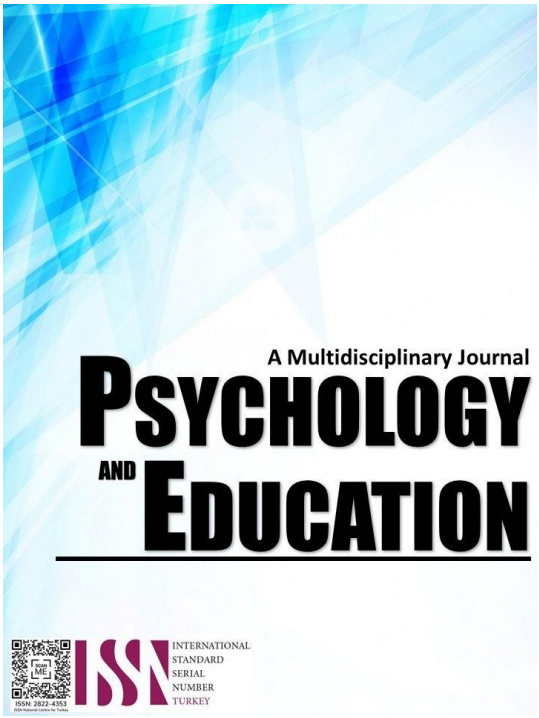
GAME-BASED AND PROJECT-BASED APPROACHES: THEIR EFFECTS ON GRADE 10 LEARNERS' PERFORMANCE IN BIOLOGY



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Research Article

Game-Based and Project-Based Approaches: Their Effects on Grade 10 Learners' Performance in Biology

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Abstract

This quasi-experimental research was conducted to find out the effects of game-based and project-based approaches on Grade 10 learners' performance in biology of Ramon Avanceña National High School, Iloilo City. Purposive sampling design was used and researcher-made instrument for pre-test and post-test on learners' performance was also utilized in gathering data. It was found out that the grade 10 learners' performance in biology before they were exposed to game and project-based approaches was fairly satisfactory. There was no significant difference in the pre-test scores of the group of learners in the game-based and project-based approaches. The Grade 10 learners' performance in biology after they were exposed to game-based and project-based approaches was very satisfactory. There was significant difference in the pre-test and post-test scores of learners in the game-based and project-based approaches. There was no significant difference in the post-test scores of learners in the game-based and project-based approaches.

Keywords: *game-based approach, project-based approach, learners, biology performance*

Introduction

The COVID-19 pandemic had a profound effect on people's lives across the world. Due to the health emergency brought about by this global health crisis, many schools and universities were forced to undertake drastic shift from traditional face-to-face instruction to digital teaching and learning. Academic normalcy still seems out of reach for many students, teachers, and parents as the country approaches the two-year anniversary of the initial wave of pandemic-caused school closures. Schools have been forced to deal with acute staff shortages, high absenteeism rates, quarantines, and rolling school closures in addition to an increase in COVID-19 cases by the end of 2021. Additionally, there are mental health issues among children and teachers, higher rates of violence and misbehavior, and worries about wasted instructional time.

Despite what's happening, learning still needs to continue. For the majority of teachers, teaching during the pandemic is challenging, and they are all still figuring out a rhythm that works. Though there are so many unanswered questions regarding the pandemic and the social isolation it is causing, face-to-face classes is now happening.

Teachers and DepEd, being empathetic about the situations, strive to find some solutions regarding the pressing problem. There are some modalities that teachers practiced such as online class, modular-print, blended learning, and many more.

One teaching and instructional strategy that can be used in the new normal is the Game-based Approach (prodigy.com, 2022) that stated game-based learning is one teaching strategy that's growing increasingly popular to help students achieve their learning objectives especially that students nowadays are becoming tech savvy at an earlier age and educational technology companies are developing more efficacious products that can and the students and teachers in the learning process.

It was discovered in Pratama and Setyaningrum's (2018) study that "evidence that the use of educational games could support and increase the mathematics learning outcomes." Teachers use game-based learning to incorporate educational activities into their lessons so that students can independently or collaboratively refresh or solidify previously learned concepts. Teachers can create engaging learning environments that increase student engagement by taking advantage of the in-depth knowledge of game play that is possessed by today's students.

On the other hand, according to (O'brien, 2021), Project Based Learning (PBL) is an instructional methodology encouraging students to learn by applying knowledge and skills through an engaging experience. PBL presents opportunities for deeper learning in-context and for the development of important skills tied to college and career readiness.

To acquire a skill or complete a task, multiple learning strategies might be applied at once. For instance, the behaviorist method is required to perform song chords on an instrument, whereas the cognitive approach is appropriate for learning song chords. The researcher believes that the above-mentioned approaches could somehow alleviate the problems about the performance of learners on how to understand and be motivated in learning science specifically in some topics covered by the curriculum guide as mandated by DepEd. Furthermore, this study was conducted in the hope of improving the performance of learners in biology by providing them with alternative teaching strategies in learning, such as game-based and project-based learning, where learners are given games and projects to improve their performance in science. The researcher believes that both game-based and project-based learning can meet

the needs of learners in a variety of ways, particularly in terms of performance improvement. Hence, this study was conducted.

Research Questions

This study aimed to find out the effects of game-based and project-based approaches on the Grade 10 learners' performance in biology, specifically in the topic: Biology (Inheritance and Variation) of Ramon Avanceña National High School, Arevalo, Iloilo City, during the third grading of the Academic Year 2022-2023. Specifically, this study sought answers to the following questions:

1. What is the pretest result of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
2. Is there a significant difference in the pre-test results of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
3. What is the post-test result of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
4. project-based approaches?
5. Is there a significant difference in the pre-test and post-test results of the Grade 10 learners' performance in biology using the game-based approach?
6. Is there a significant difference in pre-test and post-test results of the Grade 10 learners' performance in biology using the project-based approach?

Methodology

This section presents the research method, research design, respondents of the study, sampling design, data-gathering procedure, research instrument, data analysis, and statistical tools used in this study.

Research Design

The quasi-experimental design specifically the pretest-posttest non-Equivalent group design was utilized in the investigation.

A quasi-experimental research design establishes cause-and-effect relationship. In quasi-experimental designs, a comparison group is identified that is as close to the treatment group as possible in terms of baseline (pre-intervention) characteristics. The comparison group represents the outcomes that would have occurred if the intervention had not been undertaken. As a result, the intervention can be said to have caused any difference in outcomes between the treatment and comparison groups (White & Sabarwal, 2014). This study aimed to find out the effects of game-based and project-based approaches on the pre-test and post-test of Grade 10 learners' performance of the concept in biology (Inheritance and Variation) during the 3rd grading period for the school year 2022-2023 at Ramon Avanceña National High School; hence, this research design was appropriate to be used in this study.

Participants

The participants of the study were the Grade 10 Mt. Madjaas and Mt. Igcoron learners of Ramon Avanceña National High School purposively chosen to meet the necessary characteristics needed for the study during the 3rd grading period of the school year 2022-2023. One group was exposed to used game-based approach, and the other group was exposed to project-based approach as teaching strategies. Table I shows the distribution of the subjects.

Table 1. *Distribution of Subjects by Teaching Strategy*

Category	*N*	*%*
Mt. Madjass-Game Based	38	50.00
Mt. Igcoron-Project Based	38	50.00
Entire Group	76	100.00

Instruments

To gather the data needed for this study, the researcher was constructed a 50-item multiple-choice test in the topic biology (Inheritance and Variation). The questionnaires underwent content and face validation by three expert science teachers in the field of general science. Their comments, suggestions, and recommendations were incorporated into the final version of the instrument.

Procedure

Pre-Experimental Stage. Prior to the administration of the research instrument, the researcher prepared a Table of Specification for pre-test and post-test on lessons about biology (Inheritance and Variation) as reflected in the curriculum guide for junior high school. Then, the researcher constructed test items for pre-test and post-test and submitted these to the panel of experts for face and content validation. The comments and suggestions of the validators were incorporated in the final draft of the pre-test and post-test. After the validation process, the test items were submitted for reliability testing at Melchor L. Nava National High School using item analysis,

then the researcher asked permission from the Schools Division Superintendent and from the School Principal of the Melchor L. Nava National High School and Ramon Avanceña National High School for proper protocol. The pilot testing took place in MLNNHS to thirty Grade 10 learners. Results of the pilot testing were subjected to item analysis.

Actual Experimental Stage. After the tests have been found out to be valid and reliable, the researcher was immediately reproducing the test items for the actual experimentation at Ramon Avanceña National High School. The first step was the conduct of the pre-test, the actual conduct of the experiment was followed using the game-based approach for the Grade 10 Mt. Madjaas learners and the project-based approach for the Grade 10 Mt. Igcoron learners. The designed lesson matrix was also and followed during the actual conduct of the study.

Post Experimental Stage. After the conduct of the experiment, the post-test was conducted, checked, tabulated and subjected to data analysis at Ramon Avanceña National High School. After the post-test was conducted, the researcher checked the result of the post-test and subjected for Statistical Analysis.

Results and Discussion

This section presents analyses and interprets the data gathered in this study which aimed to compare the effects of game-based and project-based approaches on the Grade 10 learners' performance in biology, specifically in the topic: Biology (Inheritance and Variation) of Ramon Avanceña National High School, Arevalo, Iloilo City, during the third grading of the Academic Year 2022-2023. Specifically, this study sought answers to the following questions:

1. What is the pretest result of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
2. Is there a significant difference in thepre-test results of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
3. What is the post-test result of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
4. Is there a significant difference in the post-test results of the Grade 10 learners' performance in biology using the game-based and project-based approaches?
5. Is there a significant difference in the pre-test and post-test results of the Grade 10 learners' performance in Biology using the game-based approach?
6. Is there a significant difference in pre-test and post-test results of the Grade 10 learners' performance in Biology using the project-based approach?

The scores of the learners in the pretest and posttest were tabulated, analyzed, and interpreted using appropriate statistics.

Pretest Results of the Grade 10 Learners' Performance in Biology Using the Game-Based and Project-Based Approaches

To determine the pretest results of the grade 10 learners' performance in biology using the game-based and project-based approaches, the researcher used the mean. The obtained mean for game-based approach was 12.76 which was described as fairly satisfactory. As to project- based approach, the obtained mean was 12.82 and described as fairly satisfactory.

The mean of the total pretest results of grade 10 learners with the two approaches was 12.79, described as fairly satisfactory. This means that teachers should provide more input and even persuade other teachers of the benefits of these two approaches as additional teaching strategies.

Work done by Tsai et al. (2019) described how learners' engagement in board game-based learning positively affected their motivation and attitudes to learning topics that relate to the natural science school syllabus. Consequently, the capability of board game-based teaching raising learners' motivation and interest in learning natural science, has drawn the attention of curriculum planners and developers in the field of initial teacher education.

Project-based learning (PBL) is a group-work method to teaching and learning that exposes students to circumstances involving real-life concerns and activities. Additionally, this learning process involves a number of challenging assignments that keep students' minds busy as they work on projects. In other words, open-ended tasks that involve problem solving, making decisions, or conducting investigations are utilized to accomplish desired goals and assess their performance and advancement (Chiu 2020).

Data was shown in Table 2

Table 2. *Pre-test Results of the Grade 10 learners' Performance in Biology Using the Game-based and Project-based Approaches*

Approaches	*N*	*Mean*	*Description*
Game-based	38	12.76	Fairly Satisfactory
Project-based	38	12.82	Fairly Satisfactory

Legend: Scores Description 32.01 – 40.00 Outstanding 24.01 – 32.00 Very Satisfactory 16.01 – 24.00 Satisfactory 8.01 – 16.00 Fairly Satisfactory 0.00 - 8.00 Did Not Meet Expectations

Difference in the Pretest Results of Grade 10 Learners' Performance in Biology using the Game-based and Project-based Approaches

To determine the significant difference in the pretest results of grade 10 learners' performance in biology using the game-based and project-based approaches, the researcher used the Mann Whitney U-Test set at 0.05.

Results of the study revealed that there was no significant difference between game-based and project-based approach in terms of their pretest performance. The obtained Z-value was -0.387 with a p-value of 0.699.

Since the p-value was greater than alpha level of 0.05, therefore the difference was not significant. The findings imply that both game-based and project-based approaches have a direct impact on learners' science performance.

In contrast to students who received traditional instruction, those who participated in board game-based science learning demonstrated improved cognitive gains in the mastery of concepts related to life and living, matters and materials, energy and change, and earth and beyond. This was documented in a study by Hussein et al. (2019).

PBL improves deep collaborative trans disciplinary learning, involves students in real-world activities, and fosters an iterative culture in which students constantly prototype, reflect, rethink, modify, and assess, which are regarded as the basic PBL techniques (Grossman et al., 2019).

Data was shown in Table 3

Table 3. *Difference in the Pretest Results of Grade 10 Learners' performance in Biology using the game-based and project-based approaches*

Approaches	*n*	*Mean Rank*	*Mann-Whitney U*	*Z*	*p-value*	*Remarks*
Game-based	38	37.53	685.00	-0.387	0.699	Not Sig
Project-based	38	39.47				

Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based and Project-based Approaches

To determine the post-test results of the grade 10 learners' performance in biology using the game-based and project-based approaches, the researcher used the mean.

The obtained mean for game-based approach was 24.16 which was described as very satisfactory. As to project-based approach, the obtained mean was 24.89 which described as very satisfactory.

The mean of the total posttest results of grade 10 learners with the two approaches was 24.53, described as very satisfactory. This means that the two approaches benefit learners' practical skill development through project-based learning and knowledge retention through game-based learning. It captivates learners' interest, motivation, and understanding of the science concepts outcomes.

In the study of Kirriemuir and McFarlane (2004) cited two main motivations for developing games for education: 1. The goal to "make learning entertaining" by harnessing the motivational potential of games. 2. A conviction that "learning via doing" in simulation games provides a potent teaching tool. A top priority in light of the difficulties presented by globalization and the elevated

expectations for students' outstanding academic achievement is the exploration of new efficient learning techniques. Recently, it was suggested that one of the many strategies' teachers can employ in their classrooms to raise student engagement is game-based learning. Three main factors—motivation, material mastery, as well as higher order thinking and social skills—are reasons why games are utilized to aid in learning.

This is due to the fact that project-based learning involves cooperative learning, which means that students must assume more responsibility in developing their social skills in addition to their academic competence. Students gain valuable interpersonal skills and exposure to a range of viewpoints and methodologies while collaborating on a shared project (Byun, 2007).

Data was shown in Table 4

Table 4. *Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based and Project-based Approaches*

Approaches	*N*	*Mean Rank*	*Description*
Game-based	38	24.16	Very Satisfactory
Project-based	38	24.89	Very Satisfactory

Legend: Scores Description 32.01 – 40.00 Outstanding 24.01 – 32.00 Very Satisfactory 16.01 – 24.00 Satisfactory 8.01 – 16.00 Fairly Satisfactory 0.00 - 8.00 Did Not Meet Expectations

Difference in the Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based and Project-based Approaches

To determine the significant difference in the post-test results of the grade 10 learners' performance in biology using the game-based and project-based approaches, the researcher used Mann Whitney U-Test at 0.05.

Results of the study revealed that there was no significant difference between game-based and project-based approaches in terms of their posttest results.

The obtained Z-value was -0.734 with a p-value of 0.463. Since the p-value was greater than alpha level of 0.05, therefore the difference was not significant. The findings imply that both game-based and project-based approaches are expressive of the learning process of grade 10 students.

Recently, it was suggested that one of the many strategies' teachers can employ in their classrooms to increase student engagement is game-based learning. Three main factors—motivation, material mastery, as well as higher order thinking and social skills—are reasons why games are utilized to aid in learning (Kirriemuir & McFarlane 2004).

In a collaborative classroom setting, learning takes place as students work together to solve issues and present their findings. Teachers and students must act in ways that are different from how they are used to acting in such a setting (Choi, 2010).

Data was shown in Table 5

Table 5. *Significant Difference in the Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based and Project-based Approaches*

Approaches	*n*	*Mean Rank*	*Mann-Whitney U*	*Z*	*p-value*	*Remarks*
Game-based	38	36.64	651.00	-0.734	0.463	Not Sig
Project-based	38	40.36				

Difference in the Pretest and Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based Approach

To determine the difference in the pretest and post-test results of the grade 10 learners' performance in biology using the game-based approach, the researcher used the Mann Whitney U-Test set at 0.05.

Results of the study revealed that there was a significant difference in the pretest and posttest results of grade 10 learners using game-based approach.

The obtained Z-value was -5.39b with the p-value of 0.000. Since the p-value was less than alpha level of 0.05, therefore the difference was significant. The findings imply that the game-based approach was important to help scaffold collaboration, critical thinking, communication, and creativity in the learning process of grade 10 students.

Numerous scientific studies have shown the value of a game-based approach to learning, especially when considering the educational benefits of playing while learning. Additionally, it was suggested that game-based activity processes can both boost people's motivation for learning and offer them opportunities for interactive education (Hwang, Wu & Chen, 2015).

In addition, students engaging in project-based learning are assigned authentic tasks in which the purpose is to help students grasp what has been taught and how these concepts apply to the real world. In order to achieve these benefits, teachers should provide timely feedback throughout class. So, in project-based learning, taking some time for self-reflection through feedback activities is regarded as a learning process that involves collaborating with project team members and looking for both collective and individual learning results (Hung, Keppell & Jong, 2004).

Data was shown in Table 6

Table 6. *Difference in the Pretest and Post-test Results of the Grade 10 Learners' Performance in Biology Using the Game-based approach*

Game-based Approach	*Ranks*	*N*	*Mean Rank*	*Z*	*p-value*	*Remarks*
Pre-test-Posttest Results	(-) Ranks	0[a]	0.00	-5.39[b]	0.000	Sig
	(+) Ranks	38[b]	19.50			
	Ties	0[c]				
	Total	38				

P<0.05, <Significant

Difference in the Pretest and Post-test Results of the Grade 10 Learners' Performance in Biology Using the Project-based Approach

To determine the significant difference in the pretest and post-test results of the grade 10 learners'

performance in biology using the project-based approach, the researcher used Mann Whitney U-test set at 0.05.

Results of the study revealed that there was a significant difference in the project-based approach among grade 10 learners in terms of their pretest and posttest results.

The obtained Z-value was -5.38b with a p-value of 0.000. Since the p-value was less than alpha level of 0.05, therefore the difference was significant. The findings imply that the project-based approach was important to develop the ability to work with his or her peers, building teamwork and group skills in the learning process of grade 10 students.

The benefits of game-based learning in this context have been shown to be intriguing and motivating since they allow learners to readily acquire the intended knowledge and skills in pleasurable and exciting learning environments. When used properly, opportunities for learning by doing can improve education quality and help students build problem-solving abilities based on research and inquiry (Aksoy, 2014).

After building the information necessary to arrange their thoughts and their work, students independently examine their investigation to solve their difficulties or draw conclusions before submitting the project task or presenting it. This process is carried out by collaborative activities, process monitoring, and activity feedback (Thomas, 2000).

Data was shown in Table 7

Table 7. *Difference in the Pretest and Post-test Results of the Grade 10 Learners' Performance in Biology Using the Project-based Approach*

Project-based Approach	*Ranks*	*N*	*Mean Rank*	*Z*	*p-value*	*Remarks*
Pre-test-Posttest Results	(-) Ranks	0[a]	0.00	-5.38[b]	0.000	Sig
	(+) Ranks	38[b]	19.50			
	Ties	0[c]				
	Total	38				

P<0.05, <Significant

Conclusion

Based on the aforementioned findings, the conclusions were drawn:

Science teachers may provide more input and even persuade, influence, and encourage other teachers of the benefits of these two approaches, game-based and project-based, as supplementary teaching strategies.

The use of game-based and project-based learning can be an effective way to engage students' learning experiences. They can be used to enrich discussions, motivate students, and help them understand the lessons.

Game-based and project-based approaches finds some ways to improve the performance of learners. They should require the sustainability of support and dedication of the teachers to incorporate games and projects in the lesson. Learners who use these two approaches have increased motivation, self-efficacy, and understanding which help them develop teamwork and problem-solving skills.

Teachers should be aware of the benefits that game-based and project-based approaches can provide in terms of more input and knowledge retention in the delivery of lessons. The games and projects strategies can be incorporated as part of the lessons.

Teachers and learners are the key players in the learning process, knowing their strengths and weaknesses can directly contribute to academic success. The varied games and projects that teachers can give are indeed the strategies that can maximize the learning process.

Based on the results of the study, the following recommendations are proposed:

Teachers should sustain the utilization of game-based and project-based approaches in lesson delivery. In a learner-centered environment, utilization of these approaches can help motivate and understand students' needs.

Furthermore, other derivatives or innovated strategies related to game-based and project-based need to be explored more by the teachers. Given that they perceive the utilization of these two approaches, they can be more interested in knowing other strategies that would have the same effect as the game-based and project-based.

Teachers in the entire school's division of Iloilo City may continuously improve their learning style and approach to teaching so that they would be able to captivate the learners' attention by creating and bringing things alive.

School heads may take into consideration their teachers' strengths and weaknesses on improving their teaching strategy. They should ensure that they are all directed with the results of this experimental study. This may involve providing teachers with adequate instructional tools, opportunities to participate in long-term professional learning experiences, and collaborating to design learning strategies for their students. Similar studies may be undertaken in other national high schools at other grade levels to uncover other

relevant outcomes that may assist teachers improve their teaching style and method.

Importantly, as crucial players in the learning process, learners should be exposed to tactics that may help them progress in all aspects of the learning process. These are the 21st century learners for the 21st century society. After being prepared for the future, they should grow to love and respect understanding science. As a result, they may become the future leaders of society.

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