Novelty Journals

ISSN 2394-9686

International Journal of Novel Research in Education and Learning
Vol. 4, Issue 6, pp: (1-7), Month: November-December 2017, Available at: www.noveltyjournals.com

Multi-Media Supported Inquiry-Based Learning: A Merged Strategy to Enhance Students' Science Academic Performance

Richard A. Ogatis

Tagoloan National High School, Division of Misamis Oriental-Region 10, Philippines

Abstract: **This action research investigated if teaching Grade 7 science using Multimedia Supported Inquiry-based Learning improved the academic performance of the students. The study utilized pre-test-post test control group design. Two sections of Grade 7 were purposely selected to be the control and experimental group of the study. Both the control (N=50) and experimental group (N=49) was taught using Inquiry-based Learning but the experimental group was given multimedia as a support intervention. Pre-test/post-test was administered using a validated 15-item questionnaire adapted from Grade 7 Science Learner's Material Module for the K-12 program of the Department of Education. Analysis of data was done after two-week intervention. After comparing the post-test means of the control and experimental group the means are significantly different. The results showed enough evidence that Multi-media supported Inquiry-based Learning was much better teaching approach compared to Inquiry-based learning alone. The study therefore concludes that Inquiry-based Learning must be supported by Multimedia in teaching science to better improve the academic performance of the students.**

Keywords: **Action research, inquiry-based learning, multimedia learning, pre-test-post test, teaching approach, teaching science.**

I. INTRODUCTION

1.1 Background of the study

New educational reform is emerging in the Philippines. The K to 12 framework demands best teaching strategies to address students' needs in this new curriculum. Over the past several years, inquiry-based learning was used in teaching science in the K to 12 programs. Inquiry-based has significant constructive effects on science achievement and interest in science (Areepattamannil, 2012). Inquiry-based learning can present important opportunities for students to develop their understanding of both science content and scientific practices. But, the completion of inquiry-based learning in classroom practice has been challenging because of different conceptualizations and practices across educational fields (Levy et al., 2013). Inquiry-based learning is gaining recognition in science curricula in the 21st century teaching. One of the essential reasons is that its success can be significantly enhanced due to the recent technological advancement that permit the inquiry process to be supported by electronic learning environments (Pedaste et al., 2015). One of the electronic supports that gain popularity is by the use of the multimedia. Multimedia can be static graphics such as photos, drawings, maps, charts, figures, and tables or dynamic graphics such as video or animation (Mayer, 2002). Using multimedia, Mayer (2002), also stressed out that people learn better from graphics and narration than from graphics, narration and on-screen text. People better understand when words and pictures are presented near rather than far from each other on the page or screen. Mayer (2002) pointed out that people learn better when cues that highlight the organization of the essential material are added in the instruction. The study of Jamet (2014), found out that the effects of attention guiding during the learning

of a multimedia, visual cues can promote learning. The research of Ljubojevic, et al (2014) found out also that the use of supplementary video content in multimedia teaching increase students' perception of important information and motivation for learning. The results of their study also suggest that the most efficient method of use of supplementary video is incorporation with educational video content in the middle of a lecture. This point of video insertion provides the best results.

Teachers find difficulties in teaching science using a learner centered and inquiry-based approach since concepts and skills in Life Science, Physics, Chemistry and Earth Science are presented with increasing levels of complexity from one grade level to another in spiral progression. The lack of resources, large classes, and the limited exposure to inquiry of learners hinder the realization of inquiry-based learning and teachers resorting to a didactic pedagogy (Ramnarain, 2014). In spite of the encouraging effect of inquiry-based learning, teacher-researcher observed that using inquiry-based approach, Grade 7 students were not performing well in science. Specifically, the weakness of the Grade 7 students is on retention of learning science ideas and concepts. Students not only do not know how to investigate and solve problems in science, they also do not know how to decipher good information from irrelevant information. Lehtinen & Viiri (2017) on their research found out that inquiry-based learning must be properly guided in order to attain most favorable learning outcomes. The teacher-researcher also observed that students lack strategies and interest in understanding science concepts.

Teacher-researcher was intrigued by the phenomena of how students who are repeatedly exposed to a concept, yet still do not perform well in science. This situation calls for teachers to be creative and innovative in preparing lessons for all students based upon their readiness, interests, and background knowledge. Teachers need to experiment with new teaching approaches in their classroom sometimes in combination of different teaching strategies (Crawford et al., 2014). Since K to12 science curriculum suggest that science teaching must be in inquiry-based learning, the merging of inquiry-based learning and multimedia represents a powerful teaching strategy that might improve the interest and academic performance of students in science.

1.2 Objectives of the study

This experimental research aimed to compare the science performance of Grade 7 students of Tagoloan National High School using two different teaching strategies for school year 2017-2018. Specifically, it also aim to investigated if teaching Grade 7 science using Multimedia Supported Inquiry-based Learning improved the academic performance of the students.

II. METHODOLOGY

2.1 Innovation, Intervention and Strategy

At present, students in their science classes were taught using inquiry based teaching with spiral progression approach. In the K-12 program, science education aims to develop scientific literacy among students that will prepare them to be informed and participative citizens who are able to make judgments that may have social, health, or environmental impact.

Prior to the study, the teacher-researcher administer pretest to both control and experimental group on the topic 'Reproduction' of Module 4 of Unit 2. Module 4 introduced students on the different modes of reproduction in representative plants, animals, and microorganisms. Learning activities on this module helped students recognize the different ways that organisms reproduce. At the end of the module, students were capable of explaining asexual and sexual reproduction and differentiate the offspring resulting from each mode of reproduction. The suggested time allotment for this topic is 5 to 6 hours. Thus, this action research was conducted for about two weeks. Both the control and experimental group was taught using inquiry-based learning but the experimental group was given multimedia as a support intervention. The experimental group was reinforced using power point presentations, video presentations and animations. After the topic had been discussed, post test was administered. The scores were analyzed to determine if students on control and experimental group have learned something on the topic about 'Reproduction'. The data from the pre/post test was used to determine if inquiry-based learning as well as the Multimedia Supported Inquiry-based Learning had been effective in enhancing students' performance in science. It was also used to determine whether the experimental group performs much better than the control group.

Novelty Journals

ISSN 2394-9686

International Journal of Novel Research in Education and Learning
Vol. 4, Issue 6, pp: (1-7), Month: November-December 2017, Available at: www.noveltyjournals.com

2.2 Action Research Methods

This action research utilized the pretest-post test control group research design since its main purpose was to analyze the effectiveness of an innovative teaching strategy, the Multi-Media Supported Inquiry-Based Learning. According to Dugard & Todman (1995) pre-test-post-test control group designs are suited in investigating the effects of educational innovations and are frequently used in educational research. The possible effect of Multi-Media Supported Inquiry-Based Learning strategy to the mean scores on achievement of students on a two-week lesson in Grade 7 Science was analyzed in order to find out if the proposed intervention was effective in improving students' academic performance in science.

Two sections of Grade 7 students were taught the same lessons for two weeks. The experimental group was taught using Multi-Media Supported Inquiry-Based Learning. On the other hand, the control group was taught using Inquiry-based learning alone.

2.2.1 Participants of the study

The participants of the study were composed of two groups of Grade 7 students of Tagoloan National High School in which both belong to heterogeneous class and of almost equal intellectual ability. The control group was Grade 7 Section Attentive. This section was composed of 24 males and 26 females (N=50). The experimental group was Grade 7 Admirable, composed of 22 males and 27 females (N=49). Simple random sampling was done to identify which group will be the control and experimental group. The experimental group was given interventions to enhance their academic performance in science by using multimedia as an interactive tool in teaching. The other section served as the control group of the study. The science topics and teaching methodologies in the experimental group and control group were identical but the experimental group had multimedia as support intervention.

2.2.2 Data Gathering Method

After the study was recommended and approved by the principal and division office, the teacher-researcher started the experiment for two weeks. The research instrument used was a validated 15- item pre-test/post-test adapted from Grade 7 Science Learner's Material Module for the K-12 program. The average scores for pre-test and post-test was used for statistical treatments to determine whether the proposed intervention was effective or not.

3.1 Discussion of Results

Based on the computed results of the study the means of the pretest of the control group was 4.16 (SD=1.6581) while on the experimental group was 4.0204 (SD=1.6769). The variance results of 2.7494 and 2.8121 were not that large which indicate that both classes were heterogeneous. This means that the students of the control and experimental group were of differing level of intelligence. This was definitely an excellent baseline since the results showed that the two sections included in the study were almost the same in the manner that the scores were scattered. This means that the students' groupings were mixed as to their abilities. The post test results revealed an increase on students' performance both the control and experimental group. The post test mean of the control was 7.08 (SD=1.5887) while on the experimental group was 8.1837 (SD=1.5636) as shown in Figure 1.

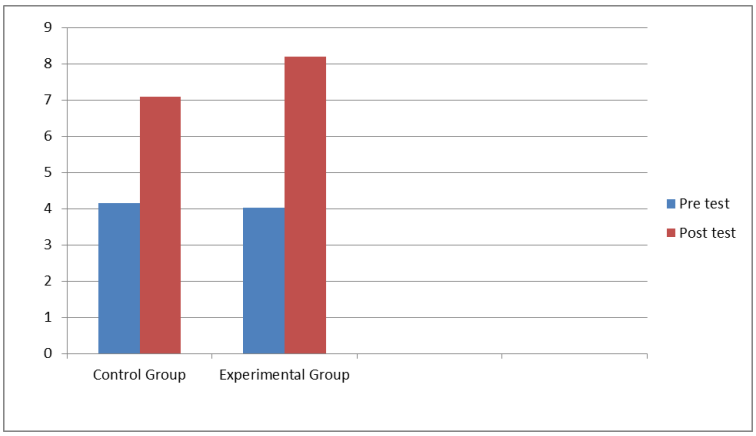

Figure 1. Pretest and Post test Results of the Control and the Experimental Groups before and after the Experiment

Novelty Journals

ISSN 2394-9686

International Journal of Novel Research in Education and Learning
Vol. 4, Issue 6, pp: (1-7), Month: November-December 2017, Available at: www.noveltyjournals.com

T-test for two independent samples of the pre test score means revealed that the t value was smaller than critical value (0.4164<1.987), so the means were not significantly different (Table 1). The results showed that the control and experimental group had the same background knowledge about the topic 'Reproduction'. This was definitely a good baseline since the results implied that the two groups included in the study were almost the same in the way that the scores were showing.

Table 1. Significant Difference between Pretest of the Control Group and Experimental Group Prior to the Experiment

	Control Group	Experimental Group
Mean	4.16	4.0204
Variance	2.7494	2.8121
Stand. Dev.	1.6581	1.6769
N	50	49
T	**0.4164**	
degrees of freedom	**97**	
critical value	**1.987**	

**p<0.05

The absolute value of the calculated t for the pretest/post-test of the control group exceeds the critical value (8.2666>2.011), so the means were significantly different (Table 2). This implied that there was an improvement in their performance after two weeks session on the topic 'Reproduction'. The results signify that Inquiry-based Learning enhanced the academic performance of the control group. The results were the same to the study of Abdi (2014) about the effect of inquiry-based learning on students' academic achievement in science course, also found out that Inquiry-based Learning improved students' achievement in science. Sever & Guven (2014) found out some resistant behaviors of students in science classes but by using Inquiry-based Learning positive improvement on student resistance behavior in learning science were achieved. In short, Inquiry-based Learning does not only improve achievement in science, it also improved students' behavior towards learning science concepts.

Table 2. Significant Difference between Pretest and Posttest of the Control Group

	Pre test	Post test
Mean	4.16	7.08
Variance	2.7494	2.5241
Stand. Dev.	1.6581	1.5887
N	50	50
T	**-8.2666**	
degrees of freedom	**49**	
critical value	**2.011**	

**p<0.05

The absolute value of the calculated t of pretest/post-test of the experimental group exceeds the critical value (12.505>2.011), so the means were significantly different (Table 3). The results showed that Multi-media Supported Inquiry-based Learning enhanced Grade 7 students' academic performance in science after a two-week session about the topic 'Reproduction'. Ljubojevic, et al., (2014) suggested that the use of Multi-media can be effective if supplementary video was incorporated in the middle of a lecture. This point of video insertion provides the best results. Ocepek et al, (2013), also suggested that students prefer structured texts with color discrimination in multi-media learning. Proper technique was necessary in order for multi-media learning to be effective. Mayer (2002) suggested that people learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.

Table 3. Significant Difference between Pretest and Posttest of the Experimental Group

	Pre test	Post test
Mean	4.0204	8.1837
Variance	2.8121	2.4447
Stand. Dev.	1.6769	1.5636
N	49	49
T	**-12.505**	
degrees of freedom	**48**	
critical value	**2.011**	

**p<0.05

After comparing the posttest means of the experimental and control groups of the two independent samples, the absolute value of the calculated t exceeds the critical value (3.4838>1.987), so the means were significantly different as shown in Table 4. The result showed enough evidence that Multimedia Supported Inquiry-based Learning was much better teaching approach compared to Inquiry-based learning alone. The results also showed that the proposed intervention was effective in enhancing Grade 7 students' academic performance in science on the topic about 'Reproduction'. Pedaste et al., (2015) stressed out on their study that one of the essential reasons inquiry process significantly enhanced learning due to the recent technological advancement that permit the inquiry process to be supported by electronic learning environments. Sever et al., (2013) on their study had also found out that technology-supported teaching strategies had a positive influence on students' attitudes toward science and technology and contributes to increase their academic achievement. Cheung et al., (2017) also pointed out that technology applications helped teachers increase the effectiveness of their lessons, especially in making concepts visual, motivating, and accessibility.

Table 4. Significant Difference between the Posttest of the Control and Experimental Group after the Experiment

	Control Group	Experimental Group
Mean	7.08	8.1837
Variance	2.5241	2.4447
Stand. Dev.	1.5887	1.5636
N	50	49
T	**-3.4838**	
degrees of freedom	**97**	
critical value	**1.987**	

**p<0.05

III. CONCLUSION

Teachers encountered some problems in teaching science using inquiry-based approach. The lack of resources, large classes, and the limited exposure to inquiry of learners are some problems that limit the implementation of inquiry-based learning. Since K to12 science curriculum suggests that science teaching must be in inquiry-based learning, the results of this study concluded that inquiry-based learning must be merged with multimedia to better improve academic performance of students in science.

The major findings of the study clearly show that Multimedia Supported Inquiry-based Learning significantly improved the academic performance of the students on the topic 'Reproduction', the teacher-researcher would use this method to other topics in Grade 7 science. Teacher-researcher suggests the used of power point presentation with photos, drawings, maps, charts, figures, and tables or video and animation in teaching science subjects. Cues that highlight the organization of the essential material must be added in the instruction. Corresponding words and pictures must be presented near rather than far from each other on the page or screen. To have a better results, educational video must be incorporated in the middle of a lecture. The teacher-researcher observed that Multimedia Supported Inquiry-based Learning does not only improved academic performance in science but also boost the interest of students in learning science.

The study focused only to science subject, the teacher-researcher recommends that Multimedia Supported Inquiry-based Learning must also be utilized to other subject area. Since the study was limited to inquiry-based learning merged with multimedia, it would be more worthwhile that there must be future studies to be conducted in which multimedia must be merged with other teaching strategies that might improve students' performance.

REFERENCES

[1] Abdi, A. (2014). The effect of inquiry-based learning method on students' academic achievement in science course. Universal journal of educational Research, 2(1), 37-41. Retrieved from: http://www.hrpub.org/journals/article_ info.php?aid=944 (July 18, 2017)

[2] Areepattamannil, S. (2012). Effects of inquiry-based science instruction on science achievement and interest in science: Evidence from Qatar. The Journal of Educational Research, 105(2), 134-146. Retrieved from: http://www. tandfonline.com/doi/abs/10.1080/00220671.2010.533717 (July16,2017)

[3] Cheung, A., Slavin, R. E., Kim, E., & Lake, C. (2017). Effective secondary science programs: A best-evidence synthesis. Journal of Research in Science Teaching, 54(1), 58-81. Retrieved from: http://onlinelibrary.wiley.com/ doi/10.1002/tea.21338/full(September 28, 2017)

[4] Crawford, B. A., Capps, D. K., van Driel, J., Lederman, N., Lederman, J., Luft, J. A., ... & Smith, K. (2014). Learning to teach science as inquiry: Developing an evidence-based framework for effective teacher professional development. In Topics and Trends in Current Science Education (pp. 193-211). Springer Netherlands. Retrieved from: https://link.springer.com/chapter/10.1007/978-94-007-7281-6_12 (July 8, 2017)

[5] Dugard, P., & Todman, J. (1995). Analysis of pre-test-post-test control group designs in educational research. Educational Psychology, 15(2), 181-198. Retrieved from: http://www.tandfonline.com/(September 28, 2017)

[6] Jamet, E. (2014). An eye-tracking study of cueing effects in multimedia learning. Computers in Human Behavior, 32, 47-53. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0747563213004342 (July 8, 2017)

[7] Lehtinen, A., & Viiri, J. (2017). Guidance Provided by Teacher and Simulation for Inquiry-Based Learning: A Case Study. Journal of science education and technology, 26(2), 193-206. Retrieved from: https://link.springer.com/article/ 10.1007/s10956-016-9672-y (July 16, 2017)

[8] Levy, B. L., Thomas, E. E., Drago, K., & Rex, L. A. (2013). Examining studies of inquiry-based learning in three fields of education: Sparking generative conversation. Journal of teacher education, 64(5), 387-408. Retrieved from: http://journals.sagepub.com/(July 12, 2017)

[9] Ljubojevic, M., Vaskovic, V., Stankovic, S., & Vaskovic, J. (2014). Using supplementary video in multimedia instruction as a teaching tool to increase efficiency of learning and quality of experience. The International Review of Research in Open and Distributed Learning, 15(3). Retrieved from: http://www.irrodl.org/index.php/irrodl/article/ view/1825 (July 3, 2017)

[10] Mayer, R. E. (2002). Multimedia learning. Psychology of learning and motivation, 41, 85-139. . Retrieved from :http://www.sciencedirect.com/science/article (July 6, 2017)

[11] Ocepek, U., Bosnić, Z., Šerbec, I. N., & Rugelj, J. (2013). Exploring the relation between learning style models and preferred multimedia types. Computers & Education, 69, 343-355. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0360131513001966 (July 24,2017)

[12] Pedaste, M., Mäeots, M., Siiman, L., De Jong, T., Van Riesen, S. A., Kamp, E. T., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: definitions and the inquiry cycle. Educational Research Review. Retrieved from: https://telearn.archives-ouvertes.fr/hal-01206700/ (July 26, 2017)

[13] Ramnarain, U. D. (2014). Teachers' perceptions of inquiry-based learning in urban, suburban, township and rural high schools: The context-specificity of science curriculum implementation in South Africa. Teaching and teacher education, 38, 65-75. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0742051X13001753 (July 26, 2017)

[14] Sever, D., & Guven, M. (2014). Effect of Inquiry-Based Learning Approach on Student Resistance in a Science and Technology Course. Educational Sciences: Theory and Practice, 14(4), 1601-1605. Retrieved from: https://eric.ed.gov/?id=EJ1045037 (July 24, 2017)

[15] Sever, S., Oguz-Unver, A., & Yurumezoglu, K. (2013). The effective presentation of inquiry-based classroom experiments using teaching strategies that employ video and demonstration methods. Australasian Journal of Educational Technology, 29(3). Retrieved from: https://ajet.org.au/index.php/AJET/article/view/229 (September 28, 2017)