EFFECTS ON THE INTERACTIVE SCIENCE TOOLKIT ON PERFORMANCE OF STUDENTS IN SCIENCE 8

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ABSTRACT: .*Science education plays a vital role in fostering critical thinking, innovation, and informed decision-making. Despite continued efforts by the Department of Education, many Filipino students still struggle in mastering scientific concepts. This study investigated the effectiveness of the Interactive Science Toolkit in improving the Science 8 performance of students at La Libertad National High School during the school year 2024–2025. Using a quasi-experimental pretest–posttest non-equivalent group design, the study compared an experimental group taught with the toolkit and a control group taught through traditional methods. Data were gathered through researcher-made tests and analyzed using mean, standard deviation, z-tests, and t-tests. Results showed no significant difference between groups in the pretest; however, the experimental group demonstrated significantly higher posttest scores and substantial improvement from pretest to posttest. Findings indicate that the Interactive Science Toolkit enhanced students' conceptual understanding and engagement. Integrating such interactive tools in science instruction is recommended to support improved academic performance, motivation, and active learning. Future studies may examine long-term retention and conceptual mastery.*

Keywords: Interactive Science Toolkit, Science 8, pretest–posttest, academic performance, quasi-experimental design

INTRODUCTION

A country's future is greatly influenced by science education since it promotes critical thinking, creativity, and well-informed decision-making. A concerted effort is being made worldwide to improve scientific education to satisfy the needs of the 21st century. Traditional teaching methods, however, often fall insufficient in teaching students and promoting deep understanding. This has led to the exploration of interactive learning tools designed to address these challenges. In science education, school children, college students, or the general public are taught and learn science. However, low performance in mathematics and science is one of the problems with scientific education in the Philippines, [1]

The K–12 curriculum was introduced by the Philippine Department of Education in an effort to raise educational standards, with a special emphasis on scientific subjects. Despite these efforts, studies indicate that students continue to face difficulties in grasping scientific concepts, resulting in suboptimal performance in science assessments. For instance, a survey by Ahakiri [2] found that students exposed to web-based interactive learning environments exhibited higher academic performance compared to those who received traditional instruction. The potential of interactive technologies to promote scientific teaching was also highlighted by M. T. Fajardo *et al* [3], which showed that the usage of Interactive scientific Notebooks considerably increased student instructors' physics success levels.

The use of an interactive science toolkit is vital in the science classroom and can motivate students to study the sciences in greater depth. Students gain critical thinking, technological literacy, and problem-solving skills through this that will help them succeed in school and beyond. According to the study, using an Interactive Science Toolkit is a teaching method that can help students do better in science 8.

While students engage in various computer-related activities at school, research shows that interactive teaching tools significantly boost engagement and academic performance, especially in higher education. These tools—such as interactive classroom technologies—have been found to enhance student interest, skills, and collaboration. Moreover, they help create a supportive learning environment that fosters intellectual competence and critical thinking, ultimately leading to improved cognitive development and more effective learning.

In many important ways, interactive educational tools (Interactive Science Toolkit) are superior to traditional classroom environments and provide an interactive approach to learning. Students' levels of engagement and motivation are increased by these resources, which are frequently enhanced with gamified aspects and multimedia material [4]. Personalized learning technology allows teachers to create dynamic learning environments that adjust to the individual needs and preferences of each student. It will increase student engagement and improve learning results overall [5]. Additionally, by removing conventional obstacles, interactive tools improve accessibility and provide flexible learning opportunities, which will allow the students to collaborate with knowledge at their own leisure and pace [6]. By supporting multimodal learning experiences, including real-world applications, and encouraging collaborative learning environments, these technologies accommodate a different learning styles and offer a comprehensive educational approach [7, 8, 9].

Science education still faces difficulties in raising student performance and engagement despite the implementation of numerous instructional methodologies. This is primarily because interactive and student-centered learning resources are not used to their full potential [9]. In conventional classroom environments, science instruction tends to rely on lectures, which restrict students' chances for interactive exploration and active engagement, both of which are critical for understanding complex scientific principles [10]. According to teacher comments and national assessment data, a major issue in Science 8 education is pupils' diminishing academic performance, especially when it comes to understanding hard subjects like biology, chemistry, and physics[11]. This issue is compounded by the disparity between conventional teaching methods and students' increasing preference for technology-driven, interactive learning experiences that align with their digital-native tendencies [12].

The objective of this study is to evaluate how an Interactive Science Toolkit affects Science 8 students' performance in order to address these problems. The toolkit incorporates technology-based learning materials, simulations, and hands-on activities designed to foster engagement and deepen understanding. In order to improve students' academic performance and cultivate a love of science, this study is required to ascertain whether such an innovative method can close the gap between existing teaching approaches and the learning demands of today's students.

METHODOLOGY

This study employed a quasi-experimental design with a pretest-posttest nonequivalent groups approach to evaluate the effectiveness of an Interactive Science Toolkit on Grade 8 students' performance in Science. Two sections—Galileo (experimental group) and Archimedes (control group)—from La Libertad National High School were selected for the 2024–2025 academic year. The experimental group received the Interactive Science Toolkit intervention for three days with 1-hour sessions, while the control group was taught using conventional methods. Both groups completed a 30-item multiple-choice pretest and posttest, constructed based on Bloom's Taxonomy to cover cognitive competencies from remembering to creating.

The test items were validated by experts in science education and pilot-tested with a separate Grade 9 section to ensure content validity and reliability, with reliability assessed using the Kuder–Richardson 21 (KR-21) formula. Item analysis was conducted to determine the difficulty and discrimination indices, retaining only items with optimal metrics. Students' performance was categorized into five levels—Outstanding, Very Satisfactory, Satisfactory, Fairly Satisfactory, and Did Not Meet Expectations—with a minimum competency score of 75%.

Data were analyzed using mean scores, standard deviations, z-tests, and t-tests to determine the effectiveness of the toolkit. Ethical clearance and permissions were secured from the school administration, parents, and students prior to data collection.

RESULTSAD DISCUSSION

This chapter provides an analysis and interpretation of the data gathered, addressing the research questions stated in the first chapter. The results are organized based on the order of the research problems.

Problem No. 1 What is the pretest performance of the students in the control and experimental groups?

Pretest Performance of the Control Group

Table 1 shows the learners' pretest performance in the control group prior to the application of any intervention. The results were measured based on three competencies related to the digestive system: (1) explaining the processes of ingestion, absorption, assimilation, and excretion; (2) understanding how digestive system diseases are prevented, detected, and treated; and (3) identifying healthful practices affecting the digestive system. A comparative analysis was conducted against a standard set at a 75% mastery level.

Pretest Performance of the Experimental Group

Table 2 shows the pretest performance of students in the experimental group, highlighting their grasp of essential science competencies related to the digestive system. The target level of mastery was set at 75% for each of the three areas assessed. The findings show that the learners did not reach the desired level of mastery in any of the competencies. Although their score in competency 1 was relatively higher than in other areas, their overall performance still fell under the "fair" category. This suggests that students had limited prior understanding of the topic and entered the lessons with foundational gaps in scientific knowledge.

Problem No. 2 Is there a significant difference in the pretest performance of the students between the control and experimental groups?

Table 3 shows the comparison between the control and experimental groups' pretest performances across three science competencies related to the digestive system. This analysis aims to assess if there were any significant differences between the two groups before the instruction was applied. The independent samples t-test was used to compare the mean scores for each competency and their overall performance. The results indicate that although the two groups had similar scores in most areas, a notable difference was observed in one competency—specifically in explaining the processes of ingestion, absorption, assimilation, and excretion—where the control group slightly outperformed the experimental group. However, for the remaining two competencies and overall pretest performance, no significant differences were found between the groups. This suggests that both groups started with comparable levels of prior knowledge.

What is the posttest performance of the students in the control and experimental groups?

Tables 4 and 5 shows the posttest performance results of the students from both the control and experimental groups. These results were obtained after the students in the experimental group were exposed to the use of interactive science toolkits, while the control group was taught through traditional instruction methods. Table 4 shows the control group's posttest scores after being taught through traditional methods. The evaluation measures three competencies related to the digestive system. The purpose of the posttest was to evaluate the level of learning achievement following instruction, with the goal that students would attain a minimum of 75% mastery. The findings suggest that although students in the control group demonstrated improvement in their posttest scores relative to their pretest scores, their performance still fell notably short of the anticipated 75% mastery benchmark. Their scores were uniformly below the

75% benchmark for all competencies and their overall performance was "good." As in the previous study, this result indicates that understanding has improved, but not enough to demonstrate mastery of the material.

Posttest Performance of the Experimental Group

Table 5 shows the posttest results of the Grade 8 students in the experimental group following their exposure to the Interactive Science Toolkit. The test evaluated three key competencies related to the digestive system: (1) explaining the processes of ingestion, absorption, assimilation, and excretion, (2) explaining how diseases of the digestive system are prevented, detected, and treated, and (3) identifying healthful practices that affect the digestive system. A benchmark of 75% mastery was used to assess performance. The outcome displays the greatest enhancement across all proficiencies, with average ratings of 7.35, 7.04, and 5.62 respectively. The standard "Very Good" descriptor also covers all ratings, while the overall average rating of 20 out of 30 maintains "Very Good." The low standard deviations suggest even student performance, which paired with the differing ability ranges, reinforces the effectiveness of the learning tool.

Problem No. 4 Is there a significant difference between the posttest performance of the students in the control and experimental groups?

Table 6 compares the posttest performance of students in both the control and experimental groups to assess whether the Interactive Science Toolkit led to better outcomes than traditional teaching methods. The test evaluated three competencies related to the digestive system, with the analysis of mean scores, standard deviation, and statistical significance conducted using an independent samples t-test. The findings show that the experimental group performed better than the control group across all competencies. Specifically, the mean total score for the experimental group was 20.00, categorized as "Very Good," while the control group scored 13.83, categorized as "Good." The t-test results showed a computed value greater than the critical value at a 0.05 significance level, indicating a statistically significant difference favoring the experimental group.

Problem No. 5. Is there a significant difference between the pretest and posttest performance of the students in the control group?

Table 7 shows the difference between the pretest and posttest of the students in the control group, focusing on science test performance across different competencies. Table 7 shows a comparison of the performance of students in the control group, who were taught using traditional methods, from pretest to posttest. The purpose of the table is to assess whether there was a notable enhancement in students' comprehension of the digestive system following the intervention. The data show an increase in mean scores from the pretest to the posttest for all competencies, although the overall improvement was moderate. The calculated t-value was lower than the critical value at the 0.05 significance level, indicating that while learning took place, the improvement was not statistically significant in most areas.

Problem No. 6 Is there a significant difference between the pretest and posttest performance of the students in the experimental group?

Table 8 shows the results of a comparison between the pretest and posttest scores of students in the experimental group, specifically examining their science test performance across various competencies. Table 8 shows the comparison of pretest and posttest scores on the performance of students in the experimental group, who were taught using the Interactive Science Toolkit. The purpose of this analysis was to assess whether the intervention had a notable impact on students' academic performance in Science 8, particularly in the digestive system unit. The results demonstrate a significant rise in mean scores from pretest to posttest for all competencies. The calculated t-values exceeded the critical values at the 0.05 significance level, suggesting a statistically significant improvement in performance after implementing the interactive learning approach.

Problem No. 7 Is there a significant difference between the mean gain scores of the students in the control and experimental groups?

Table 9 show a comparison of the mean gain scores between the control group and the experimental group to assess the effectiveness of the instructional strategies employed. It can be noted from the data that the group that used the Interactive Science Toolkit did significantly better compared to the group which was taught using conventional methods. An independent samples t-test reveals a significant difference in mean gains at the 0.05 level, which is considered statistically acceptable for the experimental group.

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the study, highlighting the key findings, the conclusions derived from the data, and the recommendations proposed based on the results.

Summary

The primary objective of this study was to investigate the impact of the Interactive Science Toolkit on the performance of students in Science 8 at La Libertad National High School during the 2024-2025 academic year.

Specifically, this research seeks to answer the following questions

1. What is the pretest performance of the students in the control and experimental groups?
2. Is there a significant difference in the pretest performance of the students between the control and experimental groups?
3. What is the posttest performance of the students in the control and experimental groups?
4. Is there a significant difference between the posttest performance of the students in the control and experimental groups?

5. Is there a significant difference between the pretest and posttest performance of the students in the control group?
6. Is there a significant difference between the pretest and posttest performance of the students in the experimental group?
7. Is there a significant difference between the mean gain scores of the students in the control and experimental groups?

Findings

The following findings were revealed:

1. The study aimed to assess the impact of the Interactive Science Toolkit on the performance of students in Science 8. Specifically, it sought to compare the pretest scores of students using the Interactive Science Toolkit versus those using the Lecture Method, evaluate their posttest performance following the intervention, and determine if there were significant differences between pretest and posttest scores within each group. Additionally, the study aimed to examine whether there was a significant difference in the mean gain scores between the two groups. A quasi-experimental pretest-posttest nonequivalent group design was employed, involving Grade 8 sections Galileo and Archimedes at La Libertad National High School. The experimental group consisted of 26 students, while the control group had 24 students. Both groups took the same pretest and posttest. Statistical methods, including mean, standard deviation, t-tests, and z-tests, were used for data analysis.
2. Most of the students' pretest scores in both the Interactive Science Toolkit and Lecture Method groups were below the expected performance level, with the majority classified under the "fair" category.
3. After the intervention, 80% of the students exposed to the Interactive Science Toolkit scored in the "very good" range, while the majority of the students under the Lecture Method remained in the "good" or "fair" categories.
4. The analysis showed that there was no notable difference between the pretest scores of students who were taught with the Interactive Science Toolkit and those taught using the Lecture Method. This indicates that both groups had similar levels of prior knowledge prior to the intervention.

5. The findings revealed a notable difference in the posttest scores between students taught with the Interactive Science Toolkit and those taught through the Lecture Method, with the experimental group outperforming the control group. This indicates that the Interactive Science Toolkit positively influenced students' learning outcomes.

6. The T-test results showed a significant difference between the pretest and posttest scores for both groups. However, the experimental group exhibited a greater improvement in their scores, suggesting that the Interactive Science Toolkit had a more pronounced effect on enhancing the students' learning progress compared to the control group.

Tables

Table 1. Pretest Performance of the Learners in the Control Group

Competencies	No. of Items	HM	AM	SD	Z-Value	D
Explain ingestion, absorption, assimilation, and excretion	11	8.25	3.88	1.23	-0.89	Fair
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	3.25	1.19	-1.02	Fair
Identify healthful practices that affect the digestive system	8	6	2.42	1.53	-0.73	Fair
Total	30	22.5	9.54	3.09	-2.645	Fair

d.f. = 91 c.v. = 1.662 α = 0.05

Legend: HM = Hypothetical Mean, SD = Standard Deviation, AM = Actual Mean, D = Description

Table 2. Pretest Performance of the Learners in the Experimental Group

Topics	No. of Items	HM	AM	SD	Z-Value	D
Explain ingestion, absorption, assimilation, and excretion	11	8.25	4.69	1.57	-2.27	Good
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	2.62	1.02	-5.51	Fair

Identify healthful practices that affect the digestive system	8	6	2.0	1.7	-2.36	Fair
Total	30	22.5	9.31	3.3	-4.002	Fair

Legend: HM = Hypothetical Mean, SD = Standard Deviation, AM = Actual Mean, D = Description

Table 3. Test of Difference between the Control and Experimental Groups' Pretest Performance

Competency	Group	Mean	SD	t-computed	p-value	Interpretation	Pooled stdev	Cohen's d	Interpretation
Explain ingestion, absorption, assimilation, and excretion	Control	3.88	1.23	-2.02	0.049	Significant	1.42	0.574	Medium effect
	Experimental	4.69	1.57						
Explain how diseases of the digestive system are prevented, detected, and treated	Control	3.25	1.19	2.00	0.051	Not significant	1.105	0.568	Medium effect
	Experimental	2.62	1.02						
Identify healthful practices that affect the digestive system	Control	2.42	1.53	0.92	0.36	Not significant	1.62	0.259	Small effect
	Experimental	2	1.7						
Overall	Control	9.54	3.09	0.25	0.80	Not significant	3.201	0.072	Small effect
	Experimental	9.31	3.3						

Legend: df = 91, α = 0.05, c.v. = 1.662

Table 4. Posttest Performance of the Learners in the Control Group

Topics	No. of Items	HM	AM	SD	Z-Value	D
Explain ingestion, absorption, assimilation, and excretion	11	8.25	5.21	2.30	-0.62	Good
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	4.67	1.86	-0.73	Good
Identify healthful practices that affect the digestive system	8	6	3.96	2.39	-0.42	Good
Total	30	22.5	13.83	5.14	-1.77	Good

Table 5. Posttest Performance of the Learners in the Experimental Group

Topics	No. of Items	HM	AM	SD	Z-Value	D
Explain ingestion, absorption, assimilation, and excretion	11	8.25	7.35	2.1	-0.43	Very Good
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	7.04	1.84	-0.66	Very Good
Identify healthful practices that affect the digestive system	8	6	5.62	1.36	-0.28	Very Good
Total	30	22.5	20	4.25	-0.59	Very Good

Legend: HM = Hypothetical Mean, SD = Standard Deviation, AM = Actual Mean, D = Description

Table 6. Test of Difference between the Control and Experimental Groups' Posttest Performance

Topics	Group	Mean	SD	t-computed	p-value	Interpretation	Pooled stdev	Cohen's d	Interpretation

Explain ingestion, absorption, assimilation, and excretion	Control	5.21	2.30	-3.43	0.001	Significant	2.198	0.972	Large effect
	Experimental	7.35	2.1						
Explain how diseases of the digestive system are prevented, detected, and treated	Control	4.67	1.86	-4.52	0.000	Significant	1.849	1.281	Large effect
	Experimental	7.04	1.84						
Identify healthful practices that affect the digestive system	Control	3.96	2.39	-2.99	0.005	Significant	1.924	0.854	Large effect
	Experimental	5.62	1.36						
Overall	Control	13.83	5.14	-4.60	0.000	Significant	4.697	1.308	Large effect
	Experimental	20	4.25						

Table 7. Test of Difference between the Pretest and Posttest of the Students in the Control Group

Topics	No. of Items	HM	Pretest AM	Pretest AM	Posttest AM	Posttest SD	t-value	p-value	Interpretation	Cohen's d	Interpretation
Explain ingestion, absorption, assimilation, and excretion	11	8.25	3.88	1.23	5.21	2.30	3.21	0.004	Sig	0.72	Medium effect
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	3.25	1.19	4.67	1.86	3.02	0.006	Sig	0.909	Large effect
Identify healthful practices that affect the digestive system	8	6	2.42	1.53	3.96	2.39	2.75	0.12	Sig	0.767	Medium effect
Total	30	22.5	9.54	3.09	13.83	5.14	3.96	0.001	Sig	1.011	Large effect

Table 8. Test of Difference between the Pretest and Posttest of the Students in the Experimental Group

Topics	No. of Items	HM	Pretest AM	Pretest AM	Posttest AM	Posttest SD	t-value	p-value	Interpretation	Cohen's d	Interpretation
Explain ingestion, absorption, assimilation, and excretion	11	8.25	4.69	1.57	7.35	2.1	6.52	0.000	Sig	1.435	Large effect
Explain how diseases of the digestive system are prevented, detected, and treated	11	8.25	2.62	1.02	7.04	1.84	13.08	0.000	Sig	2.971	Large effect
Identify healthful practices that affect the digestive system	8	6	2.0	1.7	5.62	1.36	9.93	0.000	Sig	2.352	Large effect
Total	30	22.5	9.31	3.3	20	4.25	14.86	0.000	Sig	2.809	Large effect

Table 9. Test of Difference on the Mean Gains between the Control and Experimental Group

Group	Mean Gain	Standard Deviation	t-computed	p-value	Interpretation	Cohen's d	Interpretation
Control	4.29	2.05	13.89	0.000	Significant	3.998	Large effect
Experimental	10.69	0.96					

CONCLUSIONS

Based on the findings of the study, it can be concluded that both the control and experimental groups initially demonstrated average performance in the pretest, indicating that students generally struggled to understand the concepts related to the digestive system. The similarity in their pretest scores suggests that both groups had comparable levels of prior knowledge before the intervention. Following the implementation of different teaching methods, the experimental group—who used the Interactive Science Toolkit—significantly outperformed the control group in the posttest, indicating the effectiveness of the intervention in enhancing students' understanding. While both groups showed improvement between the pretest and posttest, the experimental group achieved a greater increase in performance, confirming that the Interactive Science Toolkit had a more pronounced impact on student learning. Furthermore, the significant difference in mean gain scores between the two groups supports the conclusion that interactive, student-centered approaches are more effective than traditional teaching methods. Overall, the results underscore the value of integrating interactive and engaging strategies in science instruction to improve students' comprehension and application of scientific concepts.

Recommendations

Based on the findings and conclusions, the following recommendations are hereby offered:

1. Teachers are encouraged to incorporate interactive and student-centered learning strategies, such as the Interactive Science Toolkit, to enhance students' understanding of scientific concepts, particularly in topics related to the digestive system.
2. Curriculum developers should explore incorporating interactive teaching tools and approaches into the science curriculum to enhance student engagement and performance.
3. School administrators should provide professional development programs and training for teachers on effective interactive teaching strategies to maximize their impact on student learning outcomes.
4. Future researchers are encouraged to explore the effectiveness of interactive learning tools in other science topics or subjects to determine their broader applicability in improving student performance.

Students should be actively engaged in hands-on and interactive learning activities to enhance their comprehension and retention of scientific concepts.

REFERENCES

1. Aborot, M. A., Dizon, J. M., & Santos, R. B. (2022). Students' academic performance in mathematics and science. Philippine Journal of Multidisciplinary Education, 7(2), 45–56.
2. Ahakiri, A. C. (2022). Students' academic performance in web-based interactive learning. International Journal of Multidisciplinary Research and Development, 10(6), 25–30.
3. M. T. Fajardo et al., "The effects of interactive science notebook on student teachers' physics achievement levels," *Journal of Turkish Science Education*, 16(1): 62–76 (2020).
4. Z. Zainuddin and S. H. Halili, "Flipped classroom research and trends from different fields of study," *The International Review of Research in Open and Distributed Learning*, 17(3) (2016).
5. Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2019). *NMC Horizon Report: 2019 Higher Education Edition.* EDUCAUSE.
6. G. Siemens, "The impact of learning technologies on the future of education," *Educational Technology*, 58(5): 36–40 (2018).
7. T. Anderson and J. Dron, *The Theory and Practice of Online Learning*, Athabasca University Press (2017).
8. Y. Zhang, L. Li, and J. Wang, "The impact of multimedia learning on students' academic performance and engagement," *Journal of Educational Technology & Society*, 22(4): 153–166 (2019).
9. R. J. Marzano, *The New Art and Science of Teaching*, Solution Tree Press (2017).
10. M. Liu, P. Toprac, and T. Yuen, "The role of interactive tools in science education: Improving engagement and understanding of scientific concepts," *Journal of Science Education and Technology*, 26(3): 234–245 (2017).
11. Department of Education (DepEd), "Results of the National Achievement Test for Grade 8 Students," Philippines (2019).
12. D. Bebell and L. M. O'Dwyer, "The impact of educational technology on student achievement in K–12 schools: A review of the literature," *Computers & Education*, 102: 12–29 (2016).