RESEARCH PAPER

Effect of exposing students to science fiction films and movies on their academic achievement in science

Jamela B. Sampulna *

* Cotabato Foundation College of Science and Technology, Philippines

ABSTRACT

The main purpose of this study was to determine the effect of exposure to science fiction films and movies on achievement test scores in Science of second-year students at the Doroluman High School and Cotabato Foundation College of Science and Technology, Doroluman, Arakan, Cotabato. The study made use of the pre-test post-test control group design. About 30 students were assigned to the experimental group and they were taught with the use of the visual media approach while another group of 30 students were treated using the traditional method to make up the control group. Using non-equivalent control group design as a tool to measure the pre-test and the post-test scores of both the experimental and the control group, the test was validated, which was enter subjected to a reliability test and items-analysis. As a result, the overall pre-test and post-test mean gain scores between the experimental and the control group showed significant difference. Findings implied that exposure to science fiction films and movies was effective to improve test scores of students in a biotechnology test compared to the students taught with the use of the traditional method. Teaching through the traditional method should be discouraged while students were being exposed to the visual media approach intended to improve the teaching of biotechnology which would help students conceptualize at a much better way the content of a topic. Science teachers should integrate multimedia in their teaching methods in order to enhance the academic performance of their students in science subjects. Thus, teachers should be updated in the scientific field through a regular attendance to seminars, symposiums and workshops.

Keywords: Scientific fiction, Scientific films, Scientific Movies, Academic Achievement, Students

1. INTRODUCTION

We now live in an increasingly globalized society. Complex and media-saturated, the world has become different from the past when used to be young person who used to go to school, spent time in taking certain courses, received grades, passed not promoted. Today, learner can be seen in a new context. First, he or she is dependent on the teacher to sustain his interest, help him or her see how or what in learning prepares one for the real world. Second, to ensure lifelong learning, the learner's

curiosity has to be maintained. Third, there has to be flexibility on the part of the teacher to teach. Fourth, anyhow learners need to become even more resourceful so as to continue to learn outside the formal schooling [1].

It looks like teachers are slowly realizing that traditional methods of teaching is no longer capable of providing students with an educational foundation that is strong enough to withstand the pressures of technologically-driven society. Students of today have been raised in a society that is dependent on television, video games, computer software and most specially the Internet [2].

In August 2007, about three million fourth-year high school students have taken the second National Career Assessment Examination (NCAE). The NCAE was designed to assess the abilities of students developed over the years. According to Education Secretary Jesli Lapus, the examination would show that more than half of the 1.3 million students who took the exams were not ready for the rigors of life. Based on the data provided by the NETRC, only 468,091 students or 35.93 percent had moderate aptitude needed to pursue college education [3].

In the Third International Mathematics and Science Study (TIMSS) released in 2003, Asian countries outperformed the other participants. Singapore was the top performing country at both the fourth and eighth grades in mathematics and science. The Philippines, on the other hand, based on the table of test results covering the years from 1999 to 2003, increase rose from 345 to 377. However, the score was still relatively low compared to those other participating countries [4].

During the 2007 National Achievement Test (NAT), the division of Isabela assessed that the second-year students of Alicia National High School did low. Second year students of ANHS achieved 39.12 percent only [5]. That led ANHS to become among the poor performing schools.

Meanwhile, Doroluman High School of Doroluman, Arakan, Cotabato was one of the schools in the Division of Cotabato chosen for this study. It catered to the needs of 286 students of school year 2008-2009, with low performance in science, observed to be at 75 percent mastery level. To describe, the school ranked 106th in the National Career Assessment Examination (NCAE) of SY 2007-2008, with students coming from 160 schools in the region. With result revealed at 52.36 percent of the mean percentage score (MPS) [6]. On the other hand, the result of the National Achievement Test (NAT) as of school year 2007- 2008 in Science was pegged at an MPS of 59.67 percent with an overall Mean Percentage Score of 61.99 percent that was relatively low.

Out of the unsatisfactory results, teachers have shifted to exploring possibilities to increase the performance rating students in regional or national achievement test.

Thus, instruction using visual media was attempted. The latter is a medium for students to view science fiction films or science oriented-movies chosen from among the most stimulating and interesting types of teaching materials. The use of the visual media provides a positive impact on the ability of the students to retain concepts and ideas. When used properly, the visual media was conceived to broaden the students' understanding of science concepts,

making them motivated and interesting, making classroom discussion fruitful.

Solomon, J. (1992) has revealed that television and film watching can help in acquiring knowledge and information and at the same time provide relaxation and enjoyment as they have become sources of motivation for pupils to explore the ways for everyday life and for practical uses [7]. It has stressed that more conceptualized topics are better retained in memory resulting to better learning [8]. This means that learning would be much facilitated if students are able to understand their environment in situations that are concrete, realistic and meaningful enabling them as their engaged in activities. According to the studies supplements using models favourable enable students to learn better than the use of traditional method of teaching [9]. Further studies added that students taught by employing an integrated approach to teaching would show higher-class proficiency against a group of students taught in traditional method [10].

The creation of opportunities for students to learn about strategies and method needed to be implemented in a class. Some studies has pointed out that teachers should be creative to devise an activity that can bring about similar concepts as a topic on hand, notwithstanding the weaknesses of the Philippine educational system [11].

Considering all the theories presented by different authorities, it is believed that the effectiveness of teaching strategies of a teacher could affect the understanding of science concepts measured by the pre and post administration of a constructed science test.

The students express their views about the science fiction films and science-oriented movies would improve the test scores of students in selected topic in Science II (Biotechnology) in comparison to using the traditional method of teaching. Thus, this study was conducted to determine the effect of exposure to science fiction films and movies on academic achievement in Science II of high school students.

2. MATERIALS AND METHODS

2.1. Research Design

The study used the pre-test post-test non-equivalent control group design. It made use of two (2) groups, one assigned as the experimental group and the other was considered as the control group. The designed could be diagrammed as below.

$$\frac{Q1\ X\ Q2}{Q3 Q4}$$

Where:

Q1=pre-test mean score of the experimental group
Q2=post-test mean score of the experimental group
Q3=pre-test mean scores of the control group
Q4= post-test mean score of the control group
X = experimental treatment, which is exposure to science fiction films

2.2. The Respondents

The subjects of the study were the second year high school students of Doroluman High School and of the Cotabato Foundation College of Science and Technology. Table 1 presents the subjects of the study based on their class schedule and on the percentage of their

distribution. The researcher created both the experimental and the control group.

Table 1. Distribution of the Subjects

Section	Number of Subjects	Percentage
Control	30	50
Experimental	30	50
Total	60	100

2.3. Research Instruments

The instrument used was a researcher-made test. Before the test was constructed, the table of specification (TOS) was prepared so that the items of the test were properly distributed according to three objective domains. The test was collected from on-line materials, books and resource persons. Some instruments were adopted from Medina (2008) [12]. As found in the Table of Specification, there were 40 items on cloning; with 11 items dealing with genetically-modified organisms. The outlines of the topic taught using visual media, particularly science fiction films and science-oriented movies with supplementary conceptual activities and materials was believed to help students conceptualize a topic. The control group was taught through the traditional method of teaching that utilized lectures, seat works and board works as shown in the plan of lessons and activities prepared by the researcher herself. The test was pilot-tested to a group of third year high school students at Doroluman High School. Later, scores were gathered and an item analysis was done where the most difficult and easiest items were discarded.

2.4. Validity and Reliability of the Pre-test

To establish the validity of the instrument, the latter was first checked by the researcher's adviser for improvement. After being seen by the adviser, a panel of experts perused the instrument. After integrating all the suggestions of the experts consulted for the improvement of the instrument, the researcher fielded the instrument submitting it to a pre-test and a post-test. After the pilot test, some items were deleted for lack of discriminative characteristics. The test finality was made up of 51 number of items. Using the split half method, a reliability index of 0.94 was obtained, indicating that the test had a high reliability index.

2.5. Data Gathering Procedure

A pre-test was conducted in a class from two different schools. T-test revealed that there was no significant difference between the pre-test and the post-test mean scores of the subjects in the control group (CFCST High School) and the experimental group. It became known that the two groups were statistically equal before the start of the treatment process.

After the pre-test was conducted, the treatment process followed. One class was chosen as the experimental group while the other class as control group. The experimental group was exposed to science fiction films and science-oriented movies while the control group was introduced to the traditional method of teaching utilizing chalk and talk method as shown in the lesson plans and matrix of student activities prepared by the researcher. Both control and experimental groups were given the same topics on cloning and genetically-modified organisms. After the treatment process, a post test was conducted for the two groups.

2.6. Data Analysis

The data collected was analysed by the mean scores to establish the mean pre-test, post-test and gain score performance of both the experimental and the control group. The T-test for independent samples to determine whether the pre-test and mean gain scores of the experimental and the control group differ significantly from each other. All computations were computerized and testing of a null hypothesis was based at α = 0.05 level of significance.

3. RESULTS AND DISCUSSION

The results of the study and the subsequent analysis on the problems and null hypotheses with T-test on the Significance of the Difference between the Pre-test Mean Scores of the Experimental and the Control Group

The pre-test mean scores of the experimental and of the control group and their respective tests of significance. The experimental group revealed the following pre-test mean scores; cloning, 11.5, poor; and genetically modified organisms (GMO), 5.50, satisfactory, with an over-all mean score of 17.00, poor.

The fourth column displays the pre-test mean scores of the control group based on the following topics: cloning, 13.00, poor; and genetically modified organisms (GMO), 3.57, poor; with an overall mean score of 16.533 as poor (table 2).

The table presents that the probability level was less than 0.05 in cloning. This enabled the researcher to reject the null hypothesis that there was no significant difference between the pre-test mean scores of the experimental and the control group on the topic of cloning. It means that in the beginning of the experiment, the control group has an edge over the experimental group as regards on the topic cloning which was a sign that the experimental group showed difficulty as regards the subject matter especially that the students only had a little background on molecular basis of life vital to the understanding of biotechnology. This confirmed the study of Dede, C. et al., (1997) that it was hard to understand complex technological and scientific concepts when one did not have a prior experience in the field [13].

As to the topics on GMO and the overall score, the probability levels of the t-test were not significant at α = 0.05 level of significance. The null hypotheses, therefore, stating as that no significant difference existed between the pre-test mean scores of the experimental and the control group in relation to the topics on GMO and its entirely could not be rejected. There were indeed no significant differences that existed between the mean scores of the

Table 2. T-test on the Significance of the Difference between the Pretest Mean Scores of the Experimental and the Control Group

Topic	Pre-test Mean Score of Exptal	Qualitative Description	Pre-test Mean Score of Control	Qualitative Description	Computed t-value	Probability Level
Cloning	11.5	Poor	13.00	Poor	2.05^{S}	.045
GMO	5.50	Satisfactory	3.57	Poor	1.452^{NS}	.155
Overall	17.00	Poor	16.533	Poor	$.320^{NS}$	.750

S – Significant at α = 0.05, NS – Not Significant at α = 0.05

experimental and the control group in relation to the GMO and its entirety. This would mean that the two groups were comparable in terms of their achievement in the area on GMO and its entirety at the commencement of the experiment in which one group did not have the edge over the other group. They only showed a little prior knowledge on the basics of genetics which could be traced back to their elementary and firs year high school education.

As shown in Table 3, the pre-test and the post-test mean scores of the experimental group in cloning were: 11.50, poor; and 32.30, very satisfactory, respectively. Subjecting these two mean scores to a t-test yielded a computed t-value of 23.14, which was significant at α = 0.05 level of significance. The null hypothesis, therefore, on the non-significance of the pre-test and post-test mean scores of the experimental group was rejected. This would mean that the post-test mean score of the experimental group in cloning was significantly higher than the pre-test mean score on the same subject.

This would indicate that the exposure of the experimental group to science fiction films and movies enabled the group to improve their post-test performance in cloning. This further suggested that the visual media approach was effective in the presentation of the topics on biotechnology. Subjects improved in their test performance when treated with the visual media approach that used pervasive ideas allowing them to categorize concepts from bits of information to general-conceptual scheme. The use and, indeed, acceptance of science fiction as a valid tool in teaching has been very similar to the situation facing information technology.

As to the topic on GMO, the experimental treatment was not effective as the probability level of 0.074 was greater than the level of significance. The null hypothesis, therefore,

Table 3. T-test on the Significance of the Difference Between the Pretest and Posttest Mean Scores of the Experimental Group

Topic	Pre-test Mean Score	Qualitative Description	Pre-test Mean Score	Qualitative Description	Computed t-value	Probability Level
Cloning	11.50	Poor	32.30	Very Satisfactory	23.14^{S}	0.000
GMO	5.57	Satisfactory	7.97	Very Satisfactory	1.85^{NS}	0.074
Overall	17.00	Poor	40.27	Very Satisfactory	13.97^{S}	0.000

S – Significant at α = 0.05, NS – Not Significant at α = 0.05

Table 4. T-test on the Significance of the Difference between the Pretest and Post-test Mean Scores of the Control Group

Topic	Pre-test Mean Score	Qualitative Description	Pre-test Mean Score	Qualitative Description	Computed t-value	Probability Level
Cloning	13.00	Poor	25.03	Very Satisfactory	12.37^{S}	0.000
GMO	3.57	Poor	8.07	Very Satisfactory	13.44^{S}	0.000
Overall	16.53	Poor	33.10	Very Satisfactory	15.99^{S}	0.000

S – Significant at α = 0.05

stating that the pre-test and the post-test mean scores of the experimental group in GMO had no significant difference was accepted. Exposure to science fiction films and science-oriented movies was an approach which had no effect on the scores of the subjects on the topics of GMO. The result could be accountable to the difficulty of conceptualizing a topic especially when the researcher used plenty of sophisticated terms in discussing GMO. This was supported by the theory which state that learning genetics did require a bit of effort and sophisticated terms which had to be plentiful but understanding would come from teachers with tools in order to pry open the mystery box of genetics [14]. A very little attention was given to this topic by science teachers due to the difficulty of the subject matter especially that the science behind GMO technology is still at its early age.

Overall, the treatment was effective. Pre-test and post-test mean scores obtained by the experimental group showed a significant difference. Thus, the visual approach particularly science-oriented movie was effective. The test scores of students in biotechnology test would show. Studies claim that extensive use of the state-of-the-art audio-visual equipment and hand-outs so that students can listen in class, interact and participate in discussion [15]. Rather than keep their heads down and scribble notes non-stop helped. Furthermore, the science video approach enables students to take what they learn (genetic engineering, cloning, ethical and social sciences, etc.) throughout the course and they took the materials in a "fun" way, thus, approach was able to encourage student-student interactions and team work.

Table 4 reveals that the pre-test and post-test mean scores obtained by the control group based on similar topics in biotechnology resulted to a significant difference considering all probability levels that were greater than the level of significance at $\alpha = 0.05$. Thus, the computed t-values of the two topics on biotechnology under control group were significant. This was taken in a way that the pre-test and the post-test scores of the subjects in a biotechnology test were statistically comparable. This further suggested that utilized lecture and chalk-talk method were not effective to improve the test scores in biotechnology test. This is confirmed by the earlier study that students taught in accord to traditional methods of teaching utilized board work, chalk-and-talk method showed low class performance or proficiency level compared to the students with supplementary activities and taught with

Table 5. T-test on the Significance of the Difference between the Mean Gain Scores of the Experimental and the Control Group

Topic	Mean Gain Score of Exptal Group	Mean Gain Score of Control Group	Computed t-value	Probability Level
Cloning	20.80	12.03	6.62^{S}	0.000
GMO	2.47	4.50	1.48^{NS}	0.148
Overall	23.27	16.57	3.42^{S}	0.001

S – Significant at $\alpha = 0.05$, NS – Not Significant at $\alpha = 0.05$

models [16].

It could be gleaned that there was an over-all mean gain score of 23.37 by the experimental group whereas that of the control group was 16.57 (table 5). The overall mean gain score of both experimental and control groups showed significant differences. Thus, teaching biotechnology needs exposure of students to the visual media approach resulting to the improvement of test scores of subjects in biotechnology test. The positive effect of exposing science fiction films and science oriented movies on teaching an experimental group would be attributable to the manner of giving the subjects opportunity to conceptualize a topic from a more general concept especially on the learning of biotechnology. This confirmed the study of Soriano (2016) who has argued that students could easily learn from the content by using big ideas that pervade the subject [17]. Similar concepts and examples enable the students to easily recognize the concept of the topic on GMOs and cloning, concepts of bacterial reproduction which had to be used so that students could easily understand real life. This supports that prescribes supplements through the use of models favourably enabling students to learn better against the use of the traditional method of teaching [18].

4. CONCLUSIONS

Based the analysis of data gathered using a statistical treatment, the following findings surfaced. The experimental group did not have sufficient background on the topic, cloning, at the start of the experiment but had comparable backgrounds on the topic, GMO, at the start of the experiment. Teaching students using visual media (sci-fi movies) on the topic, cloning was effective, while there was less learning observed on the topic, GMO. The traditional teaching method was still effective in teaching the same selected topics in biotechnology. Learning was observed to transpire in the experimental group than in the control group with respect to the topic on cloning, while less learning is observable in the experimental group than in the control group with respect to the topic on GMO.

5. RECOMMENDATIONS

a) Since there was no significant difference between the pretest and the posttest mean scores of the experimental group based on the topics in the Genetically Modified Organism (GMO) topic, it is recommended that other teaching approaches should be used to teach GMO topics.

b) Teaching Advance Genetics using the traditional method should be discouraged. Exposing science fiction films and science-oriented movies can help students to better conceptualize the content of the topic.

c) Science teachers should exercise discernment in using multimedia in their teaching to increase the academic performance of their students, facilities develop positive attitudes of their students towards science subjects, and help the students in their learning.

d) Seminars and workshops for teachers on the development and utilization of science fiction films and movies in Biotechnology classes should be conducted so that the teachers become equipped with knowledge on how to enhance exposure of their students to science-oriented movies.

e) Further research is recommended to identify the efficiency of the approach

6. CONFLICT OF INTEREST

NA

7. ACKNOWLEDGMENT

NA

8. SOURCE/S OF FUNDING

No source of funding

9. REFERENCES

1. Shaw-Smith, C., Redon, R., Rickman, L., Rio, M., Willatt, L., Fiegler, H., ... & Carter, N. P. (2004). Microarray based comparative genomic hybridisation (array-CGH) detects submicroscopic chromosomal deletions and duplications in patients with learning disability/mental retardation and dysmorphic features. *Journal of medical genetics*, **41*(4)***, 241-248.
2. Koubek, R. J., Salvendy, G., Tang, E., & Brannon, N. G. (1999). Development of a conceptual model for predicting skills needed in the operation of new technologies. *International Journal of Cognitive Ergonomics*, **3*(4)***, 333-350.
3. Harwood, W. S., & McMahon, M. M. (1997). Effects of integrated video media on student achievement and attitudes in high school chemistry. Journal of Research in Science Teaching: *The Official Journal of the National Association for Research in Science Teaching,* **34*(6)***, 617-631.
4. Trends in international mathematics and science study (timss), timss 2003 results: Retrieved from https://timss.bc.edu/timss2003i/technicalD.html
5. DepEd, Division of Isabela, 2007, Republic of the Philippines. Retrieved from: https://deped-isabela.com.ph/transparency/about-sdo-isabela/history/
6. Caoli-Rodriguez, R. (2008). The Philippines country case study. Country Profile Prepared for the Education for All Global Monitoring Report.
7. Solomon, J. (1992). The classroom discussion of science-based social issues presented on television: knowledge, attitudes and values. *International Journal of Science Education*, **14*(4)***, 431-444.
8. Gonzalez, A. (1990). Evaluating bilingual education in the Philippines: Towards a multidimensional model of evaluation in language planning. *Learning, Keeping and Using Language*, **2**, 153-62.
9. Pituch, K. A., & Lee, Y. K. (2006). The influence of system characteristics on e-learning use. *Computers & Education*, **47*(2)***, 222-244.
10. Langley, D. (2004). Learning through inquiry: Toward a challenge-based curriculum. *Science*, **304*(5670)***, 521-522.
11. Rinkevich, J. L. (2011). Creative teaching: Why it matters and where to begin. The Clearing House: *A Journal of Educational Strategies*, Issues and Ideas, **84*(5)***, 219-223.
12. Barrio-Cantalejo, I. M., RM, B. G., Medina, C., Cabezas, C., & ME, M. C. (2008). Validation of the Life-Support Preferences Questionnaire (LSPQ) for its use in Spain. *Atencion primaria*, **40*(7),*** 345-349.

13. Dede, C., Salzman, M., Loftin, R. B., & Ash, K. (1997). Using virtual reality technology to convey abstract scientific concepts. Learning the Sciences of the 21st Century: Research, Design, and Implementing Advanced Technology Learning Environments. Lawrence Erlbaum: Hillsdale, NJ.
14. Longden, B. (1982). Genetics—are there inherent learning difficulties?. *Journal of Biological Education*, **16*(2)***, 135-140.
15. Zhu, H., Luo, M. D., Wang, R., Zheng, A. H., & He, R. (2021). Deep audio-visual learning: A survey. *International Journal of Automation and Computing*, 1-26.
16. Dimitrios, B., Labros, S., Nikolaos, K., Koutiva, M., & Athanasios, K. (2013). Traditional teaching methods vs. teaching through the application of information and communication technologies in the accounting field: Quo Vadis?. *European Scientific Journal*, **9*(28)***.
17. Beneke, J., Blampied, S., Dewar, N., & Soriano, L. (2016). The impact of market orientation and learning orientation on organisational performance: A study of small to medium-sized enterprises in Cape Town, South Africa. *Journal of Research in Marketing and Entrepreneurship*.
18. Maddux, C. D., & Cummings, R. (2000). Developing web pages as supplements to traditional courses. In Instructional and cognitive impacts of web-based education (pp. 147-155). IGI Global.