

Learning Styles and Retention Level in General Physics 1 of Grade 12 STEM Students at Golden Acres National High School-Senior High School

Maria Marites B. Abayare¹, Rounin N. Cuenca², Elijah L. Halili³, Dave Andrew C. Melo⁴, Jerald S. Liboton⁵, and Jay A. Gutlay^{5*}

¹Golden Acres National High School-Senior High School

²Golden Acres National High School-Senior High School

³Golden Acres National High School-Senior High School

⁴Golden Acres National High School-Senior High School

⁵Golden Acres National High School-Senior High School

*Corresponding Author: jayrgutlay24@gmail.com

Abstract: General Physics 1 is an essential course in the STEM field that plays a crucial role in understanding natural phenomena in everyday life (Brown & Weidner, 2024). Without a solid grasp of the foundational concepts in physics, students will likely face greater challenges when attempting to tackle more advanced physics topics at higher levels of education. A study by Bray and Williams (2020) stated that learners struggle in learning General Physics 1 because they often memorize the formulas or abstract concepts in General Physics 1 during earlier grades rather than acquiring a deep knowledge regarding the application in everyday activities. This study analyzes the retention levels of Grade 12 STEM students at GANHS and their learning styles to determine whether they effectively retain information from General Physics 1. The researchers employed a correlational design to analyze quantitative data on the relationship between student learning style and retention level without manipulation. A total of 141 respondents participated and completed two questionnaires: a self- designed General Physics 1 test and the adopted VARK learning style questionnaire, all conducted in the setting of GANHS. The study's findings revealed that 57 learners, accounting for 40. 4%, scored below 17 on the raw score, indicating a low retention level under the "Did Not Meet Expectations" category. The most common learning style among the respondents was kinesthetic, representing 67. 4%, while visual learners constituted the least common group at 10. 6%. The Fisher exact test resulted in a p- value of 0. 625, suggesting no association, and a 0. 166 value for Cramer' s V, which categorized the relationship between the variables as weak. The findings suggest a modification in the traditional approach, where educators can align their methods with students' diverse learning styles. Researchers recommend implementing modular activities, video- based and game- based teaching methods, and kinesthetic learning activities to enhance student retention.

Key Words: retention level; learning styles; VARK; General Physics 1; retention-enhancing

1. INTRODUCTION

The discussion of forces, motion, and behavior of matter in space and time is covered by physics, and its understanding significantly contributes to the STEM field. General Physics is a crucial specialized subject in the SHS curriculum that tackles basic physics concepts. Therefore, it is necessary for the students to deeply understand these basic ideas because they serve as the foundation for understanding the complex concepts regarding the existing forces or natural occurrences that they experience in daily life (Brown & Weidner, 2024). Fundamental concepts in physics are beneficial in a deeper understanding of advanced and complex physics discussions at higher education levels; learners who lack this basic knowledge tend to face challenges in comprehending advanced physics ideas. Filipino high school learners scored a low mean percentage of 23.59% in the 2012-2013 NAT. Based on a DepEd report, this indicates a widespread difficulty in learning quality.

Furthermore, in the 2015-2016 Global Competitiveness Report of the World Economic Forum, the Philippines quality of education in math and science ranked 67th of 140 countries, while in the 2016-2017 data, it ranked 79th of 138 countries (Cruz, 2017), indicating a decline locally and internationally. Factors affect learners' understanding of complex physics lessons; the study of Nava and Camarao tackles ineffective teaching methods, insufficient math skills, and an over-reliance on memorization rather than understanding. This finding is further supported by Bray and Williams (2020), which indicates that many students struggle with physics because the teaching methods do not accommodate diverse learning styles. Moreover, the struggles that students usually encounter in learning General Physics 1 are due to the practice that they perform during earlier grades, where students frequently memorize the formulas or abstract concepts in General Physics 1 rather than acquiring a profound knowledge regarding the application of the concepts in physics in day-to-day activities. Students' memory can be affected by these circumstances, where applying fundamental knowledge to advanced concepts is harder, with a low amount of retained information from past learning students. Furthermore, analyzing learner retention can improve the quality of students' learning and teachers' teaching approaches.


Thus, this study aims to determine if there is an existing relationship between learning styles—visual, auditory, reading/writing, and kinesthetic—and the knowledge retention of Grade 12 STEM students in General Physics 1 at Golden Acres National High School-Senior High School. By determining this, the researchers aim to inform teaching practices that can enhance learning outcomes. Furthermore, there are few existing studies regarding the relationship between knowledge retention and learning style; for instance, the study of Ollero (2023) focused on determining the existing relationship between learning styles and knowledge retention in terms of learning concepts regarding biology; however, this gap remains in the context of physics. Therefore, this study is of crucial importance because it aims to provide insightful findings on the existing knowledge gap, and the results of this study can provide valuable information to improve science, technology, engineering, and mathematics (STEM) education.

Particularly, this study aimed to provide valuable insights on the following questions:

1. What is the Grade 12 STEM level of retention when it comes to learning General Physics 1 at Golden Acres National High School-Senior High School?
2. What VARK learning styles (visual, auditory, read/write, and kinesthetic) are utilized by Grade 12 STEM students at Golden Acres National High School-SHS in learning General Physics 1?
3. Is there a significant relationship between the learning style and retention level of Grade 12 STEM students at Golden Acres National High School-SHS in learning General Physics 1?
4. What retention-enhancing activities can be implemented that are tailored to the identified learning styles of students at Golden Acres National High School-SHS?

2. METHODOLOGY

2.1 *Research Design*



The study is quantitative research, which deals with numerical data and definite reasoning (University of Southern California Libraries, 2022). The researcher employed a correlational research design, a non-experimental design that examines two or more variables and evaluates their relationship without manipulation (Divya Sreekumar, 2024). This design examines the relationship between the learning styles and retention level regarding General Physics 1 among grade 12 STEM students at Golden Acres National Senior High School.

2.2 Population and Sampling

The participants of this study were one hundred forty-one (141) enrolled Grade 12 STEM students in the school year 2024-2025 who had taken General Physics 1 at Golden Acres National High School-SHS. Seventy (70) male students and seventy-one (71) female students composed the study respondents. Thirty-seven (37) students came from the section FAITH, thirty-six (36) students came from the section KINDNESS, thirty-five (35) students hailed from the section UNITY, and thirty-three (33) learners were selected from the section VIRTUE. The majority of these respondents are seventeen (17) years old, while the others' ages range between seventeen (17) and twenty-one (21) years old. The respondents completed their General Physics 1 in their first semester, and their knowledge of this subject makes them an appropriate sample for the study.

2.3 Research Instrument

To collect data, the researchers utilized two instruments. The VARK Questionnaire by Neil Fleming was adopted with formal permission from the official VARK Learn website. From the study of Tomic (2023), forty (40) article reviews found that the VARK questionnaire is a valid and reliable tool for assessing individual learning style preference across four categories: visual, auditory, reading/writing, and kinesthetic. The second instrument was a self-made

General Physics 1 retention test. The researchers developed the test content using Bloom's Taxonomy, ensuring it aligns with the Department of Education's curriculum for General Physics 1. This test was validated through pilot testing and was face and content validated with a General Physics 1 instructor and an English major teacher. Researchers utilized this instrument to measure how well participants retained information about General Physics 1 topics.

2.4 Data Gathering Procedure

The study sought formal approval from the school principal to conduct research at GANHS. A pilot test was administered to fifteen (15) Grade 12 STEM students from Saint Francis of Assisi College Bacoor to evaluate the reliability of the test. Additionally, General Physics 1 and English teachers validated its content and construction. Next, the researchers provided the informed consent form to the respondents. They discussed the study's goal and their rights with ethical considerations through orientation to ensure their voluntary participation and the right to withdraw their involvement. Afterward, consents were collected. Then, the respondents completed both the VARK Questionnaire and the General Physics 1 retention test during a scheduled class session, where the completed forms were collected for analysis.

Treatment of Data

1. **Frequency and percentage** were utilized to analyze the retention level and learning styles of Grade 12 STEM learners.
2. **The study utilized mean, median, and mode** to determine the respondents' average retention level. Researchers used the central and most frequent scores from the General Physics 1 Test.
3. The study used the scale in DepEd Order No. 8 s. 2018 to define the respondents' level of knowledge retention according to their scores obtained from the General Physics 1 test.

Table 1. The Basis for the Level of Knowledge Retention of Student

Level	Raw Score	Grading Scale	Remarks
Outstanding	25 - 30	90 - 100	Passed
Very Satisfactory	23 - 24	85 - 90	Passed
Satisfactory	20 - 22	80 - 84	Passed
Fairly Satisfactory	18 - 19	75 - 79	Passed
Did Not Meet Expectations	0 - 17	Below 75	Failed

Source: *DepEd Order no. 8 series 2015*

4. **Cluster analysis** is a tool that finds similarities and differences in every data set to identify patterns. The researchers used this method to group the learning styles into five clusters. They used a two-stage cluster analysis method, performing initial and final clustering. This tool ensures that students with multiple learning styles are acknowledged.

5. **The Fisher Exact Test** was used to test the relationship between retention level and learning styles of Grade 12 STEM students at Golden Acres National High School-SHS with a significance level of 95% ($\alpha = 0.05$).

3. RESULTS AND DISCUSSION

Table 2. Frequency and Percentage for the General Level of Retention among Grade 12 STEM Students

Variable	<i>f</i>	%
Outstanding	20	14.2%
Very Satisfactory	17	12.1%
Satisfactory	28	19.9%
Fairly Satisfactory	19	13.5%
Did Not Meet Expectations	57	40.4%

Table 2 shows the number and proportion of Grade 12 STEM students on each retention level using frequency and percentage (%). The analysis identified the highest frequency of Did Not Meet

Expectations, with 57 responses, accounting for 40.4%. In contrast, it identified the lowest frequency of Very Satisfactory with 17 responses, representing 12.1%. This information meant that a significant portion of the students obtained a failing score below 17 on a 30-item test, indicating low retention in General Physics 1. In contrast, the lowest proportion of students had satisfactory retention or strongly understood the General Physics 1 subject.

Table 3. Mean, Median, and Mode of Retention Scores for Grade 12 STEM Students

	Retention Scores
Mean	19.28
Median	19
Mode	17

The researchers determined the mean, median, and mode in assessing retention scores. These three important central tendency measures measured respondents' general average along with the central value with the arrangement of scores from lowest to highest and the researcher's utilized mode for determining the most frequent retention score. Table 3 showed that respondents obtained a mean score of 19.23, suggesting that learners could retain moderate General Physics 1 concepts. Additionally, a retention score of 19 was the median; it indicates that half scored below this value and half scored above. The mode of 17, the most frequently occurring score, reflects that many students had lower retention levels, aligning with the high percentage in the Did Not Meet Expectations category.

Table 4. Frequency and Percentage of the Learning Styles among Grade 12 STEM Students

Variable	<i>f</i>	%
Visual	15	10.6%
Auditory	44	31.2%
Reading and Writing	21	14.9%
Kinesthetic	95	67.4%



Table 4 shows the number and proportion of Grade 12 STEM students on each learning style using frequency and percentage (%). In contrast, the study identified the highest frequency of kinesthetic ($f = 95, 67.4\%$) and the lowest frequency of visual ($f = 15, 10.6\%$). This information meant kinesthetic was the most common learning style among Grade 12 STEM students, while visual was the least common. The total frequency exceeds 141; this resulted from respondents with more than one dominant learning style, indicating some learners possess multi-preference learning.

Table 5. Cluster Analysis for the General Distribution of Grade 12 STEM Students in Terms of Learning Style

Cluster	f	%
1	15	10.6%
2	20	14.2%
3	14	9.9%
4	66	46.8%
5	26	18.4%

Table 5 shows the number and proportion of Grade 12 STEM students in each identified cluster obtained from Two-Stage Cluster Analysis using frequency and percentage. The researchers used this method to determine the number of clusters and to group the learning styles of respondents in each cluster based on similarities and differences in every data set to identify patterns. It was a tool to analyze learning styles without disregarding learners with more than one learning style, whereas Cluster 4 ($f = 66, 46.8\%$) had the highest frequency, while Cluster 3 ($f = 14, 9.9\%$) had the lowest.

Table 6. Cluster Analysis for the General Characteristics among Clusters of Learning Style

	Visual	Auditory	R&W	Kinesthetic
Cluster 1	100.0%	6.7%	6.7%	60.0%
Cluster 2	0.0%	15.0%	100.0%	30.0%
Cluster 3	0.0%	100.0%	0.0%	100.0%
Cluster 4	0.0%	0.0%	0.0%	100.0%

Cluster 5	0.0%	100.0%	0.0%	0.0%
-----------	------	---------------	------	------

Table 6 shows the proportion of students' learning styles across clusters using percentages, whereas the highest percentage per cluster indicates the most common learning style in each cluster. Results showed that the most common learning styles are visual in Cluster 1, Reading and Writing in Cluster 2, kinesthetic in Cluster 4, auditory in Cluster 5, and auditory in Cluster 3. The data indicated that each of the four clusters contained only one everyday learning style among its members. In contrast, the researchers recognized the students in cluster 3 as having auditory and kinesthetic learning styles.

Table 7. Fisher's Exact Test for the Association of Learning Style and Level of Retention

Variable	Test	p	Cramer's V	Interpretation
Learning Style*	Fisher's Exact Test	.625	.166	Not significant
Level of Retention				

Table 7 shows whether the association between learning style and level of retention among Grade 12 STEM students is statistically significant. In line with this, researchers used Fisher's Exact Test with Cramer's V. The reason for this is that the study has categorical variables (the learning style and retention level) with a contingency table of 6x5, and some groups had an expected frequency below 5, making it an appropriate alternative to the Chi-square test. Meanwhile, Cramer's V intends to measure the strength of the association between the two variables. From the Fisher Exact Test result at a 95% significance level ($\alpha = .05$), the p-value was more significant than α ($p = 0.625$), indicating no significant relationship. This idea implies that a student's learning style is unrelated to their retention level, and both variables are independent. The computed result of Cramer's V ($= 0.166$) supports the weak relationship between the two.

Retention-Enhancing Activities

From the study's findings, most respondents did not reach the passing score, with raw scores below 17, categorized as the "Did Not Meet Expectations" retention level. This information implies low retention in General Physics 1, and with this, the researchers suggest retention-enhancing activities. Introducing new and different teaching approaches in General Physics 1 from traditional teaching could help enhance student retention. Teachers could apply the following:


It is required to have Modular-based activities are beneficial as knowledge-enhancing material for subjects that require memory retention and knowledge application. A high percentage, 95.46%, of students answered that the module activity helped them understand expectations for learning in the course, and a high percentage, 96.97%, answered that the module was an effective instructional method (D'Ambrosio, 2024). Additionally, Mustofa et al. (2025) supported modular activities, as study findings showed that they could significantly enhance students' computational thinking skills, along with student performance, with an N-gain score of 0.78, indicating a high level of performance. Furthermore, the paired sample t-test produced a p-value < 0.001 , confirming that the modules statistically improved students' academic performance. Additionally, Dapitan and Salendab (2021) found that the modular learning approach (MLA) positively impacts student learning. The study found a significant moderate correlation ($r = 0.45$) between the effectiveness of the MLA and students' academic performance. Thus, the researchers recommended that educational institutions continue utilizing MLA and further enhance its application.

Video-based teaching and Learning (VBTL) is an effective learning material that increases academic performance. The investigation of Lewis (2022) showed a significant improvement in student performance, with an increase of 15% ($t = 4.36$, $p < 0.01$) in the mean score. The researchers conducted a quasi-experimental design with pre-test and post-test to measure and evaluate the effectiveness of video-based instruction in the study. These results demonstrate the ability of video-based teaching to facilitate better comprehension and retention of

material. Additionally, the study of Hernandez (2022) evaluates the impact of video-based instruction on academic performance, where findings showed a statistically significant improvement of approximately 20% in test scores ($F(2, 147) = 5.67$, $p < 0.05$) using the intervention compared to traditional lecture-only instruction. The data indicated that students who used videos for reinforcement demonstrated higher retention levels and performed better in assessments.

Game-based learning provides actual participation that enhances the engagement and interest of students. This method enhances cognitive skills in educational environments, whether digital or non-digital games (Prensky, 2001). The study of Nor (2024) supports the implementation of this approach, where it shows a mean score of 4.37 for student motivation, indicating a very high perception of motivation with game-based learning. Furthermore, Egara and Mosia (2024) used ANCOVA to determine the significant differences, where findings showed significantly higher retention scores in game-based learning compared to the control group. In terms of cognitive skills, the study by Smith (2020) shows that game-based learning improves the problem-solving and retention of learners. Osadcha et al. (2020) stated that game-based learning promotes individualized learning by engaging learners in personalized activities that align with their strengths and improve their weaknesses. Additionally, the study of Korhonen et al. (2020) supported the later information whose findings resulted in learners significantly improving their learning performance and self-regulated learning strategies with games-based learning. Lastly, a study by Bauer et al. (2020) shows a significant improvement in student collaboration and teamwork skills after the intervention of a game-based approach.

In addition, the study results indicated that Grade 12 STEM students' everyday learning style is kinesthetic. The researchers propose approaches related to kinesthetic learning, including experiments, role-play, creating crafts and diagrams, and flashcard drills with movement. Based on Peace P. et al. (2024) study, kinesthetic learning is a practical approach to increasing student engagement and knowledge retention and developing practical skills, particularly in nursing education. Involving



learners in learning develops student confidence and prepares them for real-life application. Acharjee et al. (2023) introduce the Kinesthetic Learning Activity (KLA) in teaching basic physics concepts, especially in the photoelectric effect topic of Grade 12 in two schools in Kolkata. The results indicate a significant improvement in learners' performance after the intervention, and a high score was obtained in the post-test compared to the pre-test, suggesting a highly significant difference, with a t-value of 21.289 and a p-value of 0.000. The study concludes that KLA improves students' understanding of physics and the topic of the photoelectric effect.

4. CONCLUSIONS

To sum up, this paper contended that participants exhibit a low retention rate in General Physics 1, with a retention percentage of 40.3% falling within the "Did Not Meet Expectations" category. To sum up, this paper contended that participants exhibit a low retention rate in General Physics 1, with a retention percentage of 40.3% falling within the "Did Not Meet Expectations" category.

The present findings confirm that respondents have a mean score of 19.28 out of 30-item tests in General Physics 1.

Importantly, the study results provide evidence for Kinesthetic learning as a strong learning style in Grade 12 STEM, with 67.4% indicating a preference for physical learning and engagement with experiments. Visual learning is the least common learning style, with 10.6%.

On this basis, the study concludes that there are major learning styles where learners tend to learn better. In the cluster analysis of the present study, cluster 3 indicates that students obtained more than one everyday learning style, the kinesthetic and auditory. The result suggests a multi-preference learning approach, where students possess various learning methods.

Moreover, the study accepted the null hypothesis with no significant relationship between learning styles and knowledge retention in learning General Physics 1.

5. ACKNOWLEDGMENTS

Behind this study's success, the researchers are grateful to those who supported and contributed to completing the research.

First, thanks to Almighty God for providing strength and guidance.

They thank their school principal, Sir Angelo D. Armas; assistant principal, Ma'am Sheila M. Porras; and academic coordinator, Ma'am Louise Daiz P. Lopez, for allowing the study to be conducted in the school.

Thanks to the panelists, Mr. Virgilio G. Torio Jr., Mr. Oscar T. Fuentes III, and Mr. Benjamin Zamora, for sharing their expertise and improving the paper.

The researchers are grateful to their research adviser, Sir Jerald S. Liboton, for his time and guidance and to their class adviser, Ma'am Jaiza Cia, for validating the research instrument and offering continuous support.

Lastly, they thank their parents for providing everything they needed, primarily financial and moral support.

6. REFERENCES

- Acharjee, S. R. et al. (2023). *Innovations in Teaching: A case of using kinesthetic learning activity for teaching physics*. *Indian Journal of Extension Education*, *59*(4), 54–57. <https://doi.org/10.48165/ijee.2023.59411>
- Atiq, A. F. et al. (2023). *The Effectiveness of Game-based Learning in Enhancing Students' Motivation and Cognitive Skills*. *Journal of Education and Teaching Methods*, *2*(3), 50–62. <https://gprjournals.org/journals/index.php/JETM/article/view/199>
- Bray, A., & Williams, J. (2020). *Why is physics hard? Unpacking students' perceptions of physics*. *Journal of Physics Conference Series*, *1512*(1),

012002. <https://doi.org/10.1088/1742-6596/1512/1/012002>
- Brown, L. M., & Weidner, R. T. (2024, December 9). *Physics / Definition, Types, Topics, Importance, & Facts*. Encyclopedia Britannica. <https://www.britannica.com/science/physics-science>
- Camarao, M. K., & Nava, F. J. (2019). *HIGH SCHOOL STUDENTS' DIFFICULTIES IN PHYSICS**. University of the Philippines Diliman- College of Education.
- Cruz, M. J. S. D. (2017, March 11). *Science ed and a thinking society / Inquirer Opinion*. INQUIRER.net. <https://opinion.inquirer.net/102324/science-ed-thinking-society>
- D'Ambrosio, L. (2024). *A modular activity to support knowledge retention, application, and metacognition in undergraduate immunology*. Journal of Microbiology and Biology Education, 25, e0011024. [10.1128/jmbe.00110-24](https://doi.org/10.1128/jmbe.00110-24).
- Dapitan, Y. C., & Salendab, F. A. (2021). *Effectiveness of modular learning approach (MLA) and students' academic performance in Sultan Kudarat State University-Kalamansig Campus*. Vidyabharati International Interdisciplinary Research Journal (Special Issue on Emerging Techniques in Interdisciplinary Sciences), 164, 1–7. <https://www.researchgate.net/publication/364653318>
- Hernandez, G. (2022). *The use of videos in teaching could improve academic performance by 20%*. Universitat Oberta de Catalunya News. <https://www.uoc.edu/en/news/2022/059-video-student>
- Lewis, J. (2022). *The effectiveness of video-based instruction in enhancing student learning outcomes*. Journal of Instructional Educational Research, 15(4), 98–113. <https://jier.org>
- Mustofa, M. et al. (2025). *Implementing a science module based on microcontrollers to improve students' computational thinking skills in the earth science course*. Jurnal Penelitian Pendidikan IPA, 11(2), 752–760. <https://doi.org/10.29303/jppipa.v11i2.10348>
- Nor, Amirudin. (2024). *Motivation in Game-Based Learning: A Study on Technical Analysis Education*. Information Management and Business Review, 16, 288-294. [10.22610/imbr.v16i4\(S\)I.4337](https://doi.org/10.22610/imbr.v16i4(S)I.4337).
- Ollero, J. (2023). *Analysis of the Grade 10 Students' Retention Level of Basic Biology Concepts and Terminologies in Relation to their Learning Styles*. IJCER (International Journal of Chemistry Education Research), 11–18. <https://doi.org/10.20885/ijcer.vol7.iss1.art3>
- Peace, P. et al. (2024). *Evaluating the Effectiveness of Kinesthetic Learning*. https://www.researchgate.net/publication/385285787_Evaluating_the_Effectiveness_of_Kinesthetic_Learning
- Tomić, D. et al. (2023). *Exploring the VARK model: A review of the validity and reliability of the questionnaire and its relationship to learning outcomes*. https://www.researchgate.net/publication/371633359_Exploring_the_VARK_model_a_review_of_the_validity_and_reliability_of_the_questionnaire_and_its_relationship_to_learning_outcomes