scores of the experimental group and the control group, hypothesis 1 is supported. So, it can be concluded that the use of multimedia projector in multimedia rich instruction could improve student achievement in learning science at the secondary level over the chalk and board traditional method of instruction. The hypothesis 2 is also supported by the high mean scores for the overall motivation and individual aspects of motivation by the students who learned with multimedia projectors. The observations made while the multimedia projector was being used in instruction also bare evidence to support hypothesis 2. Consequently, it can be established that students are highly motivated to learn science at secondary level with multimedia projectors in the multimedia rich learning environment.

In the light of these findings, it is suggested that science teachers at secondary level should use multimedia rich instruction with the assistance of multimedia projector to help students improve learning. If it is not always practical, at least some of the selected lessons should be taught in multimedia projector supported learning environment.

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