

Research Paper



Teachers' perception towards the use of problem-based learning for teaching and learning of mathematics in Lagos State secondary schools

Kasumu Abayomi Adeoye^{1*}, Kasumu Rebecca Oluwayimika²

^{1*}Department of Economics, Faculty of Social Sciences, Ignatius Ajuru University of Education, Rivers State, Nigeria.

²Department of Curriculum Studies/Educational Technology, Faculty of Education, University of Port Harcourt, Nigeria.

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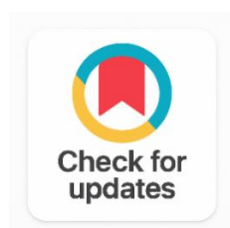
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ABSTRACT

Background: Issue based, or problem based learning is basically a teaching way where learners work together in groups to look into and crack open unstructured problems, with drive coming from the issue itself and not just from the teacher. How this is actually used inside mathematics classrooms in Nigerian secondary schools is still not really well looked at, especially when it comes to what teachers themselves think about it.

Objective: The aim of this study was to find out the views of secondary school teachers in Lagos State, Nigeria, about using problem based learning (PBL) for teaching and learning mathematics.

Method: A descriptive survey design was adopted. The study was carried out at Corona Secondary School, Lekki, and St. Saviours High School, Ikotun, both located in Lagos State. The population included 247 teachers from Corona Secondary School and 205 teachers from St. Saviours High School, so the total N was 452. A sample of 100 teachers was picked from the two schools using a stratified sampling approach, and yes the sampling wasn't random random in the usual sense. Data were collected using a standardized 30 item instrument, the Teachers' Perspective towards the use of Problem-Based Learning for Teaching and Learning of Mathematics in Lagos State Secondary Schools (TPTPBLTMLSSS) questionnaire. Face and content validity were checked, and reliability was done with Pearson product moment correlation, which gave a coefficient of 0.72. For analysis, mean scores were used alongside z test statistics.

Results: The analysis of teachers' responses gave a more measurable way to judge their stance on adopting PBL in mathematics instruction, and mean scores plus z test comparisons were used to see whether perceptions differ across the respondent groups.

Conclusion: The findings give some insight into how ready secondary school teachers are, and also what kind of attitudes they hold toward problem based learning as a teaching method

for mathematics education in Lagos State, this matters for curriculum planning as well as teacher training, like in practical terms.

Corresponding Author:

Kasumu Abayomi Adeoye

Department of Economics, Faculty of Social Sciences, Ignatius Ajuru University of Education, Rivers State, Nigeria.

Email: abayomikasumu@yahoo.com

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1. INTRODUCTION

Haward Barrows, a prominent figure at McMaster University Medical School, first used the phrase "problem-based learning" in 1974 [1]. He employed it to characterize a novel method of medical education that had been created at McMaster by Dean John Evans and his group beginning in 1965 [2]. It was a brand-new program with room for testing. The use of patient cases or descriptions of biomedical phenomena as learning prompts, the integration of disciplines under an organ system approach, the absence of any formal exams, and contempt for lectures were its key distinguishing features [3]. The idea behind problem-based learning is that knowledge and skills are learned through a gradual progression of real-world situations, learning resources, and instructor help. While one of its key goals is to encourage autonomous and lifelong learners, collaboration and personal reflection are at the heart of it. Yet, teamwork has a significant impact on the caliber of the work produced [4]. Problem-based learning is a type of active learning that promotes knowledge construction, integrates classroom instruction with real-world situations, and teaches students how to develop flexible knowledge, effective problem-solving techniques, develop intrinsic motivation, share ideas, and collaborate through collaboration. Learners are capable of determining what they already know, what they need to know, as well as how and where to find the information they require to solve a problem successfully [5]. By encouraging students to actively participate in their learning, supporting, directing, and assessing their progress, instructors can help students learn. They also help students develop their confidence. This approach allows students the chance to develop their computational, teamwork, communication, and problem-solving skills [6], [7], [8].

PBL is a curriculum and instructional strategy that allows learners to undertake research, combine theory and practice, and use their knowledge and skills to create a workable solution to a given problem. This method centers math instruction on problem-solving exercises while also giving students the chance to think critically, present their own original ideas, and collaborate mathematically with others [9]. A teaching method known as problem-based learning (PBL) encourages students to take charge of their own education. Problem-based learning encourages students to build problem-solving abilities and acquire concepts rather than just memorizing information by using complicated, real-world challenges as the subject matter in the classroom. Students may create, design, and launch their unique goods in front of their peers and local leaders in a variety of various ways, either individually or in groups [10]. Any academic topic, including math and science as well as social studies and literature, can benefit from problem-based learning. Regardless of the subject area, a successful problem-based learner approach should include elements like: Students should be pushed to make decisions they can defend, and instructors should clearly tie current topic objectives to prior courses and expertise. Students should also be encouraged to collaborate in groups to address the difficult problems at hand. Encouraging kids to work through a challenging problem in several steps [11].

PBL is an organized, student-centered method in which pupils gain knowledge of a subject by

working in groups to address an unrestricted issue. What spurs learning and motivation is the issue [12]. The following results are connected to problem-based learning, according to [13]. Students get the chance to acquire skills linked to:

- Working in teams.
- Managing projects and taking on leadership positions through the use of a well-designed PBL project.
- Working autonomously.
- Oral and written communication.
- Self-awareness and group process evaluation.

By involvement in actual work projects and experiences, problem-based learning helps students to learn in-depth and acquire fundamental employability skills. In project-based learning (PBL), students collaborate in groups over the course of a predetermined amount of time on a project intended to address a complex issue. Students create a product or give a presentation to the general public to showcase their knowledge and talents. Moreover, PBL encourages the development of 21st century abilities like critical thinking, cooperation, creativity, and communication while also allowing students to gain deep content knowledge. Several learning contexts, such as secondary schools and colleges, adopt PBL education [14]. According to [15], problem-based learning is a strategy that may be utilized in curriculum creation and the instructional process to highlight the significance of problem-solving abilities and create the capacity for self-learning. According to [16], problem-based learning is a method of instruction where students gain knowledge by resolving a real-world issue or problem. Students determine how their past knowledge can be applied to solve the problem and what else they need to learn to finish the task by working through the many steps involved in addressing the challenge. PBL is an instructional strategy that, in accordance with [17], gives students the chance to find answers to poorly structured, real-world situations. Team cohesion moderates the effects of problem-based learning on students' perceptions of skill improvement.

Teachers adjust their educational tactics over time based on a number of contextual restrictions, according to [18], Tawfik, Gish-Liberman, and Arrington (2021). Teachers frequently have to alter their PBL strategies in response to these difficulties. According to [19], [20] in problem-based learning, students focus their learning on a complex problem for which there is no single right answer. In order to determine what they need in order to solve an issue, students collaborate in groups. According to, problem-based learning offers creative contexts for aspiring and licensed teachers to collaborate in small groups. The ability to solve problems can be crucial in preparing instructors to meet these demands. [21] observed that there were significant discrepancies in the types of assignments, methods of evaluation, and group work structure. The problem-based learning models appear to encourage a better level of involvement in study activities and, as a result, a higher level of sophisticated comprehension as compared to standard engineering curricula. According to [22], and Zhang's study from 2022, problem-based learning combined with the flipped classroom teaching method can increase medical postgraduate students' overall understanding and retention of professional knowledge as well as foster teacher-student interaction and teamwork skills. According to [23], Beyene, Beyene, and Shiferaw (2017), the problem-based learning approach to teaching physics is more effective than the traditional approach. This is due to the fact that students in the experiencing group do better than those in the comparison group. Several currently available online tools, including Zoom, Google Classroom, email, etc., can be used to facilitate online classes [4]. Boredom in learning can be decreased by using an engaging and current learning model. To prevent monotony, students who use online learning platforms need a variety of learning models [24]. To create engaging learning activities for students, teachers must be creative in addition to adopting an engaging learning approach [25]. A learning environment that is focused on the needs of the students can be e-problem-based learning. In order to gather information, choose the finest self-skills for analyzing problems, and provide the best solutions, students usually work on problems in small groups [5].

Problem-based learning takes up more time and interferes with other topics' study time. Because learning is more chaotic and group dynamics concerns can occasionally undermine the effectiveness of problem-based learning, less subject knowledge may be learned. Creating appropriate issue scenarios for problem-based learning is challenging and requires greater teacher training. Students demand a change in the school's predominant lecture-based pedagogical methodology. Schools will require assistance with

staff development, generally take on additional teachers, and it works best in flexible classroom settings. Schools that question its usefulness will be resistant to it.

2. METHODOLOGY

The study's objective is to ascertain how teachers in secondary schools in Lagos State feel about using problem-based learning to teach and learn mathematics. The study's specific goals are to:

1. Examine teachers' attitudes on the use of problem-based learning in Lagos state secondary schools for the teaching and learning of mathematics; and
2. Evaluate the advantages of problem-based learning for mathematics teaching and learning in secondary schools in Lagos State.
3. Describe the dangers of adopting problem-based learning to teach and learn mathematics in secondary schools in Lagos State.

2.1. Research Questions

1. What do instructors think about the use of problem-based learning in secondary schools in Lagos State for teaching and learning mathematics?
 2. What are the advantages of problem-based learning for mathematics instruction and learning in secondary schools in Lagos State?
 3. Are there any risks associated with utilizing problem-based learning in secondary schools in Lagos State to teach and learn mathematics?
- **Research Design:** The research is a descriptive survey that aims to find out how teachers in Lagos State secondary schools feel about using problem-based learning to teach and learn mathematics.
 - **Area of the Study:** The study is being conducted at Corona Secondary School in Lekki and St. Saviours High School in Ikotun, Lagos State, Nigeria.
 - **Population:** There are 205 teachers at St. Saviours High School in Lagos State and 247 teachers at Corona Secondary School that make up the study's population.
 - **Sample and Sampling Techniques:** A sample of 100 teachers was used in the study. 100 teachers were part of the study's sample. Candidates were picked through a stratified sampling process. The instrument used for the study is a standardized 30-item questionnaire called Teachers Perspective towards the use of Problem-Based Learning for Teaching and Learning of Mathematics in Lagos State Secondary Schools (TPTPBLTMLSSS).
 - **Study Validity:** For the study, face and content validity were used.
 - **Method of Data Analysis:** Using Pearson product moment correlation, a reliability co-efficient of 0.72 was found.
 - **Reliability:** The study's statistical methods included the mean and z test.

3. RESULTS AND DISCUSSION

- **Research Question1:** What do instructors in Lagos state secondary schools think about using problem-based learning for mathematics teaching and learning?

Table 1. Outlines How Teachers View Problem-Based Learning

S/N	Items Teachers Perception Towards Problem-Based Learning	SA	A	SD	D	Mean	SD	Total No of Respondents
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1	Students are challenged through problem-based learning to use critical thinking and unconventional thinking in order to solve mathematical issues.	93	7	-	-	3.93	0.25	100
2	PBL encourages students to take charge of their own learning and exercise initiative.	56	40	4	-	3.52	0.57	100
3	Students who engage in problem-based learning might gain the self-respect and satisfaction that comes from coming up with a creative solution.	73	7	-	-	3.13	0.74	100
4	Transferable skills are developed by pupils through problem-based learning.	69	21	10	-	3.59	0.66	100
5	Pupils appreciate and feel more satisfied with problem-based learning.	71	20	9	-	3.62	0.54	100
6	Learning through problems aids in acquiring abilities for lifelong learning.	84	11	5	-	3.79	0.51	100
7	PBL fosters greater interaction and involvement with learning materials.	77	20	3	-	3.74	0.50	100
8	Higher level thinking and problem-solving abilities are promoted by problem-based learning.	67	33	-	-	3.67	0.47	100
9	Collaboration and communication are two 21st century abilities that are fostered by problem-based learning.	54	46	-	-	3.54	0.49	100
10	Problem-based instruction promotes student retention.	89	11	-	-	3.89	0.31	100
	Average Mean					3.64	0.50	

According to Table 1, students in Lagos State secondary schools accepted the complete item as their perspective on the use of problem-based learning for teaching and studying mathematics. This is so because the overall item mean was higher than the 2.50 criteria mean. The total mean of 3.64 indicates that problem-based learning challenges students to use critical thinking and problem-solving strategies.

- **Research Question 2:** What are the advantages of problem-based learning for mathematics teaching and learning in secondary schools in Lagos State?

Table 2. Advantages of Problem-Based Learning for Teaching and Learning

S/N	Items Advantages of Problem-Based Learning for Teaching and Learning	SA	A	SD	D	Mean	SD	Total No of Respondents
1	Students identify what they must learn in cooperative groups in order to solve a mathematical problem.	86	14	-	-	3.86	034	
2	Students can practice self-directed learning, apply what they've learned to the issue at hand, and then reflect on their experiences and the efficiency of their chosen tactics.	75	15	10	-	3.65	0.65	
3	PBL encourages students to study and aids in the development of their problem-solving abilities.	85	10	5	-	3.80	050	
4	PBL places the acquisition of new knowledge in the context of some significant issues or circumstances.	79	13	8	-	2..92	0.99	
5	Problem-based learning improves students' comprehension, encourages them to read more, and helps them adopt a self-directed and problem-solving mindset.	46	54	-	-	3.46	0.49	
6	PBL fosters students' vibrant classroom participation.	66	30	4	-	3.62	0.56	
7	Problem-based learning activities encourage students to collaborate and work in teams, be flexible and adaptable, and to study at a higher level and with more responsibility.	49	50	-	-	3.48	0.51	
8	Those with less severe disabilities benefit from PBL. learn to have empathy for pupils who have more severe	82	18	-	-	3.82	0.38	

	difficulties							
9	Students who communicate and exchange knowledge are better able to absorb mathematics curriculum.	78	22	-	-	3.78	0.41	
10	PBL encourages comprehensive learning and aids in students' development of self-directed learning abilities.	63	37	-	-	3.63	0.48	
	Average Mean					3.60	0.53	

Table 2 demonstrates that students in secondary schools in Lagos State acknowledged the full item as an advantage of problem-based learning for the teaching and learning of mathematics. This is so because the overall item mean was higher than the 2.50 criteria mean. Students should collaborate in groups to determine what they need to learn in order to solve a mathematical issue, according to the overall mean of 3.60.

- **Research Question 3:** Is there a risk while adopting problem-based learning to teach and study mathematics in secondary schools in Lagos State?

Table 3. Hazards associated with Utilizing Problem-Based Learning for Instruction and Learning

S/N	Items Hazards Associated with Utilizing PBL for Teaching and Learning	SA	A	SD	D	Mean	SD	Total No of Respondents
1	Previous education does not adequately equip students for problem- based learning	76	24	-	-	3.76	0.42	
2	PBL needs extra time and interferes with other subjects' study time.	72	19	9	-	3.63	0.64	
3	The messier nature of learning causes people anxiety.	81	19	-	-	3.81	0.39	
4	Problem-based learning can occasionally be compromised by group dynamics concerns.	84	16	-	-	3.84	0.36	
5	It is possible to learn less about the subject.	59	29	12	-	3.47	0.69	
6	PBL prompts more inquiries.	68	22	10	-	3.58	0.66	
7	The degree of relevance and applicability of PBL varies.	67	25	8	-	3.59	0.63	

8	PBL can lead to organizational issues as well as pupils who are impatient to finish group projects as soon as possible.	80	20	-	-	3.80	0.41	
9	Problem-based learning lacks sufficient resources and student motivation.	90	10	-	-	3.90	0.30	
10	When students take standardized examinations, spending too much time on problem-based learning could prevent them from having the depth of knowledge necessary for excellent scores.	95	2	3	-	3.92	0.36	
Average Mean						3.73	0.48	

Table 3 demonstrates that when using problem-based learning to teach and study mathematics in secondary schools in Lagos State, pupils accepted all of the items' hazards. This is so because the overall item mean was higher than the 2.50 criteria mean. A mean score of 3.73 implies that students who spend too much time on problem-based learning may not have the depth of knowledge required to perform well on standardized tests.

3.1. Hypothesis

Ho1: The perceptions of Corona Secondary School and St. Saviours High School about the application of problem-based learning for the instruction and acquisition of Mathematics in Lagos State Secondary Schools are not significantly different.

Table 4. Table of Analysis to Assess the Significance of the Perception of the Usage of Problem-Based Learning for Teaching and Studying Mathematics in Lagos State Secondary Schools between Corona Secondary School and St. Saviours High School

Group	Mean	SD	N	Df	Standard Error	Z (Cal)	Z (Tab)	Decision
Corona Secondary School	3.93	0.25	50	98	0.09	4.55	1.96	Rejected
St Saviours High School	3.52	0.57	50					

The null hypothesis is rejected since the calculated value of Z (Cal) is higher than the tabular value. The perceptions of Corona Secondary School and St. Saviours High School about the application of problem-based learning for the teaching and learning of Mathematics in Lagos State Secondary Schools are thus noticeably different. The perception of students at Corona Secondary School is better than that of students at St. Saviours High School.

3.2. Ho2: The advantages of using problem-based learning for the teaching and learning of mathematics in Lagos State secondary schools are not Significantly different between Corona Secondary School and St. Saviours High School

Table 5. Table of Analysis to Compare the Advantages of Problem-Based Learning for Teaching and Learning Mathematics in Secondary Schools in Lagos State Between Corona Secondary School and St. Saviours High School

Group	Mean	SD	N	Df	Standard Error	Z (Cal)	Z (Tab)	Decision
Corona Secondary School	3.86	0.34	51	98	0.08	2.88	1.96	Rejected
St. Saviors High School	3.63	0.48	49					

The null hypothesis is rejected since the calculated value of Z (Cal) is higher than the tabular value. This indicates that the advantages of using problem-based learning for the teaching and learning of Mathematics in Lagos State secondary schools vary significantly between Corona Secondary School and St. Saviours High School. Pupils at Corona Secondary School gain more than those at St. Saviours High School.

3.3. Ho3: While Adopting Problem-Based Learning to Teach and Learn Mathematics in Lagos State Secondary Schools, there is No Discernible Difference in the Hazards between Corona Secondary School and St. Saviours High School.

Table 6. Table of Analysis to Assess the Risks Associated with Problem-Based Learning for Teaching and Learning Mathematics in Lagos State Secondary Schools at Corona Secondary School and St. Saviours High School

Group	Mean	SD	N	Df	Standard Error	Z (Cal)	Z (Tab)	Decision
Corona Secondary School	3.47	0.69	50	98	0.11	4.09	1.96	Rejected
St. Saviours High School	3.92	0.36	50					

The null hypothesis is rejected since the calculated value of Z (Cal) is higher than the tabular value. This indicates that, while utilizing problem-based learning to teach and study mathematics in Lagos State secondary schools, there is a substantial difference in the risk between Corona Secondary School and St. Saviours High School. When mathematics is taught and learned in Lagos state secondary schools through problem-based learning, St. Saviours High School pupils are exposed to greater danger.

3.4. Research Question 1: What Do Instructors Think About the Use of Problem-Based Learning for Mathematics Instruction and Learning in Lagos State Secondary Schools?

The findings demonstrate how problem-based learning forces students to exercise critical thought and problem-solving creativity.

According to [26] research from 2022, the E-problem-based learning model had a significant impact on students' motivation, learning interest, achievement, learning interest towards study success, and motivation towards their learning interest in the entrepreneurship course. The study supports their findings.

The findings of the study concur with those of [27], who discovered that using E-learning applications to counter the problem-based learning approach can assist students solve problems, explore critical thinking, and spark an interest in solving academic problems. The E-PBL methodology employs problems to gather and incorporate new knowledge in a student-centered learning environment. In the start of the learning process, questions are presented to the students.

3.5. Research Question 2: What are the Advantages of Problem-Based Learning for the Instruction and Acquisition of Mathematics in Secondary Schools in Lagos State?

The outcome demonstrates that students collaborate in groups to determine what they must study in order to solve a mathematical issue.

The study supports the findings of [28], who discovered that problem-based learning activities can successfully increase students' engagements and improve their group of geographical topic understanding with careful planning and preparation.

The findings of the study are in line with those of [29], who discovered that problem-based learning in geography strengthens students' communication and interpersonal skills while also fostering students' leadership qualities. They also discovered that problem-based learning in geography helps students develop their observational and problem-solving skills.

3.6. Research Question 3: Is there a Risk While Adopting Problem-Based Learning to Teach and Study Mathematics in Secondary Schools in Lagos State?

The finding indicates that children who spend too much time on problem-based learning may not have the depth of knowledge required to perform well on standardized tests.

The findings of the study concur with those of [30], who showed that problem-based learning limits teachers' autonomy, impedes class predictability, and adds to their workload and time restrictions.

The findings of the study are in line with those of [31], [32], who discovered that creating a realistic problem, altering stakeholders' mindsets, students' inability to manage internal group conflicts, a constrained time frame, and students' limited capacity for higher-order thinking are the main challenges.

It is concluded that in a method called issue-based learning, students learn about a subject by collaborating in groups to find a solution to an unrestricted problem. The motivation and learning are driven by this issue. Students take a deep approach to learning when engaging in problem-based learning. Students work in small groups to explore real-world issues by actively applying their past knowledge, connecting new material to what they already know, organizing new concepts, and critically assessing their conclusions. Our results show that problem-based learning requires students to use critical thinking and problem-solving skills in order to solve mathematical problems; students work in collaborative groups to identify the skills they need to learn in order to solve a mathematical problem; problem-based learning hinders and restricts teachers' autonomy; and points to hinder class unpredictability and increased time/workload.

3.7. Recommendations

Based on the conclusions, the researchers recommended that,

- Teachers should hold brainstorming sessions.
- Teachers should allow time for collaboration.
- Teachers should conduct regular assessments.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Kasumu Abayomi Adeoye	✓	✓	✓	✓		✓		✓	✓	✓	✓			
Kasumu Rebecca Oluwayimika		✓	✓	✓			✓	✓	✓			✓	✓	✓

C : Conceptualization

I : Investigation

Vi : Visualization

M : Methodology
So : Software
Va : Validation
Fo : Formal analysis

R : Resources
D : Data Curation
O : Writing - Original Draft
E : Writing - Review & Editing

Su : Supervision
P : Project administration
Fu : Funding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

Not Applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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BIOGRAPHIES OF AUTHORS

	Kasumu Abayomi Adeoye, is affiliated with the Department of Economics, Faculty of Social Sciences, Ignatius Ajuru University of Education, Rivers State, Nigeria. His academic work engages with economic theory and its applications within educational and social contexts. As the corresponding author of this study, his research interests likely extend to education-related economic issues, including teaching methodologies and their broader implications for social and economic development in Nigeria. Email: abayomikasumu@yahoo.com
	Kasumu Rebecca Oluwayimika, is affiliated with the Department of Curriculum Studies/Educational Technology, Faculty of Education, University of Port Harcourt, Nigeria. Her academic focus centers on curriculum development and educational technology, exploring innovative teaching and learning strategies within the Nigerian education system. Her contribution to this study reflects an interest in pedagogical approaches, such as problem-based learning, and their integration into contemporary classroom practices. Email: yinkabecky1@gmail.com