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Exploring the Effect of Problem-Based Teaching and Learning Strategy on Students' Learning Outcomes

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Abstract

This study investigated the influence of problem-based teaching and learning technique on students' learning outcomes in economics in Lagos State. The study utilised a quasi-experimental design with a pre-test, post-test, and control group. The design also included a 2x2 factorial matrix. A simple random technique was employed to choose six public schools within Lagos Education District II. The students were allocated to experimental and control groups using random assignments. The intact classrooms comprised 209 senior secondary I students, including 108 male and 101 female students. The instruments used were the Student's Attitude to Economics Scale (reliability coefficient of 0.88) and the Student's Economics Achievement Test (reliability coefficient of 0.77). The data were analysed using an analysis of covariance with a significance threshold of 0.05. The treatment had a substantial influence on students' learning outcomes (students' attitude to and achievement in economics, as indicated by the significant main effect ($F(2,209) = 137.785$, partial $\eta^2 = 0.51$). The problem-based group of students achieved the highest average score of 80.97 in the learning outcomes, while the conventional group achieved an average score of 75.78. Gender did not have a notable impact on students' learning achievements. Furthermore, the statistical analysis revealed that the combined influence of treatment and gender did not yield a significant interaction effect. Implementing problem-based teaching and learning techniques led to enhanced learning outcomes in economics for senior secondary school students. Therefore, teachers are encouraged to employ this teaching and learning approach.

Keywords: Problem-based Learning strategy, Student gender, Learning outcomes, Academic Achievement in Economics

Introduction

Students are like human resources, they are active, and passionate and could use their creativity in different areas. Learners have been viewed as individuals with unique traits, personalities and behaviours. During the teaching and learning process, students often develop habits of interest and talents in the subject they are exposed to that make them seem unique. As an academic discipline, the focus of Economics is on how to make the most of limited resources to meet the increasing demands of humanity. Meanwhile, as a social science subject, Economics is a required subject at the senior secondary school, it covers a wide range of topics and aims to solve a wide range of issues around the world. It is used in most of the administration and social science courses in universities. The selection of an instructional approach plays a crucial role in influencing the extent to which the intended learning outcomes in Economics can be realised. In the context of this study, learning outcomes are measured in terms of students' attitudes and students' achievement in Economics. Learning outcomes in Economics can be viewed from varied perspectives. Student learning outcomes can be defined as the specific, observable and quantifiable behaviours that students demonstrate after a learning experience. In addition, Mishra

and Koehler (2008) looked at how well students learn by looking at the quality of their knowledge, skills, attitudes, and values they have developed in the areas of cognitive, affective, and psychomotor learning. In the context of this study, learning outcomes are measured in terms of students' attitudes to Economics and students' achievement in Economics.

The attitude of students towards learning Economics is important in the process of acquiring knowledge. To support this claim, Gbore, Olabode, and Olufemi (2011), provide information that the significance of learners' attitudinal factors as execution indicators has been accentuated by numerous researchers who demonstrated that student learning mentalities and interests could have a critical influence among students. Therefore, students' attitudes can be viewed as a way of thinking, feeling, and acting towards Economics. According to Adu (2012), attitude refers to internal beliefs that usually influence one's actions and are learned through one's experience. In addition, Fatoba and Aladejana (2014) described attitude as the human tendency to organise thoughts, emotions and behaviours towards a psychological object. Attempts have been made by researchers to explain the relationship between attitude and learning. Strongly positive or negative views are often indicative of students' performance in economics (Yusuf, 2009). According to Candeias, Rebelo, Oliveira, and Mendes (2010), students who display a pessimistic attitude towards learning are more likely to have worse academic achievement. Sejščová in Kashifa and Tabassum (2019) provided support for the notion that students' positive attitude towards a subject is a crucial factor in achieving excellent results. Yusuf (2009) further contends that students' attitudes towards economics pose a significant challenge to effective learning in secondary schools. It is also believed that students' attitudes towards economics can impact their success in the subject, and a negative attitude towards economics and their teachers can hinder their academic achievement in economics. Put simply, students' perceptions of the value of learning economics may influence their attitude towards the topic. The statements suggest that students' attitude influences their academic achievement in the subject of economics.

Academic achievement refers to the evaluation of the results of a particular course of study, typically assessed through test and examination scores or grades given by the subject teachers (Adediwura and Tayo 2007). However, the amount of success in economics is contingent upon the student's proficiency, which can vary from poor to medium to high. Previous research has indicated that students' academic performance in this subject, as assessed by the West African Examination Council, is unsatisfactory. Insufficient instruction and the acquisition of economics knowledge during secondary education, which forms the basis, are partially to blame for this. The researcher employed the problem-based learning technique to assess its impact on enhancing students' learning outcomes in economics, with gender serving as the moderate variable.

Problem-based learning is an effective learning method that can enhance the learning process. Problem-based learning is an instructional approach that promotes active student engagement by encouraging them to investigate and resolve authentic real-world challenges. The problem-based learning technique involves collaborative efforts among students to address complex, open-ended problems, fostering a sense of accountability for their learning. During the process, teachers assume the role of facilitators, enabling students to resolve problems in a manner that promotes logical reasoning and the practical application of knowledge. (Bolaji, 2014). The objective of problem-based learning is to provoke students' consciousness of relevant, practical challenges. The purpose is to encourage students to tackle authentic issues and solve practical concerns. These issues provide opportunities for significant activities that involve students in solving challenges and engaging in higher-level thinking in real-life situations (Schmid, 2004; Bolaji, 2014). In problem-based learning, learners gradually assume greater responsibility for their learning and grow more self-reliant, reducing their dependence on the teacher. Students expressed the value of having their voice and autonomy after scenarios were implemented, as well as the value of learning from self-reflection (Carrió & Llerena, 2023).

Nevertheless, there is a lack of research that has employed a problem-based learning approach in the field of economics. Therefore, it is necessary to investigate the impact of problem-based learning as a pedagogical approach to improve economics instruction and acquisition in secondary schools. Some researchers have asserted that boys outperform girls, while others have found that girls outperform males. Another group of researchers has concluded that there is no statistically significant distinction between males and females. Amuda, Omosowo, and Mohammed (2022) found a notable correlation between gender and academic achievement in economics, indicating that male students outperform their female peers.

The primary purpose of economics is to provide individuals with knowledge of economic issues, their underlying causes, and how to address them to ensure the continuation of an economic-oriented society. This emphasises the significance of this subject at the secondary school level. Unfortunately, literature has shown that students' attitude stands a chance in influencing their academic achievement in any subject and consequently, students' achievement in Economics is not satisfying and it has been of serious concern to stakeholders in education. According to the literature, students' attitude towards a subject is an important factor that can

contribute to their achievement scores. Also, poor choice of teaching methods and poor implementation of teaching methods by Economics teachers are some of the reasons why students do not perform well in Economics. Although, Problem-based teaching and learning strategies have been used in other subject areas like accounting, biology, woodwork technology, chemistry, further mathematics and so on, However, problem-based learning strategies have not been adequately deployed in the teaching and learning of Economics. It is therefore imperative to consider the influence of problem-based teaching and learning strategies on learning outcomes in terms of students' attitudes to and achievements in economics. The following hypotheses were explored and tested:

Ho₁: There is no significant main effect of treatment on students' learning outcomes (student attitude and achievement) in Economics

Ho₂: There is no significant main effect of gender on students' learning outcomes (student attitude and achievement) in Economics

Ho₃: There is no interaction effect of treatment and gender on students' learning outcomes (student attitude and achievement) in Economics.

Literature Review

Problem-based learning is an instructional approach that prioritises problem-solving and places the student at the core of the learning process. The primary goals of PBL are to facilitate the growth of flexible knowledge, improve problem-solving skills, nurture intrinsic motivation, and encourage collaborative and self-directed learning (Barrows, 1996; Barrows & Tamblyn, 1980). Furthermore, problem-based learning is an educational method that allows learners to focus on developing a profound comprehension of the topic by actively participating in genuine, practical situations (Savery, 2006; Baron and Darlington-Hammond, 2008). (Chang, Yan & Lu, 2022) stated that one of the successful teaching strategies is problem-based learning (PBL), which teaches students to learn from problems.

The PBL process comprises multiple stages: PBL serves as a strategic approach, presenting students with a genuine problem from the real world. They actively participate in conversations and formulate hypotheses. At first, students retrieve their prior information and experiences about the subject; next, they identify areas where their knowledge is lacking and commence their investigation. Afterwards, students apply their knowledge to verify the precision of their predictions through experimentation. After finishing each task, students engage in reflection to assess the knowledge they have acquired (Wang, Thompson, and Shuler, 1999). Himelo-Silver (2004) asserted that the primary determinant of problem-based learning (PBL) is the challenge itself.

Nevertheless, the process of problem-solving entails examining circumstances in which the solution is not readily apparent to the individual inquiring. For students to successfully tackle a task or problem, they must possess a comprehensive comprehension of the pertinent concepts within their cognitive framework. This aligns with the findings of researchers Johanning (2006) and O'Donoghe et al. (2011). Problem-solving is a pedagogical method that effectively teaches students the systematic process of solving problems, starting with the initial problem state and progressing to the final solution. As per Lloyd, William, Megan, Grunet, & George (2014), students who employed problem-solving heuristics exhibited enhanced self-assurance and a higher ability to address complex economic challenges.

In addition, Savery (2006) stated that in problem-based learning, educators guide students by offering suggestions on further studies or investigations without assigning specific learning assignments. Rather than receiving pre-determined tasks, students take charge of finding solutions to their challenges by describing the problem, posing relevant questions, conducting research, and creating a product that showcases their cognitive processes. Collaborative groups typically perform these tasks, often generating multiple methods to tackle the same problem and arriving at diverse conclusions. He stressed that problem-based learning is a practical alternative to traditional teaching approaches, effectively preparing students with the essential skills to address societal and economic concerns. The growing recognition of problem-based learning is due to its alignment with the desirable attributes and competencies of prospective economic leaders and administrators. Therefore, incorporating problem-based learning into the core curriculum to meet accreditation standards and foster students' independence in economics study is recommended.

Research has empirically validated problem-based learning as an effective method for improving subject matter retention, promoting favourable attitudes towards learning, and nurturing students' interpersonal skills. (Dennis, 2003; Ayeni and Fakunle, 2021). The learning method is a strategy that instructors employ during class instruction. The implementation of the lecturer's planned models approaches, and strategies is the learning method (Rafiq, Triyono & Djabatiko, 2023). Teachers adopt a facilitative role, responding to enquiries from groups, supervising both positive and negative behaviour, and actively seeking opportunities to steer students away from depending only on individual study. Building a positive mindset and improving academic performance are two benefits of using

interactive techniques (Oladele, Ligali & Ndlovu, 2024). Teachers continue to fulfil their role as educators, but they use different timing and tactics for their educational interventions compared to conventional methods. (Ayeni & Fakunle, 2021).

Stepien, Gallagher, and Workman (1993) generally recognise the benefits of problem-based learning. This technique motivates students to constantly use their information, promotes knowledge organization around fundamental theoretical and practical concepts, highlights crucial concerns that enhance authentic understanding, and instils the required intellectual rigour. Furthermore, problem-based learning fosters the development of students' cognitive skills, such as critical thinking, logical reasoning, knowledge acquisition, and efficient problem-solving. Akinwale (2010) definition of problem-based learning is objective is to foster students who possess not only the ability to memorise economic theories but also comprehend their real-world implementation. Simply introducing an economic problem to students does not guarantee their capacity to resolve it. Furthermore, it remains uncertain whether the solutions proposed by students and the methods they employ to arrive at them lead to a comprehensive comprehension of the intended underlying concepts and theories.

Also, David, Anyagh, and Adeniran (2019) described problem-based learning in secondary education is a more advantageous approach for developing critical thinking and problem-solving abilities in the face of educational transformations. This technique can help clarify the problems in ongoing educational reform efforts and contribute to supporting constructive changes, boosting students' consciousness, attitudes, knowledge, and comprehension of our social and economic surroundings. We emphasised that problem-based learning is a highly effective learning strategy that fosters student collaboration. This approach allows them to work together towards shared goals and empowers them to actively contribute to positive change in their communities within the curriculum. This approach allows students to use their academic proficiency and understanding to address practical problems and meet society's requirements. Issue-based learning is a teaching approach that involves integrating learning with the active process of seeking answers and understanding an issue. Proposals for various definitions of problem-based learning highlight this fundamental concept. According to Abubakar and Arshad (2015), problem-based learning holds students responsible for their learning, fosters linkages in both classroom and professional settings, and helps develop lifelong learning and information management abilities.

Sari, Utomo, and Astina (2021) define problem-based learning as a learning approach based on authentic issues. Students gain knowledge through active participation in real-world problem-solving activities, thus developing their understanding. This teaching style requires students to actively engage in acquiring information and exploring potential answers, while the teacher acts as a facilitator. He asserted that problem-based learning offers students a genuine problem that frequently arises in their everyday lives. This educational style encourages active student participation in the learning process by focusing on genuine problems and adopting a student-centred approach to learning. Challenge-based learning involves students working together in groups to evaluate their current knowledge, identify areas where they need to gain more understanding, develop plans to obtain new information, and eventually solve the given challenge. Nevertheless, students are required to generate hypotheses, identify learning obstacles, seek reliable sources of information, evaluate the collected data, participate in introspection, integrate new knowledge, and devise solutions to diverse problems (Abubakar & Arshad, 2015). Continually engaged in their work, students are not required to passively absorb information from lectures. This makes it impossible for students to lack enthusiasm for their tasks (Febriana, Yusri, & Delyana, 2019).

In addition, problem-based learning courses facilitate the acquisition of various vital 21st-century skills, which will be extremely important for students as they advance beyond high school. An example worth mentioning is that solving complex problems encourages the application of inventive and conceptual thinking (Gerlings, 2018). Ostby (2022) asserts that problem-based learning (PBL) combines active and collaborative learning approaches, promoting the practical application of knowledge to real-life scenarios. This method enhances students' problem-solving skills and their ability to retain information, while also fostering the growth of critical thinking abilities.

Problem-based learning, also known as PBL, offers a different approach compared to traditional learning. It allows students to actively participate in creative thinking and thoroughly analyse their approach to tackling the assigned problem. Lemke, Sen, Pahlke, Partelow, Miller, Williams, and Jocelyn (2004) are the cited sources. Students can easily and immediately apply the knowledge they gain through PBL to real-life circumstances, ensuring effective time management and avoiding taking shortcuts. The reference for this source is Poon, Reed, and Tang (1997). Bwari and Betung (2023) argue that problem-based learning, a pedagogical approach, entails presenting students with a complex problem or issue and directing them through a sequence of investigations and explorations to arrive at a solution. Therefore, participating in exploratory activities results in students gaining valuable cognitive skills, such as the enhancement of critical thinking and problem-solving capabilities. In addition, problem-based learning improves collaborative skills by promoting cooperation and encouraging the exchange of ideas among team members to achieve a solution. Moreover, he claims that this teaching method applies to several

academic topics, with its primary use in the domains of science, technology, engineering, and mathematics (STEM) education.

Olowodun, Abdullahi, Hamza, and Haruna (2023) conducted one of the previous studies on problem-based learning. Their study aimed to investigate the impact of cooperative-based learning on the academic performance of secondary school students studying financial accounting in Edo State, Nigeria. The study employed a quasi-experimental methodology and involved a sample of 217 financial accounting students from nine public senior high schools in the Akoko-Edo Local Government Education Zone. The study discovered a significant difference in the average academic performance of students who received financial accounting instruction through cooperative teaching as opposed to problem-based learning. The results show that students exposed to cooperative and problem-based learning outperformed their peers in traditional groups. In Ostby's (2022) research, students exposed to a problem-based learning environment demonstrated greater enhancements in their achievement scores compared to those who learned the same subject in a traditional classroom setting. The assessments of scholars whose research we analysed in this study indicate that problem-based learning has a substantial influence on students' academic performance.

Furthermore, practical issues and choices in the real world intricately connect to the discipline of economics. Problem-based learning (PBL) is very suitable for simulating authentic economic scenarios. Analysing the consequences of these implications can provide insights into the extent to which students are prepared to tackle economic challenges in their future careers or personal pursuits. Therefore, we anticipate that the implementation of a problem-based learning approach will enhance the teaching of economic principles.

Method

The study utilised a quasi-experimental design with a pre-test, post-test, and control group. A purposive selection technique was employed to choose a single education district among the six education districts in Lagos State, and three local government areas (LGAs) within the district were chosen for sampling. A simple random selection technique was employed to choose two schools from each local government area (LGA), resulting in a total of six secondary schools. To obtain a representative sample of students from the chosen schools, a purposive sampling technique was employed. This involved selecting a whole class of 209 SSI students, consisting of 108 males and 101 females. Two weeks before conducting the research activities, the school's authorities and students were visited to provide them with information about the study's content and to obtain their informed consent. The Student Attitude to Economics Scale and Student Economics Achievement Test were verified by specialists in scale creation. The estimated reliability coefficient for the Student Attitude to Economics Scale was 0.88, calculated using the Cronbach Alpha formula. The estimated reliability coefficient for the Student Economics Achievement Test was 0.77, calculated using the Kuder-Richardson 20 method.

The students were taught using a treatment called the Problem-Based Instructional Guide (PBIG) for five weeks. PBIG is a teaching and learning technique that focuses on problem-based instruction. During the sixth week, both the students who were included in the teaching and learning process and those who were not (the control group) were given the Student Attitude to Economics Scale and Student Economics Achievement Test in a traditional pen-and-paper format. The collected data were analyzed using covariate analysis (ANCOVA) with a significance level of $\alpha = 0.05$.

Findings

Table 1 presents the main effect and interaction of:

- i. treatment on students' learning outcomes (student attitude and achievement) in Economics
- ii. gender on students' learning outcomes (student attitude and achievement) in Economics and,
- iii. treatment and gender on students' learning outcomes (student attitude and achievement) in Economics.

Table 4.1: Summary of ANCOVA of Learning Outcomes by Treatment and Gender

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|------------------|-------------------------|----|-------------|---------|------|---------------------|
| Corrected Model | 4228.939a | 4 | 528.617 | 3.011 | .003 | .74 |
| Intercept | 90904.4 | 1 | 90904.4 | 517.789 | .000 | .632 |
| Pretest | 553.549 | 1 | 553.549 | 3.153 | .077 | .01 |
| Treatment | 4318.329 | 2 | 2159.164 | 137.785 | .000 | .517 |
| Gender | 90.292 | 1 | 90.292 | .514 | .474 | .002 |
| Treatment*gender | 285.5 | 2 | 142.75 | .813 | .444 | .005 |

| | | | |
|------------------------|-----------------|------------|--------|
| Error | 2802.674 | 204 | 13.739 |
| Total | 134190 | 209 | |
| Corrected Total | 11490.98 | 208 | |

a R Squared = 0.756 (Adjusted R Squared = .751), b Computed using alpha = 0.05, Dependent Variable: Learning Outcome.

Table 1 displays the ANCOVA analysis of learning outcome scores, categorised by treatment and gender. The model's adjusted mean is 0.756, its intercept is 0.751, its pretest value is 0.033, and its corrected total is 1490.98. The error rate is 2802.674. The study found that the treatment had a significant impact on the student's learning outcomes in economics among the participants. The statistical analysis showed a significant effect ($F(2, 209) = 137.785, p < 0.05, (.000)$) with a large effect size (partial $\eta^2 = .51$). Therefore, the null hypothesis H_{01} was rejected. The study results, as presented in Table 1, demonstrated a significant impact of both problem-based and traditional treatments on students' economics learning outcomes. The findings indicated that the problem-based learning approach had a considerable positive impact on the student's academic achievements in economics, surpassing the effectiveness of the traditional method. The students in the problem-based learning approach achieved the highest mean score on their economics learning outcomes, whereas the students in the conventional learning method earned the lowest mean score. According to Omega, Iji, and Adeniran (2017), the problem-based learning (PBL) strategy had a significantly beneficial impact on students' performance.

Table 4.1 presents the impact of gender on students' attitudes towards economics. However, there was no significant impact of gender on students' learning outcomes in economics, as indicated by the statistical analysis ($F(1, 209) = 0.514, p > 0.05, (.474)$) with a partial $\eta^2 = .00$ observed. Therefore, H_{02} was not dismissed. The findings from Table 1 suggest that gender does not have a significant impact on student's learning outcomes in economics, indicating that gender does not influence students' learning outcomes in this subject. This discovery validates the findings of Akinwale (2010) and Gbadamosi (2020), who concluded that gender does not significantly influence students' academic achievements in the field of economics. Nevertheless, it contradicts the findings of Amatobi and Amatobi (2020), who observed a gender disparity in the field of economics. While the average score of female students was higher than that of their male counterparts, as seen in Table 4.2, the observed difference was not statistically significant.

Table 1 demonstrates the significant interaction effect of treatment and gender on students' economics learning outcomes. The F statistic ($F(1, 209) = 0.813$) is not statistically significant ($p > 0.05$), with a small effect size (partial $\eta^2 = .000$) detected. Therefore, H_{03} was accepted. The ANCOVA analysis yielded significant findings on the impact of therapy, gender, and their interaction on learning outcomes. The revised model effectively accounts for the variability in learning outcomes, explaining a significant percentage of the variability. The treatment variable exerts a significant influence on learning outcomes, with distinct treatments accounting for 51.7% of the observed variations. The pretest scores did not exert a significant influence on the post-treatment learning results, indicating that the starting levels of learning did not play a substantial role in determining the outcomes following the treatment. Gender had a negligible impact on learning outcomes, with a minuscule effect size. Gender did not influence the treatment's effectiveness, as the treatment-gender interaction did not reach statistical significance.

The results indicate that the type of treatment administered was the primary factor influencing learning outcomes, with a large effect size, highlighting the importance of the specific interventions used. The non-significant effect of pretest scores implies that participants' initial abilities did not significantly predict their post-treatment performance, indicating their broad applicability. The lack of a significant gender effect suggests that the interventions were equally effective for both male and female participants, supporting the notion that the treatments were gender-neutral in their impact on learning.

Table 2: Estimated Marginal Means of Students' Learning Outcomes in Economics by Treatment

| Dependent Variable | Treatment | Mean | Std. Error | 95% Confidence Interval | |
|--------------------|------------------------|---------------------|------------|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Learning outcomes | Problem-based Learning | 80.972 ^a | 1.361 | 73.108 | 78.467 |
| | Conventional Learning | 75.788 ^a | 1.315 | 78.383 | 83.560 |

The model assesses the covariates at the following values: The pretest score is 12.80. According to Table 2, students who participated in problem-based learning achieved the greatest average score of $\bar{x} = 80.972$, whereas the control group obtained the lowest average score of $\bar{x} = 75.78888$. This suggests that problem-based learning was more effective than conventional teaching in enhancing students' learning outcomes in economics, whereas conventional teaching had the least impact on increasing students' learning outcomes in economics.

Table 3: Estimated marginal means of students' learning outcomes in Economics by gender

| Dependent Variable | Treatment | Mean | Std. Error | 95% Confidence Interval | |
|--------------------|-----------|---------------------|------------|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Learning outcomes | Male | 78.134 ^a | 1.209 | 72.475 | 83.793 |
| | Female | 79.147 ^a | 1.090 | 69.532 | 88.761 |

The model evaluates the covariates at the following values: The pretest score is 12.80. According to Table 3, female students achieved the greatest average score of $\bar{x} = 79.147$, while male students got an average score of $\bar{x} = 78.134$. The disparity in their average scores did not exhibit statistical significance. Female students demonstrate a marginally superior disposition towards economics compared to their male counterparts. The findings from Table 3 suggest that the combination of therapy and gender did not have a significant impact on student's learning outcomes in economics. Alordiah, Akpadaka, and Oviogbodu (2015) found that gender had no impact on treatment or learning results in the field of economics. As previously stated, this study found that regardless of the approach used, treatment led to enhanced learning outcomes in economics for students. However, this enhancement does not impact gender. Hence, it is possible that gender was the underlying factor responsible for the absence of any observed interaction effect. This discovery is promising about gender parity in education and underscores the significance of directing attention towards other variables that could impact academic achievement.

Discussion- Conclusions

The findings imply that educators can confidently apply the problem-based teaching and learning strategy in educational settings, disregarding any concerns about gender disparities. This finding is also encouraging in terms of gender equality in education and highlights the importance of focusing on other factors that might influence academic performance. Future research could explore other potential moderators or covariates that might influence the effectiveness of the treatments, and policymakers and educational practitioners should consider these treatments for wider implementation, especially given their robust impact on learning outcomes. The study's findings led to the following recommendations: Teachers should actively involve the students in activities that require critical thinking and the ability to make informed choices. School administrators and policymakers can implement measures to enhance student learning by establishing a re-training program for senior secondary school teachers. Workshops and seminars should be conducted on this programme, with a focus on effectively utilising problem-based learning strategies.

References

Abubakar, A. B., & Arshad, M. Y. (2015). Self-Directed Learning and Skillsof Problem-Based Learning: A Case of Nigerian Secondary Schools Chemistry Students. *International Education Studies*, 8(12), 70-78.

Adu, E.O. (2012). Two problem-based learning strategies, Quantitative ability and Gender as determinants of students' achievement in Economics. Unpublished Ph.D. thesis, University of Ibadan.

Adediwura, A. A., & Tayo, B. (2007.) Perception of teachers' knowledge, attitude and teaching skills as a predictor of academic performance in Nigerian secondary schools. *Educational Research and Reviews*, 2(7), 165.

Akinwale, O. (2010). Problem based learning: a review of literature on its outcomes and implementation issues. *Journal of Academic Medicine*, 2010, 8.4:102-110.

Alordiah, C.A, Akpadaka, G & Oviogbodu, C.O. (2015). The Influence of Gender, School Location and Socio-Economic Status on Students' Academic Achievement in Mathematics. *Journal of Education and Practice*.6.17 ISSN 2222-1735.

Amatobi, V. E., & Amatobi, D. A. (2020). The influences of gender and attitude differences to students achievement in mathematics in Nigerian secondary schools: a case study of comprehensive secondary school

Amurie-Omanze in Southeastern Nigeria. *American Journal of Research Communication*, 2020, 8(2): 1-8) www.usa-journals.com, ISSN: 2325-4076.

Amuda, A. A., Omosewo, E. O., & Mohammed, R. E. (2022). Critical Thinking Ability as A Correlate of Senior Secondary School Students' Achievement in Physics in Sokoto State, Nigeria. *IJER (Indonesian Journal of Educational Research)*, 7(2), 133-142.

Ayeni, A. J., & Fakunle, A. F. (2021). teamwork management and Teachers' productivity in secondary schools in Ondo central senatorial district of Ondo state, Nigeria. *African Journal of Educational Management*, 22(1), 49-69.

Barron, C., & Darlington-Hammond, L. (2008). Teaching for meaningful learning: A review of research on inquiry-based and cooperative learning. In L. Darling-Hammond, B. Barron, D. Pearson, A. Schoenfeld, E. Stage, T. Zimmerman, G. Cervetti, & J. Tilson (Eds.), *Powerful learning: What we know about teaching for understanding* (pp. 11-70). San Francisco: Jossey-Bass.

Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-based learning: An approach to medical education* (Vol. 1). Springer Publishing Company.

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New directions for teaching and learning*, 1996(68), 3-12.

Bolaji, B., (2014). Effects of Lecture and Activity Based Methods on the Attitudes of Junior Secondary School Students to Essay Writing in French, *European Journal of Educational Studies*, 6(1),2014, 43–49.

Bwari, E. S., & Benung, R. P. (2023). Effect of problem-based learning on secondary school economics students critical thinking and collaborative skills in Bauchi local government area, Bauchi state. *Billiri Journal of Education Studies*, 1(1), 81-86.

Candeias, A. A., Rebelo, N., Oliveira, M., & Mendes, P. (2010). Students' Attitudes and Motivation toward Learning and School—Study of exploratory models on the effects of socio-demographics, personal attributes and school characteristics. *Res. Gate*, 1, 1-18.

Carrió Llach, M., & Llerena Bastida, M. (2023). Exploring innovative strategies in problem based learning to contribute to sustainable development: a case study. *International Journal of Sustainability in Higher Education*, 24(9), 159–177. <https://doi.org/10.1108/ijsh-07-2021-0296>.

Chang, Y.-H.; Yan, Y.-C.; & Lu, Y.-T. (2022) Effects of Combining Different Collaborative Learning Strategies with Problem-Based Learning in a Flipped Classroom on Program Language Learning. *Sustainability*. <https://doi.org/10.3390/su14095282>.

Chiasom, F., Okwu, T. & Kunemeh, Y. (2013). Gender difference in Nigerian secondary school students' academic achievement in chemistry. *Journal of Education and Social Research*, 2(1), 76-81.

David, N. I, Anyagh, P. I., & Adeniran, S. A. (2019). "Effect of problem-based learning strategy on upper basic education Students interest, achievement and cognitive load in basic science in Katsina-ala local government area."

Dennis, J. (2003). Problem-based learning in online vs. face-to-face environments. *Education for Health: Change in Learning & Practice*, 16(2).

Fatoba, J. O., & Aladejana, A. L. (2014). The Attitudes of Biology Teachers and Students toward the Conservation of Natural Resources in Ekiti State, Nigeria. *European Journal of Educational Sciences*, 1(4), 38-46.

Febriana, R., Yusri, R., & Delyana, H. (2019). Development E-Learning Using Problem-Based Learning. In *International Conference on Mathematics and Science Education of Universitas Pendidikan Indonesia* (Vol. 4, pp. 1-7).

Gbadamosi, T. V., & Akanni, O. O. (2017). Counselling Implications of teaching Economics through service-learning instructional strategy to enhance entrepreneurship skills. *Fafunwa Journal of Contemporary Education (FAJOCE)*, 1 (1), 70-79.

Gbadamosi, A. (2020). Postmodernism, ethnicity, and celebrity culture in women's symbolic consumption. *International Journal of Market Research*, 62(5), 561-577.

Gbore, L. O., Olabode, A. T., & Olufemi, A. S. (2011). Skewness and Comparability of School Based Continuous Assessment Scores. *Journal on School Educational Technology*, 7(2), 39-45.

Gerlings, A. (2018). Knot Your Typical Math Problem. *Teaching Children Mathematics*, 24(7), 414–417. <https://doi.org/10.5951/teacchilmath.24.7.0414>

Glazer, E. (2001). Problem based instruction. Emerging perspective on learning, teaching, and technology. Diambil dari <http://www.coe.uga.edu/epltt/ProblemBasedInstruct.htm>.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational psychology review*, 16, 235-266.

- Johanning, D. (2006). Benchmarks and estimation: A critical element in supporting students as they develop fraction algorithms. In Proceedings of the 28th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 384-386).
- Kashifa, K., & Tabassum, F. (2019). A Study of Effect of School Environment on the Attitude towards Education among Senior Secondary School Students RESEARCH REVIEW International Journal of Multidisciplinary (RRIJM), 4.8 ISSN: 2455-3085 (Online): Retrieved from www.rrjournals.com
- Lemke, M., Sen, A., Pahlke, E., Partelow, L., Miller, D., Williams, T., & Jocelyn, L. (2004). International Outcomes of learning in mathematics literacy and problem-solving: Pisa 2003 results from the U.S. Perspective Highlights.
- Lloyd, M. M. William, W. C. Megan, L., Grunet, J. M. & George, A. (2014). The Effect of using an explicit general problem-solving teaching approach on Elementary Pre-serve teachers' ability to solve heat transfer problem. International Journal of Education in Mathematics Science and Teaching 2(3). 164-(74)
- Mishra, P., & Koehler, M. J. (2008). Introducing technological pedagogical content knowledge. In annual meeting of the American Educational Research Association (Vol. 1, p. 16).
- Oladele, B. K., Ligali, O., & Ndlovu, M. (2024). Evaluation of the nexus between student attitude, teacher teaching methods, and achievement in junior secondary school mathematics. EUREKA: Social and Humanities, 2, 56–63. doi: <http://doi.org/10.21303/2504-5571.2024.003330>
- Olowodun, Y.L, Abdullahi, A. H., Hamza, A. H., & Jibrin, H. A. (2023). Effects of Co-Operative and Problem-Based Learning on Achievement of Secondary Students in Financial Accounting in Akoko-Edo, Edo State, Nigeria. ATBU Journal of Science, Technology and Education, 11(2), 216-222.
- Omega, J. O., Iji, C. O., & Adeniran, S. A. (2017). Effect of Problem-based learning approach on secondary school students' interest and achievement in electricity in Bauchi state, Nigeria. ATBU Journal of Science, Technology and Education, 5(1), 63-70.
- Ostby, R. (2022). The Impact of Problem-Based Learning on Students Critical Thinking Skills and Peer Relationships. (Dissertation) Minnesota State University Moorhead.
- Owoeye, P. O., & Agbaje, R. O. (2016). Students' attitude and gender as correlates of students' academic performance in biology in senior secondary school. International Journal of Research and Analytical Reviews, 3(3), 1-8.
- Poon, S. K., Reed, S., & Tang, C. (1997). Problem-based learning in distance education. In Proceedings of the 5th International Conference on Modern Industrial Training, Jinan, China (pp. 593-600).
- Rafiq, A. A., Triyono, M. B. & Djatmiko, I. W. (2023). The integration of inquiry and problem-based learning and its impact on increasing the vocational student involvement. International Journal of Instruction, 16(1), 659-684. <https://doi.org/10.29333/iji.2023.16137>
- Sari, Y. I., Utomo, D. H., & Astina, I. K. (2021). The Effect of Problem-Based Learning on Problem Solving and Scientific Writing Skills. International Journal of Instruction, 14(2), 11-26.
- Savery, J. R. (2006). An overview of problem-based learning: Definitions and distinctions. Interdisciplinary Journal of Problem-based Learning, 1(1), 9-20
- Schmidt, H. 2004. The current state of problem-based learning: keynote paper presented at the problem-based learning, a quality experience. University of Salford, 15th-17th September, 2004.
- Stepien, W. J., Gallagher, S. A., & Workman, D. (1993). Problem-based learning for traditional and interdisciplinary classrooms. *Journal for the Education of the Gifted*, 16(4), 338-357.
- Wang, H. A., Thompson, P., Shuler, C., & Harvey, L. (1999). Problem-Based Learning Approach for Science Teachers' Professional Development.
- Yusuf, A. (2009). Economics education. Ilorin Journal of Education (IJE) Retrieved from http://www.musero.org.ng/economics_education.pdf, 10.