Int. j. adv. multidisc. res. stud. 2025; 5(5):365-372

Received: 25-07-2025
Accepted: 05-09-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Role of Bioman in the Memorization of Grade 11 Students of Young Achievers' School of Caloocan, Inc.

[1] Dy Iris Bianca Claire G, [2] Bacsa Rex Ivan R, [3] Bautista Sean Matthew H, [4] Cruz Angelo S, [5] Ofiaza Mariel Roeann F, [6] Soroan Aleiza May C, [7] Tamayo John Oscar E, [8] Temporoza Daniel James C, [9] Trembevilla Micquia G, [10] Doloque Cornelio S

[1, 2, 3, 4, 5, 6, 7, 8, 9, 10] Young Achievers' School of Caloocan, Inc, Philippines

Corresponding Author: **Dy Iris Bianca Claire G**

Abstract

Grade 11 STEM students have trouble maintaining their interest and engagement when it comes to learning new lessons, which severely affects their grades. One of the subjects is General Biology, wherein complex lessons such as learning about cells could illuminate overall understanding. Memorization is key when it comes to studying general biology topics, as it consists of terminologies and processes that requires not only basic understanding and comprehension but also strong recollection and retention. Many other studies have delved deeper into this concept and have researched a variety of other techniques which may be used to improve memorization. However, the purpose and objective of this study is to determine the role of "Bioman Biology" in Grade 11 Science, Technology, Engineering, and Mathematics students of Young Achievers' School of Caloocan, Inc. in General Biology 1 topics.

This research will provide insights on how "Bioman" can enhance the memorization of Grade 11 STEM students. Additionally, the researchers aim into delve deeper in the various functionalities of "Bioman" in improving memorization and if ever this specific gamification website can actually produce an effective outcome when it comes to academic performance. Moreover, it can measure the effectiveness of using it as a tool for academic improvement. The researchers aim to use this study as a basis to assist future researchers and grade 11 senior high school students in terms of improving and increasing their memorization capacity and retention skills. This study utilizes a quantitative and true-experimental approach through pre-tests and post-tests that are answered by 20 Grade 11 STEM students. It is divided into 2 groups, which are the experimental and control groups; it is to compare and analyze the outcomes, which will be the basis of the study. The outcomes of the tests will show the results of the experiment and show whether "Bioman" is proven to be effective. The results are then used by the researchers to assess whether the hypothesis of the study is accepted or not.

Keywords: General Biology, Gamification, Memorization, Comprehension, "Bioman"

Introduction

The Science, Technology, Engineering, and Mathematics strand is an academic track in senior high school which includes a variety of complex and challenging topics that attempts to sharpen the student's overall capabilities in terms of memorization, comprehension, analytical, and critical thinking skills. In recent years, STEM has become one of the most valued and vital educational systems for its crucial role in building the knowledge and skills of young students in many areas which requires efficiency, productivity, and strong capabilities to function in a real-world dynamic, including the social, political, industrial, economic, and other intricate yet essential work environments that may affect the operation of human society.

One of the key aspects of learning new topics is memorization which is also considered a skill that needs to be honed by all students. According to Güneş (2020) [5], memorization is beyond just a simple teaching technique and is also one of the oldest approaches used in education. In terms of learning strategies, memorization is required when encountering new topics in school. Senior high school students, especially in the STEM strand, have opted to the use of memorization when it comes to learning mathematical and scientific formulas, famous and relevant historical figures, important and essential dates, difficult

and scientific terminologies, and many more.

Senior high school students in the STEM strand are taught a wide variety of lessons and topics which provides them with the needed skills to survive in their future endeavors. One of the most complex and extensive subjects offered in grade 11 STEM strand is General Biology. According to Pechenik (2024) [9], in his book "*A short guide to writing about biology,"* biology is a way of thinking about the world. This means that it encompasses many factual topics about the systems, functions, and origins of all biological factors that are present on Earth. Additionally, this topic also comes with a wide range of terminologies that may prove to be challenging for the average grade 11 student. Due to its complexity, many students have a hard time grasping the concepts related to topics in biology. This specific topic requires a variety of learning approaches such as memorization, reading comprehension, and interpretations. General biology is a study of living things and their vital processes which often leads to the need for memorization that some students have struggled with. One of the main issues that many students face during their academic years is the absence of studying techniques that could potentially help them lessen the burden of studying and maintaining retention. And due to its lack of interesting qualities, it decreases the students' dedication to learn which may in turn affect their academic performance.

"Bioman Biology" is a free website created in 2008 with the sole purpose of making learning in biology more fun, engaging, and interactive for the users or students. It contains various game-based learning methods by using virtual labs, simple videos, interactive activities, and fun quizzes which allows the students to have a more graphic and engaging guide to the various topics in General Biology. For Grade 11 STEM students of Young Achiever's School of Caloocan, Inc., General Biology is one of the major subjects that is included in their curriculum. This study delves into the role of "Bioman" in enhancing the memorization of Grade 11 STEM students, seeking to determine whether this game-based learning tool is an effective approach for those who struggle with topics related to biology. Furthermore, this study includes figuring out the various possible factors which might affect a student's learning and memorization abilities. The researchers of this study aim to explore and prove the effects, benefits, and relevance of "Bioman" and its role in the memorization skills of Grade 11 STEM students of school year 2025-2026.

With the support of collected research studies conducted by other researchers in relation to gamification and its purpose on improving the memorization of STEM students, the researchers of this study were able to create various understandings that would provide the basis in conducting this study. Firstly, it is a general understanding that memorization is one of the key components when it comes to learning, however, it becomes a very significant tool for STEM students who are specifically in general biology courses. According to Doloritos *et al*. (2025) [3], the effectiveness of memorization, particularly its impact on learning outcomes, garnered substantial attention in much educational research. Additionally, a study conducted by Dedecker *et al*. (2023) [2], which mainly focuses on determining the students' perceptions in PS courses within the context of the importance of memorization and student motivation, also adds emphasis to the concept of how significant memorization is to a students' learning techniques.

Secondly, it has been proven by other studies (Selçuk & Keskin, 2024) [14] that the visual and graphic interactive features of gamification tools and websites provide a better format for improved memorization skills. This was also supported by other researchers like Alviar (2024) [1], who focuses on the importance of virtual laboratories, like "Bioman", in learning biology topics. Lastly, Farxodovna & Rustamovna (2025) [4] were able to conduct a study which delves deeper into the various uses and purposes of gamification tools, including "Bioman biology", in an educational setting. They were able to conclude that "Bioman" emphasizes gamification elements and virtual laboratories in providing knowledge and motivation in memorization to students.

From these studies, the researchers were also able to conclude that "Bioman Biology", like other gamification tools and websites, contains the needed visual and interactive elements as well as the educational and instructional discussions to become an effective learning tool. One of the key advantages of "Bioman" is that it does not only provide engaging and unique video games which relate to the topic at hand, but it also contains simple quizzes and instructional videos so that students can switch from passive to active learning styles which can be progressive in improving memorization. However, as various studies suggest, "Bioman" also has potential disadvantages that affect a student's learning.

Methodology

Research Design

This study is quantitative research which mainly focuses on interpreting numerical data instead of using opinionated or subjective evidence to reach to research conclusion. The researchers choose quantitative research design due to the study utilizing quantifiable measurements with the use of statistic tools and instruments, such as surveys, numerical data, and statistical analysis.

Specifically, this study uses experimental research with a pre-test and post-test control group design to investigate whether there are any significant difference or effects between the test scores of grade 11 STEM students before and after being introduced to an intervention, which is the gamified tool "Bioman" Biology. A true experimental research design is a complex design for it requires the researchers to identify the research variables, process of experiment, research objectives, and respondents for the experiment. With the addition of the control group, the researchers will be able to isolate each variable of the study and conclude the effects of "Bioman". The difference of the test scores between the two groups is then analyzed to reach a valid conclusion. An article by Zubair (2023) [16] stated that experimental research is a type of design that requires strict control of the researchers towards an independent variable to see its effects on a dependent variable. Experimental research is focused on establishing cause and effect between variables. With this purpose, experimental design is a form of explanatory re-search (Thomas & Zubkov, 2023) [12].

In conclusion, as the researchers focuses on the possible roles or impacts of "Bioman" to the memorization of Grade 11 STEM students, a quantitative experimental research design is the precise research design that should be used by the researchers. With this type of research design, the

researchers will be able to collect numerical and analyze the cause and effects of various factors that are included in this research study.

Locale of the Study

This study will be conducted at Young Achievers School of Caloocan Inc. A private educational institution that is located at Caloocan City. The school offers basic quality education from Pre-School to Senior High School, and it offers a variety of strands, including the Science, Technology, Engineering and Mathematics under the Senior High school program. This school was chosen as the research site because it houses numerous Grade 11 STEM students who faced various academic challenges and had encountered complex subjects that requires strong memorization and analytical skills to pass major subjects like sciences and mathematics.

The institution's supportive environment for innovative and technology assisted learning also makes it an ideal setting for evaluating the role of digital educational tools such as "Bioman". This locale allows the researchers to closely observe the impact of using "Bioman" in the memorization abilities of students within an actual classroom context. This locale allows the researchers to closely observe the role of "Bioman" in the memorization of Grade 11 STEM students.

Respondents of the Study

The researchers' only criteria for choosing the respondents for this research study are students that are currently enrolled and studying in grade 11 Science, Technology, Engineering, and Mathematics strand at Young Achievers' School of Caloocan, Inc. of school year 2025-2026. Additionally, these students must have prior knowledge in using gamified tools and manipulating gadgets, such as phones and laptops, to be chosen as a respondent. The total population of grade 11 STEM students is 169, in which the researchers chose 20 students to be their respondents. For this research study to be unbiased and remain its objective purpose, the researchers decided to conduct a simple random sampling technique conducive to equal opportunities for all grade 11 STEM students to participate as respondents for this study.

According to an article by Noor *et al*. (2022) [8], the simple random sampling technique is a widely utilized sampling method in many forms of research and is solely based on luck. Additionally, the article also stated that this type of sampling technique is highly favorable to use for homogenous and uniformly selected participants to ensure unbiased, independent, and equal probability of the population. Although this technique may prove to be cumbersome to utilize for larger numbers of populations, the researchers decided that it is the most suitable sampling method for this specific research study.

According to a journal by Memon *et al*. (2020) [7], determining an appropriate sample size is vital in drawing realistic conclusions from research findings. Having a large sample size is unethical and having a small sample size will lead to inaccurate or invalid data interpretation. Therefore, the researchers obtained the exact number of Grade 11 STEM students studying at Young Achiever's School of Caloocan, Inc. and calculated the sample size required for this quantitative experimental study.

Data Gathering Procedure

A letter of request to conduct the study will be forwarded to the Young Achiever's School of Caloocan, Inc. Senior High School Administrator. After the approval, the researchers are given permission to conduct this research study.

The researchers will utilize simple random sampling, a type of probability sample, to obtain the respondents needed for the study. Simple random sampling will be used for the reason that every member of the population has an equal chance to be selected which corresponds to the goal of the research to determining the role of "Bioman" in the memorization of grade 11 STEM students. Out of 169 students, 20 students will be the sample size of the study.

The researchers will first divide the respondents randomly into 2 groups, one is labeled as the experimental group while the other will be the control group. The researchers will then provide a pretest to the respondents to identify their initial academic performance before the introduction of an intervention. The contents of the pre-test will include general biology topics, specifically "The Cell Transport Mechanisms". The respondents are given 10 minutes to complete the pretest.

After completing the test, the researchers introduced the intervention to the experimental group while the control group underwent no such intervention or treatment. The researchers will first introduce the usage of "Bioman" before allowing the respondents to explore the various features of the website. During the intervention process, the researchers will observe how the experimental group positively and negatively interact with the features of the website to learn the lessons provided.

After 30 minutes, a post-test will be given to the same respondents, which will measure if there is an improvement in academic performance and memorization between the experimental group and the control group. The respondents are given 10 minutes to complete the posttest. After the respondents complete the tests, the researchers will gather, analyze, and tally the data. The respondents will be confidential and will not be revealed by the researchers.

Data Gathering Instruments

The instruments used to collect data for this study are pretests and posttests that are self-made by the researchers which are approved and certified by the research teacher. Due to the study being experimental in design, the researchers created a self-made pretest and post-test to determine the memorization of grade 11 STEM students before and after the intervention.

The researchers will conduct a self-made pre-test and post-test to gather data on the role of "Bioman" on Grade 11 students' memory. The pre-test sets a baseline, and the post-test evaluates the level of change caused by the intervention. In addition, the respondents were senior high school Grade 11 students. Pre-testing and post-testing are essential components of research and evaluation methodologies, utilized across various fields including education, healthcare, psychology, and marketing (Majka, 2024) [6]. And according to Villaruel (2025) [15], post-tests are conducted after an intervention to evaluate any changes that have occurred and are commonly used alongside pre-tests to measure the intervention's overall effectiveness of the implementation of the intervention.

The researchers prepared a pretests and posttests which consist of a five-point Likert scale to obtain statistical data. This research study will measure the effects of "Bioman" on the basis of these quantifiable instruments.

Statistic Tools

According to Thukral *et al*. (2023) [13], the t-test is a statistical tool that is widely used in research for comparing the means of two groups. In this study, the researchers conducted an independent t-test to measure the means of two independent groups, in this case, the control group and the treatment/experimental group. This study utilized this specific statistical tool due to the fact that, unlike other varieties of t-tests, the independent samples t-test compares the mean scores of two independent groups of the same population in order to determine whether there is any significant difference between them.

This statistical tool is used in order to determine if the control group, the group with no treatment or involved intervention, and the experimental group, the group introduced to an intervention, have any difference between each other. Therefore, an independent sample t-test will allow the researchers to deduce whether "Bioman" has any effect in the memorization of the respondents or if it has no significant difference.

Additionally, this study also utilizes the paired t-test, which is also known as the dependent sample t-test, in order to determine if there is a significant difference between the pre-test and post-test of the experimental group. According to Sedhai (2025) [10], a paired design consists of one group with two data sets related to each other which means that a paired t-test is used when it comes to comparing paired data sets that are related. Likewise, Talikan *et al*. (2025) [11] stated in their research that the paired samples t-test is a commonly used statistical procedure for comparing the means of two paired populations to determine their equality. This is important in order to know if two similar and related groups have a difference before and after taking an intervention. This is used to answer the SOP of the study.

Results and Discussions

This chapter is the compilation, summarization, and analyzation of the collected data from the tests conducted among the grade 11 Science, Technology, Engineering, and Mathematics strand of Young Achievers' School of Caloocan, Inc. In this chapter, the researchers will discuss if the alternative hypothesis of the study is accepted or not through the results of the test score data between the control group and the treatment group. Additionally, this study also conducted a pretest to obtain the base scores of the experimental group before they took the final test so that the researchers can determine whether "Bioman" could improve the performance of the respondents or not.

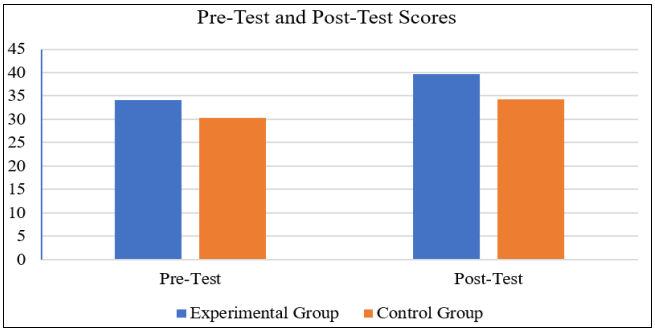

Fig 1: Pre-Test and Post-Test Score Graph

The test scores of both the experimental group and control group are graphed in **Fig 1**. As seen in the graph above, the researchers were able to analyze that both groups improved during their posttest. The graph showcases the performance of each group during their pretest and posttest. The data gathered in these tests will then be used to discuss the answer to the questions of the SOP of this study.

The Effects, Importance, and Relevance of Utilizing "Bioman" Biology to the Grade 11 STEM Students

Table 1: Computed T-test Table of Treatment Group and Control Group

X_1	X_1^2	X_2	X_2^2
48	2304	30	900
50	2500	32	1024
48	2304	34	1156
36	1296	29	841
31	961	34	1156
26	676	29	841
38	1444	39	1521
45	2025	33	1089
31	961	44	1936
44	1936	39	1521
Total: 397	$\sum X_1^2$= 16,407	Total: 343	$\sum X_2^2$ = 11,985
M_1 = 397/10 = 39.7		M_1 = 343/10 = 34.3	

In Table 1, the sum of all scores of both the treatment group and the control group are shown. Then the researchers squared each of the scores before computing the sum of all the squared test scores of the two groups. After that, the researchers computed for the t-statistic value and the p-value to determine whether the hypothesis of this research study is accepted or not.

The researchers first created a null hypothesis to determine the results of the independent t-test. The null hypothesis (N_0) states that there is no significant difference between the test scores of the treatment group and the control group, which

means that "Bioman" is not effective in improving the memorization of the students. After we computed for the test values and p-value, the researchers were able to reach a conclusion.

Since the t-value (1.74) is higher than the table-t value (1.734), the researchers concluded that the null hypothesis is rejected. Therefore, there is a statistical difference between the test scores, and the alternative hypothesis is accepted. This proves that "Bioman" is effective in improving the test scores and memorization of the Grade 11 STEM students.

The Effects: Based on the results of the tests of the respondents conducted by the researchers which may be found on Table 1, there is a significant difference between the treatment group and control group of students' test scores after the implementation of "Bioman" Biology as a learning method, showing that the tool had a positive effect on their memorization skills. Additionally, the post-test scores of the treatment group are higher compared to the control group, with many enhanced recalls in different complex topics in general biology. It suggests that the game-based features of "Bioman" helped the students in storing their memories by actively engaging.

This research emphasizes the benefits of gamified learning tools, specifically the "Bioman" biology, in enhancing the student's memorization. The students' feedback indicated increased enjoyment in studying different topics in biology, which likely improved the memorization of the students during the lessons. The utilization of "Bioman" biology demonstrates a positive effect on the memorization skills of grade 11 STEM students in general biology topics. It shows that this digital tool can enhance students' learning outcomes when it comes to science education.

The Importance: "Bioman" biology introduces educational content through games that support active participation of the students, making it more entertaining and meaningful for the students who are using it. The results of the post-test present strong evidence that the different complex topics in "Bioman" were easier to understand when delivered through "Bioman" biology. It shows that "Bioman" is important as a strategic component in biology education, as it contributes to the understanding and long-term memory of the students. Additionally, for those students who may struggle with textbook-based learning, they showed benefits from the gamified activities, which allowed the students to engage with the content at their own pace.

Based on the results, it shows that after the implementation of "Bioman" as a learning tool, it improves the test scores of the students from the treatment group. It shows the importance of "Bioman" as a learning method, because it provides enough sources for the students to understand the different complex terms in biology topics. Also, after computing the results of the students from the pre-test and post-test, the researchers can conclude that "Bioman" really helps when it comes to improving the memorization skills of the students. In conclusion, the utilization of "Bioman" proved to be important in improving the memorization among grade 11 STEM students. The observed test scores highlight its role not just as an engaging educational aid, but also as a tool in reinforcing learning outcomes in general biology topics.

The Relevance: The Science, Technology, Engineering, and Mathematics strand has complex topics in its curriculum, and each topic contains various information that students struggle to memorize and understand. Since General Biology is a specialized subject, and due to the multiple activities of "Bioman" Biology, the relevance of "Bioman" Biology to the respondents is that they use this website to strongly enhance their memorization because they find it more engaging to learn and it motivates them to study. Additionally, based on the results between the pretest and posttest, it is proven that there is a significant difference between the test scores. Proving that it is effective to be used as their learning technique.

The Factors that Hinder the Memorization of Grade 11 STEM Students

The factors that prevent Grade 11 STEM students from improving their memorization skills include the lack of effective learning tools that can help in better understanding and recalling of information, as shown by the results of the experiment. Without interactive and engaging educational resources, students resort to the use of traditional learning methods, which can limit their active participation and ability to remember concepts effectively. Furthermore, the lower mean scores of the control group compared to the experimental group suggest that the absence of a gamification study tool or interventions reduces the chance for better comprehension and retention of information, making it more challenging for students to significantly improve their academic performance.

Table 2: Percentage Answers in Likert Scale Pre-test

Question #	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)
1	5%	65%	20%	10%	0%
2	20%	55%	20%	5%	0%
3	30%	50%	15%	0%	5%
4	15%	15%	30%	35%	5%
5	5%	30%	35%	20%	10%
6	20%	20%	40%	5%	15%
7	10%	15%	20%	35%	20%
8	15%	10%	45%	30%	0%
9	10%	10%	35%	40%	5%
10	15%	20%	20%	35%	10%

In Table 2, the researchers tallied the number of students who answered strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree for each item in the test. Now the researchers analyzed each question and came to the following conclusions:

1. In question 4, the statement asks whether the respondents can memorize the different transport mechanisms by reviewing the lesson once. The majority of the respondents, reaching up to 35%, answered disagree. Additionally, in question 10, when asked if the respondent had no problem in remembering and drawing the flow of molecules in a cell membrane, 35% once again marked disagree. This indicates that due to the complexity of certain topics, students have a harder time trying to remember the different lessons, processes, and terminologies. With difficulties in memorization rising from the complexity of the topics, the academic performance of the students is also deeply affected.
2. In question 7, the test asks if their average correct answers in tests or quizzes ranges from 80% or above. The result of the test showed that 35% disagreed with this statement. This indicates that most of the students are still prone to mistakes in terms of memorization

when they use traditional methods. Even if the students claim to have memorized the lessons, when applied in academic performance, most of them still failed to reach 80%.

3. Questions number 8 and 9 question the confidence of the students in their knowledge in the general biology topic and their confidence in remembering the topics in it. The result of these tests showed that 45% of the respondents answered neither for statement 8, which might imply their ambiguity and unsure stance of the respondents in this statement, while 40% disagreed for statement 9, which indicates that majority have low confidence when it comes to explaining the topics they have learned in general biology.
4. In question 6, when asked if the respondent was able to focus and maintain motivation when learning general biology topics, 40% of the students neither agreed nor disagreed on the statement. This test indicates that majority of the students are unsure of their stance when it comes to their focus and motivation. This might also indicate that the respondent is neither too focused nor less focused when it comes to general biology topics. This may have affected the motivation of the students to memorize and learn the lessons in general biology.

In conclusion, the researchers found that the main factors that affect the memorization of the students are the lack of self-confidence, the complexity of the topics, the lack of visual and creative thinking, and the lack of focus and motivation when it comes to learning general biology topics. However, in the post-test, these factors were able to be resolved once the students applied "Bioman" in their learning.

The Results in the Memorization Skills of Student Before and After Using "Bioman"

Table 3: Computed Paired T-Test Scores of the Experimental Group

X_1	X_2	d	d^2
46	48	-2	4
50	50	0	0
44	48	-4	16
25	36	-11	121
34	31	3	9
20	26	-6	36
31	38	-7	49
32	45	-13	169
28	31	-3	9
32	44	-12	144
$\sum X_1 = 342$	$\sum X_2 = 397$	$\sum d = -55$	$\sum d^2 = 557$
$M = 342/10 = 34.2$	$M = 397/10 = 39.7$		

In Table 3, the researchers gathered the pretest and posttest scores of the treatment group. X_1 represents the pretest scores while the X_2 represents the post-test scores. The researchers then computed the mean of both tests and analyzed that the posttest scores are higher compared to the pretest scores which signifies that the students from the treatment group improved their test scores after the use of an intervention. Next the researchers will identify if these scores have a significant different (H_A) or not (H_0).

To calculate the significant difference, the researchers utilized the paired t-test. First, the researchers calculated the difference between the scores and the square of the difference, as seen in Table 1. After getting the summation of the difference ($\sum d$) and squared difference ($\sum d^2$), the researchers can compute for the mean of the sample difference ($\bar{d}$) and the standard deviation (SS_D). Once all the values are collected, the researchers can now substitute the values to the formula to solve for the t-statistic of the paired t-test.

With a t-statistic value of -3.271 and a t-table value of 2.262, we can conclude that the t-value is higher in value. Therefore, the null hypothesis (H_0) is rejected and there is a significant difference between the pretest and posttest scores. Hence, the researchers can conclude that the students improved after utilizing "Bioman" as a study tool.

The respondents under the experimental group completed a pretest paper provided by the researchers before beginning the intervention and then they were given a posttest after they finished with the use of "Bioman". Through this experiment, the researchers can now determine whether grade 11 STEM students' memorization differs significantly before and after the intervention.

Based on the results of the pretest and posttest, the researchers can conclude that there is a significant change in the memorization of Grade 11 STEM students. Each of the students shown remarkable improvements during their post-tests which are proven through their performance while answering the test questions. The data results gathered from the pre-test and post-test showed that the average student was able to increase their score by 5 points after they utilized the gamified website during their study sessions. Therefore, the researchers can say that "Bioman" is effective and greatly helps STEM students in broadening their thinking and enhancing their critical thinking skills.

Advantages of "Bioman" as a Learning Tool for Grade 11 STEM Strand

Table 4.1: Percentage Answers in Likert Scale Pre-test of Experimental Group

Question #	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	Mean
4	20%	10%	20%	40%	10%	2.9
6	30%	20%	20%	10%	20%	3.3
7	20%	20%	10%	20%	30%	2.8
8	20%	10%	40%	30%	0%	3.2
9	20%	0%	30%	50%	0%	2.9
10	20%	20%	10%	40%	10%	3.0

Table 4.2: Percentage Answers in Likert Scale Post-test of Experimental Group

Question #	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	Mean
4	10%	50%	10%	20%	10%	3.3
6	30%	10%	30%	30%	0%	3.4
7	40%	10%	30%	10%	10%	3.6
8	50%	0%	20%	30%	0%	3.7
9	50%	10%	40%	0%	0%	4.1
10	60%	10%	30%	0%	0%	4.3

Table 4.1 and Table 4.2 showcases the percentage number of students who answered in each category of the Likert scale for each statement. After discovering the factors that prevent the improvement of the memorization of the respondents, the researchers tallied the results of the post-test of the experimental group to determine if "Bioman" was able to resolve these issues.

In question 4, which asks whether the respondents can memorize the different transport mechanisms by reviewing the lesson once, 60% out of 10 respondents of the experimental group agreed that they improved after using "Bioman". The mean scores of the pre-test (2.9) compared to the post-test (3.3) shows that there is a significant difference between the test-scores. This indicates that "Bioman" was able to teach information and have students retain this information even if reviewing only once.

In question 6, which states if the respondent was able to focus and maintain motivation when learning general biology topics, the mean for the pre-test is 3.3 while the mean for the post-test is 3.4 which means that "Bioman" can improve the focus and motivation of the respondents in learning General Biology topics.

For questions 7, 8, 9, and 10, we can also see that the mean scores for each question also improved significantly after the respondents utilized "Bioman" before taking the post-test. It shows that the scores of the students improved in general biology topics, improves their confidence in memorization, and improve retention.

In conclusion, "Bioman" is not only for obtaining new knowledge but also made to cater to the learner's capabilities in studying. As what the researchers observed on the post-test, students who used "Bioman" as their learning tool for biology lessons had more advantages. Based on their answers that the researchers gathered, "Bioman" significantly enhanced their memorization and retention skills and also improved their comprehension of complex topics in general biology.

The researchers also noticed an increase in their motivation and engagements when learning because of its various interactive games. Accoriding to the statistical results on Table 3, The results of the pre-test and post-tests showed that these advantages contributed to better academic performance compared to students who used traditional learning methods. Additionally, the researcher observed a remarkable difference between their answers on the likert scale survey that the researchers provide after they are learning with "Bioman". This just showed that "Bioman" really had an impact on their biology lessons as it illustrates the concept well for better understanding than those who just used a traditional learning method which is likely lacking with illustration. To conclude, students who use "Bioman" had shown noticeably differences on answers than the control group.

Conclusions

The research titled "Role of "Bioman" in the Memorization of Grade 11 Students of Young Achievers' School of Caloocan, Inc." demonstrates the impact of "Bioman" gamified learning in enhancing the memorization skills among Grade 11 STEM students. Gamified platforms can be their learning method, which is highly beneficial. The researchers, based on the data generated from the study, identified the differences with the use of t-tests and paired t-tests. Therefore, the results show that there is a significant difference between the pre-test and post-test.

The results demonstrate that "Bioman" biology functions effectively and greatly supports the growth of Grade 11 STEM students' memorization. This research study was able to prove that "Bioman" has the potential to improve and enhance the memorization of the grade 11 Science, Technology, Engineering, and Mathematics strand students by utilizing the interactive game elements which improves student engagement, and instructional videos that provides clear, concise, and easy-to-understand explanations of the various lessons in General Biology.

Recommendations

For Students: It is recommended to use "Bioman" as a supplementary learning tool for the students to improve and strengthen their memorization skills and understanding of biology topics. They are encouraged to use this educational gaming app not only during their activities inside the classroom but also as self-study sessions at home to improve their memorization skills. Due to its graphics and variety of games students will find it engaging. Additionally, "Bioman" can help them review all their biology lessons with a quizzes design especially for them.

For Teachers: It is recommended for the teachers to use "Bioman" in their lesson plans and activities to make learning more enjoyable and interactive. They can also provide clear guidance for their students about the structured activities in "Bioman" Biology, and they may evaluate the students' progress by conducting an assessment through the use of "Bioman". It makes their students capable of coping with biology's complex concepts. This study will help them to make their lessons easier to understand by making sure after using a game, it is followed by some class discussion to boost the understanding of the learners.

For School Administrators: The administrators may support the integration of "Bioman" into the school's programs by providing Internet access and equipment needed. They can also provide a training program for both students and teachers to help them ensure that the "Bioman" is really effective and has purpose as a learning tool. Researchers recommend considering providing professional development for teachers on how to effectively implement gamification for a better understanding of how to use the game.

For Future Researchers: It is suggested that they may conduct an investigation about the effectiveness of "Bioman" not only in memorization but also on other skills that "Bioman" can develop, like enhancing comprehension, critical thinking, and problem-solving. They can also conduct an assessment to know the impact of "Bioman" biology on academic performance and study habits. Furthermore, they can use a larger sample size or other academic materials to expand the results of their research.

Acknowledgement

We extend our sincerest gratitude to our school Chief Operating Officer, Mrs. Janette Hernandez-Isuela for giving the researchers the opportunity to conduct this study in the school premises. For supporting the senior high school students for providing all the facilities throughout the research process.

Secondly, for our School Principal, Dr. Rey M. Revuelto, we would like to thank and show appreciation for letting the researchers conduct the study by collecting data and giving support in completing this study.

We are also thankful to the administration and faculty of Young Achievers' School of Caloocan, Inc. for providing us with the necessary resources and support to conduct this research. Their commitment to academic excellence has greatly motivated us to pursue this study with diligence and dedication.

To our class adviser, Sir. Albert Y. Balderas, we are immensely grateful for his unconditional support, encouragement, and guidance. His patience, motivation, and belief in our capabilities have been our driving force throughout this research journey.

Additionally, we extend our sincere appreciation to our research adviser, Cornelio S. Doloque, PhD, for his invaluable guidance, constructive feedback, and unwavering support throughout the research process. His expertise and encouragement have been instrumental in shaping this study, helping us navigate challenges, and ensuring the quality and credibility of our work.

We also acknowledge and appreciate the participation of our respondents, the Grade 11 STEM students, for their willingness to be part of this study. Their cooperation and honest responses were crucial in gathering the data needed to assess the role of "Bioman" in enhancing their memorization skills.

Above all, we express our gratitude to God Almighty, for granting us the strength, wisdom, guidance, and perseverance so that we were able to complete this study despite the challenges we encountered along the way.

References

1. Alviar CE. Life Sciences Teachers' Profiles, Knowledge, Skills, Extent of Use, and Challenges in Utilizing Virtual Laboratories. In SEAQIS International Conference on Science Education. 2024; 1:11-24.
2. DeDecker S, Vale J, Gordon K, Clemmer R. STEM Student Perceptions of Problem-Solving Skill Development and The Importance of Memorization in Problem-Solving Courses. Proceedings of the Canadian Engineering Education Association (CEEA), 2023.
3. Doloritos Mico B, Rosario Vincent P, Torrejos Chrestine B. Cognitive Strategies, Visual-Spatial Abilities, and Memorization Efficacy among Stem Senior High School Students. American Journal of Educational Research. 2025; 13(4):184-232.
4. Farxodovna SS, Rustamovna SS. Opportunities for Using Innovative Software Tools in Developing Methodological Competence of Future Biology Teachers. Web of Teachers: Inderscience Research. 2025; 3(4):273-275.
5. Güneş F. Discussions of Memorization in Education. Eğitim Kuram Ve Uygulama Araştırmaları Dergisi. 2020; 6(3):409-418.
6. Majka M. Understanding the Importance of Pre and Post-Testing in Research and Evaluation, 2024.
7. Memon MA, Ting H, Cheah JH, Thurasamy R, Chuah F, Cham TH. Sample size for survey research: Review and recommendations. Journal of Applied Structural Equation Modeling. 2020; 4(2):i-xx.
8. Noor S, Tajik O, Golzar J. Simple Random Sampling. 2022; 1:78-82. Doi: 10.22034/ijels.2022.162982
9. Pechenik JA. A short guide to writing about biology. Waveland Press, 2024.
10. Sedhai G. Basic Statistical Tools in Research and Data Analysis, 2025.
11. Talikan A, Salapuddin R, Aksan J, Ismael A, Jimlah R, Idris N, *et al*. On Paired Samples t-test: Applications, Examples and Limitations, 2025. Doi: 10.5281/zenodo.10987546.
12. Thomas D, Zubkov P. Quantitative Research Designs, 2023, 103-114.
13. Thukral S, Kovac S, Paturu M. t-test. In Translational Interventional Radiology. Academic Press, 2023, 139-143.
14. Varol Selçuk Z, Özer Keskin M. Gamification in Biology Education: A Systematic Review Analysis. Uluslararası Avrasya Sosyal Bilimler Dergisi. 2024; 15(55):375-405.
15. Villaruel Jordan. Enhancing Student Academic Performance through Engagement and Learning Resources in Project Self. International Journal on Integrated Education. 2025; 8:213-219. Doi: 10.31149/ijie.v8i4.5434
16. Zubair A. Experimental Research Design-types & process. Academia Open, 2023.