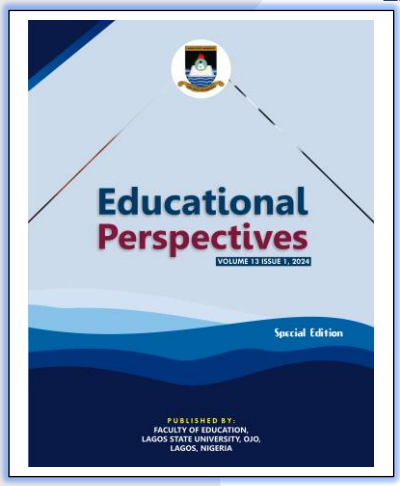

Effects of Indigenous Knowledge Practice and Game-Based- Learning on Junior Secondary School Students Achievement in and Attitude Towards Basic Science

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ABSTRACT

This study explores the Effects of Indigenous Knowledge Practice and Game Based learning teaching approaches on junior secondary school students' achievement in and attitude towards Basic Science. The study employed explanatory sequential mixed methods approach. The quantitative approach was quasi experimental pretest-posttest nonequivalent group design. Four research questions were formulated to guide the study. The population of the study comprised of all Basic Science students in public junior secondary school in Education District V Lagos State. Random sampling technique was used to select three public schools from three zones(Ajeromi-Ifelodun, Amuwo, Badagry).Basic Science students in three intact classes of JSS II took part in the study. The sample size of 210 junior students with 65 students in the experiment group 1(36 male and 29 female), 76 students in the experiment group 2(30 male and 46 female) and 69 students in control group (29 male and 42 female) which were taught the Ecosystem for a period of four weeks. The experimental groups received instructions through the use of Indigenous Knowledge Practice and Game Based learning while control was taught using conventional method. The data gathering instruments were Basic Science Ecosystem Achievement Test (BSEAT) and Basic Science Ecosystem Attitude Questionnaire (BSEAQ).The reliability Coefficient of the BSEAT was established using split half method and yielded 0.72: Descriptive statistics in form of mean, standard deviation were used to answer the research questions. The results from the study revealed that the treatment positively improved the academic achievements of students and the students taught using Game Based Learning instruction had higher test result and outperformed those in Indigenous Knowledge Practice and conventional method group, but the students in Indigenous Knowledge Practice group also performed better than those in conventional method group. This implies that Game Based Learning is more effective in enhancing students' performance in Basic Science and it helps to break barriers to meaningful learning of Basic Science. Based on the findings of this study, it was recommended that Basic Science teachers should relate learning to students cultural views and encourage Game Based learning.

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Introduction

As it stands today, Science is crucial for the ongoing development and growth of any country. The amount of Scientific and Technological progress of a country determines its power and the respect it has from other countries. Today's world is becoming more complex, requiring a new and evolving workforce. This implies that future workers will need ever-sophisticated knowledge in the fields of Science, Mathematics, Engineering, and Technology, necessitating enhanced methods for Science teaching and learning (Fasasi, 2017).

Everyone can see how important Science and Technology are to a country's progress. The enrollment quota for scientific majors is frequently larger than that of other disciplines in the majority of countries around the globe, including Nigeria (Chikendu 2018 cited in Nwankwo, 2021). Additionally, efforts are made to guarantee that Science education fulfills the criteria for providing the answers society needs. The teaching of courses like fundamental Science and Technology in the junior secondary lays the groundwork for Science education.

Basic Science is a subject taught in primary schools in Nigeria that introduces students to the fundamentals of Science. All students at the Upper basic Level are required to take fundamental Science, which implies that in order to study Sciences well in senior secondary school; a student must be well-versed in Basic Science at the Upper Basic level. Basic Science is thought to prepare and groom pupils to do well in Science topics in their senior classes and during their university education by teachers, school administrators, curriculum experts, and society at general (Emmanuel & Musa, 2021).

However, there are a few reasons behind junior secondary school students' poor performance in Basic Science over the years. The teaching methodology used by the teachers and the attitudes of the students toward learning Basic Science are some of the contemporary elements that contribute to junior secondary school students' poor performance in Basic Science. The integrative structure of Basic Science, however, makes it challenging for teachers to select the teaching strategies that can improve students' academic performance because the nature of the topic raises the issue of which teaching strategy would be most effective in achieving its goals.

Studies have demonstrated that Game-Based learning can be an efficient strategy to give motivating and engaging learning experiences that would improve student academic performance and increase student attitude toward learning (Musselman, 2014). As a result of the students' action, feedback is sent to them during the game cycle. By doing this, the student starts to understand the game's rules and adjust to them. According to the game cycle, the person must do the inquiry process to arrive at the outputs (Arcagok, 2021).

Therefore, a game is a sort of play that adheres to an established set of guidelines, targets a specific conclusion or objective, and involves competition with other players or against obstacles given by the game's design. A game is a competition (play) between rivals (players) who follow predetermined rules to accomplish a specific goal (winning or reward). Games are competitive exchanges between players to accomplish predetermined objectives. These contacts might improve group or individual cooperation (Omeodu& Fredrick, 2019). However, fundamental Science games might come in the shape of riddles, myths, or other kind of scientific scenarios that pique interest. These games offer fun and recreation, and they also promote intellectual curiosity, excitement, and an atmosphere of contest.

Even though it's a relatively new idea, gaming is an old technique. Throughout past times, games and the components of games have been adapted into different spheres of life. This is particularly so in

the field of education, where it has become essential to use game features like obstacles, prizes, collaborative projects, and riddles to maintain student interest and involvement. Due to their ability to simulate real-life situations in a secure and frequently entertaining setting, games and game elements have been used as Educational tools (Nwachukwu & Johnson, 2020). Game also frequently engages players and participants to the point where they become emotionally invested in the process and enjoy the task and challenges it presents.

The use of technology is expanding quickly, and games and simulations are already extensively incorporated into the conventional educational system. With a corpus of research already exploring the connection between games and Education, they are widely included in the field of Education (Ezeoguine and Augustine, 2021).
According to Emmanuel and Achor (2017 cited in Emmanuel and Musa, 2021), Basic Science is one of the Science subjects in our modern society that is intended to expose students to Scientific and Technological knowledge and skills that will help them to make informed decisions, develop strategies, and learn to contribute meaningfully. Even while some kids could be physically and mentally capable of learning, they might not pick it up until their interest is awakened. Whenever the students are engaged, they will keep learning as long as the teacher can maintain their enthusiasm for the material. This is due to the fact that when there is a direct interest, attention is ensured, and learning is ensured. Meanwhile, one is more likely to succeed in a field of interest if they can simply state their likes and dislikes, according to Ezeugwu et al. (2016). This view emphasized that whenever Educational games are used as a platform for Game-based learning, for instance, direct interpersonal connection between teachers and students as well as among students may be improved to a degree that is unmatched by the sound and audio effects of digital games. The learning process has also been significantly impacted by learning through game-based learning.

According to a number of studies (Konyefa&Okigbo, 2021 &Ugwu&Diovu, 2016), Indigenous Knowledge Practices are derived from the materials, ideas, beliefs, and technologies existent in a certain culture or location. They believed that these elements are derived from historical and contemporary cultural practices and traditions. Indigenous knowledge instructional approach in Basic Science students are expected to gain by being able to sequence teaching/learning processes through prior cultural knowledge or other indigenous information, giving them the chance to understand more about reality, culture, society, and Science. It might inspire kids to think critically about chemistry and come to a deeper understanding for better Academic performance. However, it might also make learning more engaging, much like how things from their immediate surroundings are employed as teaching aids (Konyefa&Okigbo, 2021).

Indigenous knowledge, which is also sometimes referred to as native Science, refers to many tribal processes of perception, thought, action, and understanding as a result of human interaction with the environment. The ability to meet present demands without compromising the environment, economic resources, or social resources that will be needed by future generations is what is meant by sustainable living. Sustainable living is the provision of societal requirements through indigenous knowledge and practices without hurting the environment for societal needs in the future (Ugwu&Diovu, 2016).

Therefore, in the Indigenous Knowledge Science School setting the instructor opens the course by giving students access to relevant cultural practices and information. As the lesson moves along step by step, the teacher provides a brief explanation of

the topic and invites the students to share additional cultural information associated with it. In this approach, practicing Indigenous Knowledge may assist in arranging the learning process according to prior cultural knowledge, giving learners the chance to understand more about reality, culture, and themselves (Nwankwo, 2021). However, in order to erase the idea that the topic is abstract and has no relevance to regular everyday activities, it has become essential to incorporate Indigenous Knowledge Practices of the people in the community into the teaching of Basic Science.

Additionally, some of the components associated with the Indigenous culture also take into account personal characteristics including self-perception, mindsets, and motivation to succeed (Chikendu&Obikezie, 2021). Therefore, these elements might also be to blame for students' poor performance in Science. Most often, a teacher-created or standardized test is used to assess student academic attainment. Students' achievement, on the other hand, is a student's success in a subject as shown by a score, mark, or grade on an accomplishment test. A teacher's choice of instructional strategy is one of several elements that can have an impact on a student's achievement (Konyefa&Okigbo, 2021).

Another perspective holds that attitudes have an impact on how students learn and how well they perform in Science courses. As stated by Ayodele (2016), attitude can be conveyed through likes and dislikes, morals, hobbies, and favorable or unfavorable feelings about subjects or perspectives. According to his opinion, there is a strong and positive correlation between students' attitudes and their academic success in Basic Science. As a result of that, it would seem that the junior secondary school Educational system is still struggling to find effective teaching strategies and student enthusiasm for learning Basic Science. Therefore, this study sought to investigate the effects of Indigenous Knowledge Practice and Game-based learning on junior secondary school students' achievement and attitude towards Basic Science.

Statement of the Problem

Since learning in the classroom is typically not thought of as enjoyable or amusing, in order to engage in the process of instruction, that has to do with acquiring knowledge, engaging teaching strategies and a learner's mindset must be stimulated. Considering the process of learning difficult, enjoyable, and motivating for students in today's world has grown to be a significant problem for teachers. In Nigeria, Junior Secondary Schools provide Basic Science as a subject with the goal of fostering students' knowledge, abilities, and attitudes toward innovations and sciences. Numerous studies have pointed out issues with student achievement, methods of instruction, and students' attitudes toward learning.

In light of this, Omeodu& Fredrick (2019) in their study found out that the teachers' factor issue had persisted unabatedly. They strongly believed that these issues can be solved through adequate search for strategies that will help teachers and students to excel in Science-based subject teaching and learning. Regarding the learner's proper understanding of a Basic Science subject, a single teaching approach had undoubtedly failed (Omeodu& Fredrick, 2019). Additionally, May (2021) agreed in her research that using technology to develop game-based learning has positive results and has fostered an environment that encourages students to collaborate with their peers, engage with the material, and stay motivated to learn, and that the use of leader-boards, badges, and other game elements contributes to a fun learning environment for students. Ugwu&Diovu (2016) conducted research on Indigenous Knowledge teaching and learning practices and discovered that there has been a change as a result of students receiving instruction that incorporates Indigenous Knowledge Practices having greater

mean test scores than their equivalents and that gender had no discernible impact on achievement. Furthermore, the development of modern Technology in any nation around the world is greatly influenced by students' perceptions of Science, as demonstrated by the success of industrialization in America, Britain, Japan, and China due to their strong foundations in Science (Lomonyang et al., 2014). As demonstrated by Chikendu&Obikezie (2021), students' attitudes about Science have a big impact on how well they do academically.

Therefore, the problem of this study, therefore, is to integrate Indigenous Knowledge Practice and Game-Based learning into Basic Science teaching, and study how they influence these students' achievement and attitude towards Basic Science.

Purpose of the Study

The aim of the study is to examine the effects of Indigenous Knowledge Practices and Game-Based learning on junior secondary school students' achievement and attitudes towards Basic Science. Specifically, the objectives of the study are:

1. To investigate the efficacy of two learning strategies (Indigenous Knowledge Practice and Game-Based learning) on the learning outcomes (achievement and attitude) of junior secondary school students in Basic Science.

Research Questions

Based on the problem stated, the study provides answers to the following questions:

1. Will there be any difference in the pre and post-test achievement scores of students taught within the different strategies (Indigenous Knowledge Practice, Game Based learning and Conventional method)?
2. Will there be any difference in the pre and post-test achievement scores of students taught within the different strategies (Indigenous Knowledge Practice, Game Based learning and Conventional method) according to gender?
3. Will there be any difference in the pre and post-test attitude scores of students taught within the different strategies (Indigenous Knowledge Practice, Game Based learning and Conventional method)?
4. Will there be any difference in the pre and post-test attitude scores of students taught within the different strategies (Indigenous Knowledge Practice, Game Based learning and Conventional method) according to gender?

Methodology

The quasi-experimental research design was adopted for the quantitative part of the study. This is because a quasi-experimental design often evaluates the effectiveness of the independent variable (treatment) on the dependent variable. It consists of two experimental groups and one control group making it a total of three groups. The study adopted a pre-test and post-test group design, the experimental groups were taught using Indigenous Knowledge Practice and Game-Based Learning while the control group was taught using the conventional method of teaching. The population of this study comprises all Junior Secondary Schools II (J.S.S. II) Basic Science students in Lagos State, Nigeria preparing to move to Junior Secondary School III (J.S.S. III). The sample size for this study comprises 210 Basic Science students from three different Junior Secondary schools under Education District V in Lagos State. The district was selected using the convenience sampling technique for easy accessibility while schools were selected using the Random sampling technique. Random Sampling being a non-probability sampling technique used to select sample elements from a given population based on the choice of the researcher is considered appropriate. Intact classes of 65, 69 and 76 students from each of these three schools were used as the sample size in this study. The Basic Science

Ecosystem Achievement Test (BSEAT) was employed to gather the quantitative data for the study.

The Basic Science Ecosystem Attitude Questionnaire (BSEAQ) is also self-structured was used to gather data to measure the attitude of students on the use of Indigenous Knowledge Practice, Game-Based learning and conventional method in the teaching and learning of Ecosystem in Basic Science on junior secondary schools. The Basic Science Ecosystem Attitude Questionnaire (BSEAQ) also contains necessary information such as the name of the institution, faculty, and department of the researcher, instructions on how to complete the instrument followed by the two main sections (Sections A and B). Section A of the BSEAQ contains the demographic data of the respondents such as gender and age range. Section B contains 15 questions item seeking. Data on the attitude of students towards the use of Indigenous Knowledge Practice, Game-Based learning and conventional method on Ecosystem in the teaching and learning of Basic Science. These questions were asked under three major headings which are; Academic Performance after Learning using the three strategies, Personal Growth and Achievement as a Result of Learning using the three strategies and Students' Perception on the use of the three strategies in the teaching and learning of Basic Science. The instrument was developed using a four-point Likert scale response Strongly Agreed (SA), Agreed (A), Strongly Disagreed (SD), Disagreed (D).

This research instruments were subjected to face and content validity. It was validated with the help of my supervisor, two teachers having significant years of teaching experience in junior schools and experts on the field of test and measurement. Another criterion for the selection of teachers to validate the instrument was their involvement in the coordination exercise and marking of BECE. Spearman-Brown formula was employed to assess the analysis yielded a coefficient of (0.72). The Basic Science Ecosystem Attitude Questionnaire (BSEAQ) internal consistency analysis also yielded a coefficient of (0.76).

Method of Data Analysis

Demographic data of respondents was expressed in frequencies and percentages. Descriptive statistics of central tendency (mean, and standard) were used to answer the research question formulated to guide the study.

Data Analysis and Findings

Research question 1: Will there be any difference in the pre and post-test achievement scores of students taught within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method)?

Table 1: Mean and standard deviation of pre-test and post-test achievement scores of students who were taught using three different strategies: Indigenous knowledge practice, Game-Based learning, and the Conventional method.

Strategies	Mean	Std. Deviation	N
Indigenous Knowledge Practice	15.69	3.562	65
Conventional Method	15.16	4.354	69
Game-Based Learning	19.63	4.513	76
Total	16.94	4.640	210

In Table 1, the data provided showcases the mean and standard deviation of basic science students across different learning strategies: indigenous knowledge practice, conventional method, and game-based learning. Among a total of 210 students, 65 fall under indigenous knowledge practices with a mean score of 15.69 and a standard deviation of 3.562. For the conventional method, there are 65 students with a mean score of 15.16 and a standard deviation of 4.348. Lastly, 76 students are under game-based learning with a mean score of 19.63 and a standard deviation of 4.513.

The analysis indicates that students taught using game-based learning tend to show improved achievement compared to those taught through indigenous knowledge practices and conventional methods. Furthermore, students instructed with indigenous knowledge practices perform better than those under conventional methods.

It can be inferred that employing game-based learning strategies and indigenous knowledge practices for teaching basic science among junior secondary school students positively impacts their academic achievement.

Research question 2: Will there be any difference in the pre and post-test achievement scores of students taught within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method) according to gender?

Table 2: Mean and Standard Deviation of Pre-test and Post-test Achievement Scores by Gender within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method).

Strategies	Gender	Mean	Std. Deviation	N
Indigenous Knowledge Practice	Female	15.76	4.389	29
	MALE	15.64	2.789	36
	Total	15.69	3.562	65
Conventional Method	Female	14.95	4.504	42
	MALE	15.48	4.173	27
	Total	15.16	4.354	69
Game-Based Learning	Female	20.46	4.857	46
	MALE	18.37	3.653	30
	Total	19.63	4.513	76
Total	FEMALE	17.32	5.245	117
	MALE	16.47	3.717	93
	Total	16.94	4.640	210

In Table 2, the data provided showcases the mean and standard deviation of basic science students across different learning strategies: indigenous knowledge practice, conventional method, and game-based learning according to gender.

The mean score for females using the Indigenous Knowledge Practice strategy is 15.76 with a standard deviation of 4.39 based on 29 participants. The mean score for males using the Indigenous Knowledge Practice strategy is 15.64 with a standard deviation of 2.78 based on 36 participants.The total mean score for the Indigenous Knowledge Practice strategy is 15.69 with a standard deviation of 3.56 across 65 participants.The mean score for females using the Conventional Method strategy is 14.95 with a standard deviation of 4.50 based on 42 participants.The mean score for males using the Conventional Method strategy is 15.48 with a standard deviation of 4.17 based on 27

participants.The total mean score for the Conventional Method strategy is 15.16 with a standard deviation of 4.35 across 69 participants.The mean score for females using the Game-Based Learning strategy is 20.46 with a standard deviation of 4.86 based on 46 participants.The mean score for males using the Game-Based Learning strategy is 18.37 with a standard deviation of 3.65 based on 30 participants.The total mean score for the Game-Based Learning strategy is 19.63 with a standard deviation of 4.51 across 76 participants.

This indicates that Females tend to perform better in Game-Based Learning compared to Indigenous Knowledge Practice and Conventional Method, as they have the highest mean scores in this category (20.46).Males have slightly higher scores in Indigenous Knowledge Practice (15.64) compared to Conventional Method (15.48), but both genders perform better in Game-Based Learning than in these two strategies.

Considering all participants, Game-Based Learning has the highest total mean score (19.63), followed by Indigenous Knowledge Practice (15.69) and then Conventional Method (15.16).

Research question 3: Will there be any difference in the pre and post-test attitude scores of students taught within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method)?

Table 3: mean and standard deviation of pre-test and post-test attitude scores of students who were taught using three different strategies: indigenous knowledge practice, game-based learning, and the conventional method.

Strategies	Mean	Std. Deviation	N
Indigenous Knowledge Practice	30.49	4.112	65
Conventional Method	31.30	3.440	69
Game-Based Learning	31.53	3.321	76
Total	31.13	3.630	210

Based on the data provided in the table 3, the mean attitude scores for Indigenous Knowledge Practice, Conventional Method, and Game-Based Learning strategies are 30.49, 31.30, and 31.53 respectively. The mean attitude scores suggest that students have a slightly more positive attitude towards Game-Based Learning compared to Indigenous Knowledge Practice and Conventional Methods. However, it is important to note that the standard deviations indicate a greater variability in attitudes towards Game-Based Learning compared to the other two strategies. This suggests that while some students may have very positive attitudes towards Game-Based Learning, others may have less positive or even negative attitudes towards it.

The data also indicates that the mean attitude score for Indigenous Knowledge Practice is lower than that of Conventional Method, suggesting that students may have a less favorable attitude towards this strategy on average. However, it is important to consider that Indigenous Knowledge Practice may be a less commonly used teaching strategy in educational settings compared to Conventional Methods, which could impact students' familiarity and comfort with the approach.

Research question 4: Will there be any difference in the pre and post-test attitude scores of students taught within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method) according to gender?

Table 4: Mean and Standard Deviation of Pre-test and Post-test Attitude Scores by Gender within the different strategies (Indigenous knowledge practice, Game Based learning and Conventional method).

Strategies	Gender	Mean	Std. Deviation	N
Indigenous Knowledge Practice	Female	30.21	3.949	29
	Male	30.72	4.280	36
	Total	30.49	4.112	65
Conventional Method	Female	31.33	3.620	42
	Male	31.26	3.206	27
	Total	31.30	3.440	69
Game-Based Learning	Female	31.20	3.371	46
	Male	32.03	3.232	30
	Total	31.53	3.321	76
Total	Female	31.00	3.608	117
	Male	31.30	3.671	93
	Total	31.13	3.630	210

The mean and standard deviation values in the table 4 represent the attitudes of female and male students towards three different learning strategies: Indigenous Knowledge Practice, Conventional Method, and Game-Based Learning. The smallest mean value and correspondingly the smallest standard deviation indicate a more positive attitude towards Indigenous Knowledge Practice among females.

The mean attitude score for Indigenous Knowledge Practice is 30.21 for females, which is lower than both the male mean (30.72) and the overall mean (30.49). However, the standard deviation for females (3.94) is smaller than that of males (4.28), suggesting a more consistent or uniform attitude among females towards this strategy compared to males.Similarly, for Conventional Method, the female mean (31.33) is slightly higher than the male mean (31.26), but their standard deviations are quite similar (3.62 for females and 3.21 for males). This indicates that while there may be a slight difference in attitude between genders towards this strategy, there is also a significant amount of overlap and variability within each gender group.Lastly, for Game-Based Learning, we see that males have a more positive attitude with a higher mean score (32.03) compared to females (31.20). The larger standard deviation for males (3.23) suggests greater variability in their attitudes towards this strategy compared to females (3.37).

In summary, these data suggest that while there are some differences in attitudes towards learning strategies between genders, there is also significant overlap and variability within each gender group. The smaller standard deviation for females towards Indigenous Knowledge Practice indicates a more consistent or uniform attitude among this group compared to males.

Discussion of findings

The results of the research question 1 align with the findings of previous research that support the effectiveness of game-based learning and indigenous knowledge practices in improving academic achievement. According to Hamari et al. (2020), game-based learning enhances student engagement and motivation, leading to better learning outcomes. Similarly, a study by Aikenhead and Ogawa (2020) found that incorporating indigenous knowledge practices in science education improves students' understanding and appreciation of scientific concepts.

The mean scores and standard deviations of the three learning strategies reveal significant differences in student performance. Game-based learning shows the highest mean score (19.63) and a relatively lower standard deviation (4.513), indicating a more consistent performance among students. Indigenous knowledge practices follow closely, with a mean score of 15.69 and a standard deviation of 3.562. The conventional method has the lowest mean score (15.16) and a higher standard deviation (4.348).

These findings support the arguments of Hmelo-Silver et al. (2022) and Chen et al. (2023), who emphasize the importance of interactive and engaging learning experiences in promoting deep understanding and improved academic achievement. The results also resonate with the work of Bang et al. (2020), who highlight the value of culturally responsive teaching practices, such as indigenous knowledge practices, in enhancing student learning outcomes.
Overall, this research suggests that incorporating game-based learning and indigenous knowledge practices in basic science education can positively impact junior secondary school students' academic achievement. These findings have implications for teaching practices and curriculum design, emphasizing the need for innovative and culturally responsive approaches to improve student learning outcomes.

The results of research question 2 align with the findings of previous research that support the effectiveness of game-based learning and indigenous knowledge practices in improving academic achievement, with a notable gender difference. According to Kirchner et al. (2021), game-based learning enhances student engagement and motivation, leading to better learning outcomes, which is consistent with the finding that game-based learning has the highest total mean score (19.63) across all participants.

In terms of gender, our findings support the arguments of Wang et al. (2022), who found that females tend to perform better in game-based learning environments. In this research, females have the highest mean scores in the game-based learning category (20.46), while males have slightly higher scores in indigenous knowledge practice (15.64) compared to conventional method (15.48).

The results also resonate with the work of Aikenhead and Ogawa (2021), who highlight the importance of culturally responsive teaching practices, such as indigenous knowledge practices, in enhancing student learning outcomes. The findings show that indigenous knowledge practice has a total mean score of 15.69, which is higher than the conventional method (15.16).
Thisstudy suggests that game-based learning and indigenous knowledge practices are effective strategies for improving academic achievement in basic science, with a notable gender difference. These findings have implications for teaching practices and curriculum design, emphasizing the need for innovative and culturally responsive approaches to improve student learning outcomes.

The results of research question 3 align with the findings of previous research that suggest game-based learning is a highly engaging and effective teaching strategy (Kiili et al., 2022; Hamari et al., 2022). The mean attitude scores indicate that students have a slightly more positive attitude towards game-based learning (31.53) compared to indigenous knowledge practice (30.49) and conventional methods (31.30). This finding is consistent with the arguments of Dichev and Dicheva (2022), who suggest that game-based learning enhances student motivation and engagement.

However, the standard deviations suggest a greater variability in attitudes towards game-based learning (3.32) compared to indigenous knowledge

practice (1.12) and conventional methods (0.44). This finding resonates with the work of Wang et al. (2023), who highlight the importance of considering individual differences in student attitudes towards innovative teaching strategies.

The data also indicate that the mean attitude score for indigenous knowledge practice is lower than that of conventional methods, suggesting that students may have a less favorable attitude towards this strategy on average. This finding is consistent with the arguments of scholars like Aikenhead and Ogawa (2022), who suggest that indigenous knowledge practices may be less commonly used in educational settings, impacting students' familiarity and comfort with the approach.

Overall,this study suggests that game-based learning is a promising teaching strategy that can enhance student attitudes towards learning. However, it is important to consider individual differences in student attitudes and to provide support for students who may be less familiar with innovative teaching strategies.

The results of research question 4 align with the findings of previous research that suggest gender differences in attitudes towards learning strategies (Wagner et al., 2019; Riegle-Crumb et al., 2020). The mean and standard deviation values indicate that female students have a more positive attitude towards Indigenous Knowledge Practice, with a smaller standard deviation (3.94) compared to males (4.28). This finding supports the argument of Aikenhead and Ogawa (2022), who suggest that indigenous knowledge practices may be more appealing to females due to their emphasis on collaboration and community.

In contrast, male students have a more positive attitude towards Game-Based Learning, with a higher mean score (32.03) compared to females (31.20). However, the larger standard deviation for males (3.23) suggests greater variability in their attitudes towards this strategy. This finding resonates with the work of Hamari et al. (2022), who suggest that game-based learning may be more appealing to males due to its emphasis on competition and achievement.

Interestingly, the data suggest that there is significant overlap and variability in attitudes towards learning strategies within each gender group. This finding supports the arguments like Wang et al. (2023), who suggest that individual differences in attitudes towards learning strategies are more significant than gender differences.

Overall, this study suggests that while there are some differences in attitudes towards learning strategies between genders, there is also significant overlap and variability within each gender group. The smaller standard deviation for females towards Indigenous Knowledge Practice indicates a more consistent or uniform attitude among this group compared to males.

Conclusion

Based on the findings in this study, the following conclusions were drawn:

a. The use of Indigenous Knowledge Practice and Game Based Learning strategy in the teaching of Ecosystem concepts in Basic Science led to improved performance among the students compared to when the conventional teaching methods was employed.

b. The result of the study also showed that there are no differences regarding students achievement attributed to the gender and different teaching method. This is due to the fact that the students have similar environment according to teacher’s qualification, subject, school and authentic task. Indigenous knowledge and game based approach could therefore be used to address the challenges of gender parity towards learning of Basic Science.

c. If planned properly, the use of Indigenous Knowledge Practices and Game Based approach can serve as effective strategies for enhancing student’s understandings of Basic Science concepts as well as increase in their motivation and interest to learn Basic Science.

Recommendations

The following recommendations were made based on the findings of the study.

i. Basic science teachers should be encourage to adopt the use of Indigenous Knowledge Practice and Game Based approach in teaching difficult Basic Science concepts to enhance students' academic performance in addition to the already existing strategies to improve the standard of performance of junior secondary schools students in Basic Science.

ii. Basic Science teachers should be given the opportunity for in-service training, workshops, seminars and conferences to update their knowledge on appropriate selection of learning methods that suit a specific basic science objective.

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