American Journal of Educational Research, 2014, Vol. 2, No. 3, 138-141
Available online at http://pubs.sciepub.com/education/2/3/4

DOI:10.12691/education-2-3-4

Can Integrating Media into Science Learning Activities Improve Students' Learning Outcomes?

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Received February 07, 2014; Revised February 18, 2014; Accepted March 06, 2014

Abstract Improving science teaching as a way of improving science products in Nigerian schools is a top priority of the present. This is due to the importance attached to the vision 20:2020 policy of the government which is striving to use science learning as a launching pad for growing her economy. However, the exigencies of the present economic situation of most countries including Nigeria show strict economic policies that have placed constraints on funding of science education. This has resulted in poor and ill-equipped laboratories, poor manpower, inadequate resources for the teaching of science, and consequently, poor science products. The attention of science practitioners has therefore turned to other possible ways of improving science teaching and learning in schools. The attributes of videos and other audiovisuals in compelling learners to learn have been variously reported. This study thus investigated the effect of these audiovisuals in helping science learners improve learning outcomes in science. 40 SS2 students in two groups of 22 (experimental) and 18 (control) participated in the study that lasted for seven weeks. A pretest-posttest-control group design was adopted. While the experimental group viewed videos of the conduct of experiments and activities before engaging in the same activities, the control group used manuals carefully prepared by the researcher showing experimental procedures. Three instruments: test of attitude towards science, test of manipulative skill, and test of achievement in science concepts were administered to both groups. Data collected were subjected to t-test and the result showed no significant difference between the experimental and control groups in attitude, manipulative skill, and achievement except in the overall performance in which the experimental group showed marginal superiority. The study concluded that though there are inherent benefits of the use of audio visuals in science teaching, there is a need to apply it in addition to other techniques. It also recommended the enhancement of the videos with direct focusing attributes to improve their effectiveness.

Keywords: *science teaching, science learning, audiovisuals, effect of DVDs, CDs on learning*

Cite This Article: Clara Dumebi Moemeke, "Can Integrating Media into Science Learning Activities Improve Students' Learning Outcomes?" *American Journal of Educational Research*, vol. 2, no. 3 (2014): 138-141. doi: 10.12691/education-2-3-4.

1. Introduction

For many decades now, improving science learning and consequently, technological know-how has been Nigeria's priority and policy focus. The recent vision 20: 2020 captures Nigeria's vision for her economy for this decade and beyond. The pursuit of this economic revolution is articulated in the policy goal thus:

"To establish a modern and vibrant education system that ensures the maximum development of the potentials of individuals and promote a knowledge-driven society that propels the nation's development."

The policy interprets "a modern and vibrant education system" to entail wide-ranging activities that would ensure functional, qualitative education of the highest possible standards at basic, post-basic, and tertiary levels. This is to be achieved through providing access to quality education at all levels, improving learning and teaching infrastructure, according greater importance to science, information technology, technical, vocational education, and training. Government's intentions are thus clear on the effect that education should have on the economy.

Achieving these intentions depends on the production of quality science graduates from the schools. This on the other hand also rests squarely on the availability of school variables that affect the teaching and learning of science such as the availability of qualified teachers of science, availability of well-equipped modern laboratories for conduct of experiments, appropriate science curriculum, and adequate instructional materials amongst others. However, the ever-increasing student population, coupled with the poor financial state of government treasury (resulting in poor school financing) and ill-trained teachers [5] have resulted in inadequate science students' preparation and consequently poor products.

The importance of the laboratory in science learning has been emphasized by research over the years. Apart from giving students the opportunity to behave like scientists, enhancing performance (e.g. [1]), acquiring important learning outcome [16], there are cultural and intellectual reasons for involving students in science activities. References [10] and [6] explained that Piagetian stages of

thought vary across cultures and as such secondary school students who are just learning to think in abstract terms require laboratory exercise to provide concrete basis for anchoring such intellectual acquisitions. An important objective of science education is that students learn science through the investigation of physical, chemical, and biological phenomena through scientific inquiry process and application of scientific models, theories, and laws so as to adequately explain events [5].

In experimental studies conducted separately, [6,16] and [13] showed that laboratory instruction help to improve students' attitude toward science, help them face their misconceptions, and increase achievement of important learning outcome. However, recent developments have shown that this all-important facility for learning science is either not available in many schools in developing countries or is ill-equipped and as such cannot adequately serve the purposes for which laboratories are known or are grossly inadequate for the student population. It, therefore, becomes necessary that attention is given to possibilities that could positively impact science learning outcomes. In this light, the use of visual attributes of diagrams, pictures, and illustrations for enhancing practical skill acquisition as well as attitude and achievement has been investigated [7,8,15,18,21]. Evidence shows that diagrams and pictures through their visual attributes helped science students overcome limitations in noticing, encoding, linking, and retaining sequence of ideas. Other benefits that students were reported to derive from the use of visual attributes of diagrams include the conception of science ideas, focusing, and improvement of verbal ability as well as storing of verbal information.

Attention has also been drawn to the visual properties of electronic visual media in achieving the same purpose as diagrams, pictures, and illustrations. This is based on the theoretical framework that visual media have a strong impact on science students' understanding and retention of new ideas [2,4,14,17,19]. This paradigm shift has expanded educational tools to include the use of internet tools that facilitate participatory interactive platforms for individuals to contribute, and share information and result. Since the 21st-century student generation has been variously described as digital natives, digital generation, Zap generation etc [3] it becomes important that the science teacher harnesses this quality in improving instruction and learning. The availability of electronic visual media (VCD, DVDs etc) and their attention-compelling attribute are easily recognized in Young people's attachment to them. Young people tend to forget classroom work but will retain and remember films, videos, and movies which they have watched. Reference [5] in a study on the effect of visual media in enhancing science teaching and learning in historically disadvantaged secondary schools in South Africa, used recorded Digital Versatile Disk (DVD) to visualize all science experiments prescribed for the learners. She found that the device afforded teachers more time to facilitate students' learning activities, helped students who experienced language barriers to conceptualize because of its replay possibility and helped to emphasize complex concepts. Reference [20] also noted that audio-visual media such as VCD and DVD present great revolution in that apart from being used for receiving/recording information, they are projected on televisions and are useful to educators for

1. Recording their own tapes to be shown in the classroom whenever necessary.
2. Record TV shows that are educational.
3. Record your own classroom teaching and reshow when necessary.

This study thus asks; can the use of videos, films, DVDs, and VCDs help to enhance science students' science activities? Will VCD, Video, and DVD use in science classrooms improve science learning attitudes, achievements, and manipulative skill development? This is the focus of this study.

2. Hypotheses

The following hypotheses were tested in the study:

1. There is no significant difference in the attitude towards science of science students who studied specific concepts through audio-visual supported classroom activities and those who did not.
2. There is no significant difference in the practical manipulative dexterity of science students who studied specific concepts through audio-visual-supported classroom lessons and those who studied the same concept without the facility.
3. There is no significant difference in the achievement of science students who studied specific concepts through audio-visual supported activity classroom lessons and those who studied the same concepts without the facility.
4. There is no significant difference in the overall performance of science students who studied specific concepts through audio-visual supported activity, and classroom lessons and those who studied the same concepts without the facility.

3. Method of the Study

The independent variable in the study is the classroom mode consisting of two levels (audio-visual supported classroom and zero audio-visual classrooms). The dependent variables are scores of students' achievement in science, attitude towards science, and manipulative skills. A one-shot quasi-experimental design was thus used in the study.

The sample consisted of two intact classes of senior secondary school 2 (SS2) physics students studying a unit in temperature/heat for two hours every week for five weeks. The activities covered.

1. Measuring with different types of thermometers and determining the boiling and melting points of common liquids.
2. Linear expansion of solids —bimetallic stripes and thermostats.
3. Volume expansion of common liquids — water, and alcohol.
4. Thermal expansion of gases, Charles laws, and investigations on pressure–temperature change.
5. Studying heat change, the calorimeter, and designing calorimeters.

6. Change of state —melting, vaporization, solidification, and molecular nature of solids, liquids, and gases.

The experimental intact class consisted of 22 students who were provided with video-recorded C.Ds of students doing the same science activity which they were allowed to watch in whole class sessions and individually before commencing the activity. Each DVD/CD is distributed to the students one week before the activity is carried out. This is to enable adequate viewing. The control group studied the same concepts and carried out the same activities through teacher-prepared handouts/manuals fortified with drawings of the experimental procedures. The control group consisted of 18 students. The assignment of the experimental and control intact class was by ballot. The control group subjects received the manuals one week ahead of the commencement of the treatment. The CDs and DVDs were prepared from the recorded Lab sessions of the 2012 academic year. During the activities, there was ample opportunity for students to interact with themselves and with the teacher and lab assistants.

Thus a total of 40 students in SS2 participated in the study which lasted for seven weeks. The first week of the seven weeks was used for general orientation and explanation of the goals of the study while the seventh week was devoted to administration of test of attitude towards science, manipulative skill/dexterity and achievement in science.

The attitude test consisted of a 29-item 4- point linker instrument made up of 17 positively worded and 12 negatively worded items. Each item was scored from 1 to 4 points (i.e. Not Agree (NA), Not sure (NS), Agree (A), and Strongly Agree (SA)) but negatively worded items were scored in the reverse order. The reliability coefficient of the instrument was found by Combach alpha to be 0.71. The manipulative skill instrument consists of 17 items in four categories - handling materials and equipment, setting up the experiment, Accuracy of readings and recordings and cleanliness of the workbench, and time management/utilization. Subjects' performances in these categories were rated by the researcher and the research assistant during each of the five practical sessions for the five weeks of treatment. The test of manipulative skill consists of four subsets and each subset was rated on a four-point scale of very high, high, low, and very low. Students in the experimental group were usually given enough opportunity to watch the recordings before engaging in the activity while the control group was also given ample time with their manual before the activities. The test of manipulative skill and test of achievement in science was found by Kudder Richardson 21 to be 0.68 and 0.81 respectively.

4. Discussion

The result of the study is shown in Table 1 below.

Table 1. Frequency and mean of Experimental and control 1 group scores in three measures during the activities

Measures	Group	N	Mean	SD	df	tcal	ttab	Sig.
Attitude	Exptal	22	4.7	0.2				
					38	0.043	2.02	NS
	Cont.	18	3.5	1.0				
Manipulative skill	Exptal	22	3.9	0.6				
	.				38	0.043	2.021	NS
	Cont	18	2.7	1.8				
Achievement	Exptal	22	4.2	0.3				
					38	0.008	2.021	NS
	Cont.	18	3.6	0.9				
Overall	Exptal	22	440.7	6.62				
					38	9.05	2.021	*
	Cont.	18	307.7	12.61				

*sig. at p<0.05 alpha level

From Table 1 above showed that the difference between the experimental and control groups on attitude towards science (tcal.= 0043, df=38) at 0.5 alpha level is not significant. This means that attitude towards science of the experimental and control groups did not differ significantly. Thus hypothesis 1 which stated that there is no significant difference in the attitude towards science of subjects who studied specific concepts through audio-visual-supported classroom activities and those who did not was retained. The two groups were similar and any difference observed is attributable to chance and not large enough to be significant.

The table also revealed that the experimental and control groups did not differ significantly either in manipulative skill or achievement in science concepts (tcal. = 0.043 and 0.008 at df 38 respectively) at the 0.05 alpha level chosen for this study. This also means that hypotheses 2 and 3 are also not rejected. The noticed differences in the means (3.8 and 2.7 for manipulative skill and 4.2 and 3.6 for achievement in science concepts for the two groups were due to chance.

When the overall performance of the experimental and control groups was considered, the difference was significant at 0.05 alpha level. (t=9.05 df 38) Hypothesis 4 which stated that there is no significant difference in the overall performance of the experimental and control groups was therefore rejected. The difference was too large to be due to chance; hence it is due to treatment.

The findings of this study corroborates that of De Jager (2012) and Coutinho and Junior (2009) in the overall effect of electronic visual media on learning. There however seem not to be enough evidence from this study on its effect on specific learning outcome. It is possible that the period of exposure to media during the study was too short for its effect on specific outcome measures to be felt. Also the extent to which the experimental group devoted time to viewing the recoded digital versatile disc (DVD and VCD) given to them may have consequently reduced impact. While the control group had ample opportunity to regularly learn from the text material illustrated with diagrams, the experimental group relied only on a limited viewing period which is determined by availability of power and study time.

The result of this study is a contrast to that reported by [5]. This is understandable when viewed from the premise that her study was a survey that drew conclusions from the perceptions of the subjects. While De Jager's data were qualitative, this present study based its findings on quantitative data. Variables were also manipulated in an experimental setting. Other possible reasons for the difference may be the nature of the sample and some cultural/background factors that affect school performance. Despite these differences, the overall impact of media on learning tends to be the same in the two studies.

5. Conclusion/Recommendation

While educators are in search of methods and techniques for improving science teaching and learning, there is the need to understand that the application of technology must be ruled by certain acceptable conditions if it must yield the expected outcome results. One of the possible interferences to learning from DVDs/CDs is focusing on the entertainment and aesthetic aspect of Television to the detriment of academic purposes. This may have hindered the achievement of the specific measure outcome in this study. On this premise,

There are inherent educational benefits of integrating visual media into science classrooms

Visual media should be used alongside other techniques because of inherent power interference in developing countries like Nigeria.

Visual media for educational purposes should be prepared with attention paid to attributes that enhance direct focusing and highlight the Visual media to attract and sustain learners' attention while viewing.

There is a need for a more extended study that will afford learners proper understanding and adaptability to the academic qualities of visual media. This is because such outcomes as attitude are known to develop gradually over time but have tremendous effects on other outcome measures.

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