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Effects of Problem-Based Instructional Strategy on Senior School Students' Performance in Circle Theorems

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Abstract

This study was conducted with the aim of determining the effects of Problem-Based Instructional Strategy (PBIS) on students' performance in circle theorems in Mathematics. The study is a quasi-experimental type of non-randomized, nonequivalent pre-test and post-test control group involving a 2 x 2 x 3 factorial design, indicating instructional strategies at two levels (Problem-Based Instructional Strategy and conventional method), gender at two levels (male and female) and scoring level at three levels (high, moderate and low level). The target population was all Senior Secondary School students in Ogbomoso, Nigeria. A total of 244 students participated in the study. The research instrument used is Circle Theorems Performance Test (CIRTPT). t-test statistics and ANCOVA were employed to analyze the data. The findings of the study revealed that: there was a significant difference in the performance of students taught circle theorems using PBIS and those taught with conventional method ($t_{(242)}=2.87$; $p<0.05$); there was no significant difference in the performance of male and female students taught circle theorems using PBIS ($t_{(110)}=0.52$; $p>0.05$); and there was no significant difference in the performance of students on the basis of score levels when taught circle theorems using PBIS ($F_{(2,108)}=2.31$; $p> .05$).

Keywords*: circle; gender; performance; problem-based learning*

Abstrak

Tujuan penelitian ini adalah untuk mengetahui pengaruh Strategi *Problem Based Learning* (PBM) terhadap kinerja siswa terkait teorema lingkaran dalam Matematika. Penelitian ini merupakan jenis eksperimen semu dengan jenis kelompok kontrol pre-test dan post-test non-randomized, nonequivalent yang melibatkan desain faktorial 2 x 2 x 3, yang menunjukkan strategi pembelajaran pada dua tingkat (Strategi Pembelajaran Berbasis Masalah dan metode konvensional), gender pada dua tingkat (laki-laki dan perempuan) dan tingkat penilaian pada tiga tingkat (tingkat tinggi, sedang dan rendah). Populasi dalam penelitian ini adalah semua siswa Sekolah Menengah Atas di Ogbomoso, Nigeria. Sebanyak 244 siswa berpartisipasi dalam penelitian ini. Instrumen penelitian yang digunakan adalah Circle Theorems Performance Test (CIRTPT). Statistik uji-t dan ANCOVA digunakan untuk menganalisis data. Hasil penelitian menunjukkan bahwa: terdapat perbedaan yang signifikan kinerja siswa yang diajar teorema lingkaran

menggunakan PBM dan siswa yang diajar dengan metode konvensional ($t(242)=2,87$; $p<0,05$); tidak ada perbedaan yang signifikan dalam kinerja siswa laki-laki dan perempuan yang diajarkan teorema lingkaran menggunakan PBM ($t(110)=0,52$; $p>0,05$); dan tidak ada perbedaan yang signifikan dalam kinerja siswa berdasarkan tingkat skor ketika diajarkan teorema lingkaran menggunakan PBM ($F(2,108)=2,31$; $p> 0,05$).

Kata kunci: gender; kinerja; lingkaran; problem based learning

INTRODUCTION

Mathematics is an indispensable subject in all aspects of human life. Mathematics is a tool use in science, technology, and industries. It is also seen by society as the foundation of scientific and technological knowledge that is vital in social and economic development of a nation. Okafor and Ananduka (2014) noted that every individual requires the knowledge of mathematics to function effectively and efficiently in the society. Adeniji and Salman (2016) described mathematics as the most important part of science and technology and a tool inevitable for human survival in everyday life. Imoko and Isa (2015) posted that mathematics provides the bedrock and foundation for creative thinking and cognitive development and should, therefore, be emphasized early in the academic life of a nation's citizenry. A credit passes in mathematics at Senior Secondary Certificate Examination, General Certificate of Education (SSCE/GCE) ordinary level is a requirement for admission into all science courses such as Medicine, Pharmacy, Engineering, among others. A failure in mathematics is a major obstacle to students' quest of admission into higher institutions (Adeniji & Salman, 2016). Despite all the importance attached to mathematics in Nigerian educational system, it is disheartening to note that nearly every year, students' performance in mathematics in both internal and external examinations has not been encouraging at all (Akanmu & Fajemidagba, 2013 and Salman & Ameen, 2014;). The West Africa Examination Council (WAEC) Chief Examiners' reports from 2009-2018 revealed that students' performance in Senior School Certificate Examination (SSCE) in mathematics was inconsistent.

Several factors have been identified to be responsible for the students' high failure rate in Mathematics. These include student factors, teacher factors, school factors, home factors and societal factors (Ananduka& Okafor, 2013). Some found out that low interest by students, difficulties of examinations, poor instructional strategies, lack of interesting teaching approaches, insufficient qualified mathematics teachers, limited mathematics laboratories, students' perception that mathematics is difficult and the use of traditional method of teaching (Ale, 2002, Okpala, 2011, Agwagah, 2008, Odili, 2006 and Ali, Hukamdad, Akhter and Khan, 2010).

The poor achievements in mathematics are usually more pronounced in some aspect or topics than other areas. The Chief Examiner's reports (2011, 2012 & 2014-2018) pointed out that candidate exhibited weaknesses in the following areas:

1. Translating word problems to mathematical statements and solving them,
2. Solving problems involving plane geometry and circle theorems,
3. Mensuration,
4. Bearing and distance, and
5. Reading and answering from graphs.

Geometry is a key mathematics component that is required in all applied physical sciences; its teaching and learning through the use of effective and efficient instructional strategy helps students to develop insights into an understanding of today's technological industry. It contributes immensely to helping students develop the skills of critical thinking, problem-solving ability, conjecturing, deductive reasoning, logical argument and proof. It helps to sharpen man's intuition and ability to think logically as well as kindle his interest in observations (Schettino, 2012). It comprises of theories and logical proofs which could be very interesting if well understood.

Unfortunately, geometry is the worst performed topic in all Nigerian external and internal examinations, thus affecting the overall subject performance (Tsoho, 2011). Circle theorems is a subtopic under geometry, and it is one of the dreaded topic to students.

Various studies have identified that teachers still use conventional method of teaching to handle the teaching and learning of mathematical concepts (Odili, 2006, Agwagah, 2008, Mereku, 2010 & Okpala, 2011) The authors were of the opinion that traditional strategy does not give room for students' activities and creative thinking as required for the learning of mathematics. Also, this strategy of teaching and learning of circle geometry lay more emphasis on how much a student can remember and less on how well the student can think and reason, and it makes the teacher dominate the classroom and turns students to mere listeners.

The professional standards for teaching Mathematics asserted that teachers must shift from a teacher-centered to a student-centered approach in their instruction (Van de Walle, 2007). The path towards the shift and reform is the adoption of modern methods of teaching whose focus is on students sharpening their problem-solving abilities, as well as reasoning.

Adani, Eskay and Onu (2012) stated that when students' performance is not encouraging, teacher needs to employ better teaching/learning strategies to help students' understanding of the concept taught. Teachers should enrich the lesson using effective and efficient instructional approach that will enhance students' understanding of the

concepts in order to improve students' performance and consequently bring out the desire learning outcomes.

Khurshid and Ansari (2012) reported that innovative instructional strategies promote students' academic performance and reduced boredom among students in schools. Some of these innovative instructional strategies that can be used to improve students' performance and the topics perceived to be difficult to understand by the students includes: guided inductive inquiry, task analysis model, guided discovery strategies, cooperative learning, inquiry teaching, concept mapping, Problem-solving strategies, Problem-Based Instructional Strategy, Demo-kit strategies and uses of technology.

Problem-Based Instructional Strategy (PBIS) sessions are usually organized according to Maastricht University seven steps/ procedure. Generally, those seven steps are:

STEP I. CLARIFY TERMS: Identify and clarify unfamiliar terms presented in the scenario.

STEP II. DEFINING PROBLEM: Define the problems to be discussed.

STEP III. BRAINSTORMING: Aspects on basis of prior knowledge are collected. This should result in ideas to structure the problem.

STEP IV. STRUCTURING AND HYPOTHESIS: Review steps ii &iii, and arrange explanations into tentative solutions during the fourth step, which forms the core of the analysis.

STEP V. LEARNING OBJECTIVES: Group reaches consensus on learning. Objectives are focused, achievable, comprehensive and appropriate.

STEP VI. SEARCHING INFORMATION: This is self-independent learning. During this phase, students are supposed to provide answers to the questions evoked in problem-analysis phase and offer possibility to acquire a more profound knowledge of theories at the root of the problem.

STEP VII. SYNTHESIS: Groups share result of private study. The tutor checks learning and may access the group. So, the final step is synthesizing and testing the newly acquired information.

Loyens, Magda, and Rikers (2008) identify five main goals of PBI for students: It is designed to construct an extensive and flexible knowledge base; become effective collaborators; develop effective problem-solving skills; become intrinsically motivated to learn; and develop self-directed learning skills. In PBIS, students themselves lead the session and learn how to work in their small team. The students become each other's teachers and make use of self-selected resources such as textbooks, journals, online resources and other library resources and discuss more than the traditional classroom

students (Sockalingam et al, 2012). The teacher acts as a facilitator making sure the problem directions are thoroughly understood by the students and facilitate group work that takes place during the lesson, and his/her interventions diminish as students progressively take on responsibility for their own learning processes (Ronis, 2008).

Several researches reported the usefulness of PBIS in considerably positively improved students' performance. The students' interest was stimulated and sustained using PBIS, which eventually enhance their performance in mathematics (Ali, Hukamdad, Akhter, and Khan 2010, Alfred, David and Abayomi, 2013 and Iji, Emiakwu and Utubaku, 2015). Ajai, Imoko, and O'kwu (2013) carried out a research on the effect of Problem-Based Learning (PBL) approach on senior secondary school students' achievement in Algebra, the result showed that students taught using PBL performed significantly higher than those taught using conventional method and both gender are capable of competing and collaborating in classroom activities. The study focused on algebra and did not considered score levels.

Alfred, David and Abayomi (2013) investigated the effect of Problem-Based Learning (PBL) on senior secondary school students' achievements in Further Mathematics (FM) in Nigeria, the result showed that PBL enhances meaningful learning, assist low achievers and enhance the low achievers' interest in further mathematics. The study focused on further mathematics and did not used scoring levels.

Iji, Emiakwu and Utubaku (2015) also studied the effect of Problem-based Learning on students' achievement in senior secondary school Trigonometry in Northern Educational zone of Cross River State, Nigeria considering gender as an intervening variable. The findings of the study revealed that there was no significant interaction effect between teaching method and gender on students' achievement in trigonometry. The study considered trigonometry as content scope and gender as moderating variable.

Abubakar (2007) who carried out a research on effects of guided inquiry teaching method on students' achievement and interest in geometry found that the mean achievement scores of the male students were significantly higher than their female counterparts irrespective of teaching methods.

Omuanaman and Babatunde (2007) in a study on gender role stereotypes and careers choice of secondary school students observed that boys showed interest on brain tasking career while girls were interested on careers that do not require much brain work as they further explain that to ensure learner-friendly environment, effective learning should be encouraged. Adesoji (2008) investigated students' ability level and effectiveness of problem-solving instructional strategy and revealed that there was no significant difference in the performance of different ability level after treatment. Sam-Kayode and Salman (2015) investigated the effect of ludo game on senior school students'

performance in probability as the study revealed that there was a significant different in the performance of high, moderate and low scoring students in the experimental group.

The cited research revealed a dearth of empirical studies on the effect of Problem-Based Learning Strategy for teaching and learning of mathematics concepts. None of the cited studies was carried out on circle theorems, and only one of them considered performance as dependent variable and scoring level as moderating variables. Thus, the present study intends to fill the vacuum created with reference to the moderating variables and the content scope. Therefore, the present study will investigate the effects of Problem-Based Instructional Strategy on senior school students' performance in circle theorems. Students' gender and scoring level will serve as moderating variables.

METHOD

This section presents the methodology that was adopted in carrying out this research work. This would be discussed under the following subheadings: Research Design, Population, Sample and Sampling Techniques, Research Instrument, Validation of Research Instruments, Procedure for Data Collection and Data Analysis Techniques.

Research Design

The study is a quasi-experimental type of non-randomized, nonequivalent pre-test and post-test control group involving a $2 \times 2 \times 3$ factorial design, indicating instructional strategies at two levels (Problem-Based Instructional Strategy and Traditional method), gender at two levels (male and female) and scoring level at three levels (high, moderate and low level).

Population, Sample and Sampling Techniques

The population for this study comprised of all Senior Secondary School students in Ogbomoso, Nigeria. The target population was all Senior Secondary School students (SSS 2) in Ogbomoso, Nigeria. The choice of SSII students as the target population werebased on the fact that the content scope of the study, circle theorems is scheduled to be taught at this level (NERDC, 2011). The sample for this study comprised of two co-educational Senior Secondary Schools in Ogbomoso; which consists of one experimental group and one control group. The simple random sampling technique was used to select the two (2) co-educational schools that participated in the study. A total of two hundred and fortyfour (244) students participated in the study (112 for the experimental group and 132 for the control group). Students' pretest scores were used to categorize the students' performance into high, moderate and low score level. Intact classes were used.

Research Instrument

The research instrument that was used to collect data in the study is Circle Theorems Performance Test (CIRTPT). The CIRTPT consists of 20 objectives and three (3) theory

items on Circle Theorems constructed by the researcher and drawn from past SSCE questions. These questions are to measure the students' performance level and ability to apply appropriately theorems in solving questions on circle theorems. Thesame (CIRTPT) instrument was administered to both (experimental and control) group before introducing PBIS to the experimental group and conventional method to the control group.

Validation of Research Instrument

To ensure face and content validity, the research instruments was given to experts in the Department of Science Education, University of Ilorin, two mathematics lecturers from Mathematics department, University of Ilorin, Nigeria and two experienced mathematics teachers (of at least ten years) in Ogbomoso, Nigeria to determine the appropriateness of the instruments. Their judgment and suggestions concerning the content validity of the areas of interest and clarity of items were considered before the final selection of the items of the research instrument. The test instrument was administered to 25 students in SSII of a nonparticipating school in the study. Test-retest method was used to determine the reliability of the instrument. A reliability coefficient of .74 was obtained using Pearson Product Moment Correlation Statistics at .05 alpha level of significance, which shows that the instrument is reliable for the study.

Procedure for Data Collection

The researchers visited the sampled schools for the study to seek for the permission of the authority of the schools by meeting them and giving them an introductory letter, on the need to engage both the SSII mathematics teachers and students in the research study. Copies of informed consent forms were distributed to students in the selected schools for endorsement by their parents. This is to indicate the parents' willingness to allow their children voluntarily participate in the study.

In the first week, the students were informed about the objectives of the study and the test instrument (CIRTPT) was administered to both the control group and the experimental group, the result serves as pre-test scores. The essence of the pre-test is to ascertain the background knowledge of the participants in both the control and experimental group before ~~entering into~~ the treatment and their scores were used to categorize the students into scoring levels (low, moderate and high). In the experimental group, the researchers grouped the students heterogeneously based on their performance in the pretest cores. The classes were referred to as Learner's Community Group (LCG) which will consist of nine (9) students in each group involving high, moderate and low scorers. The students were asked to construct a nametag used as a form of identification.

The second and third week were used to give orientation on PBIS to the experimental group in 60 minutes lesson (twice for the second week and thrice for the

third week) and the control group also were taught with the use of conventional method. The researchers lead discussion in the mathematics classroom using PBIS in a scaffolding manner to suit the already prepared instructional plan. The PBIS group process to be adopted in seven steps namely (i) identify and clarify problems; (ii) define the problem; (iii) brainstorming (iv) structuring and hypothesizing; (v) formulate learning objective (vi) search for information; (vii) synthesis and feedback. The CIRTPT was re-arranged containing the same test items as in the pre-test as post-test. The post-test was administered to both the experimental group and the control group at the fourth week.

Data Analysis Techniques

The data collected were analyzed and tested using descriptive and inferential statistics. The research questions for the study were answered by comparing the means and standard deviations of the experimental and the control group scores. The research hypotheses were tested at p-value<.05 level of significance using t-test for hypotheses 1 and 2 and Analysis of Covariance (ANCOVA) for hypothesis 3 and 4. The pretest scores served as the covariates. Analysis of covariance (ANCOVA) was used to take care of possible lack of initial equivalence in the groups.

RESULTS AND DISCUSSION

This section presents the results of data analysis using descriptive and inferential statistics. Specifically, the four research questions were answered using the descriptive statistics of mean and standard deviation. Null hypotheses 1 and 2 were tested with t-test statistics, while null hypotheses 3 and 4 were tested with Analysis of Covariance (ANCOVA). All hypotheses were tested at .05 level of significance.

Results

Research Question 1: What is the difference between the performances of students taught circle theorems using Problem-based Instructional Strategy (PBIS) and those exposed to conventional method?

Table 1 shows the mean and standard deviation values of the post-test scores of students taught with Problem-Based Instructional Strategy (M=51.88, SD=13.37) while the post-test scores of students taught using conventional method (M=40.37, SD=13.05). The PBIS group had higher mean gain score of 16.69 compared with the conventional method whose mean gain score is 10.31.

Table 1. Mean Difference of Mathematics' Students taught with PBIS and those taught with Conventional Method

Treatment Group	Sample N	Pre-test Mean	Pre-test Std.	Post-test Mean	Post-test Std.	Difference Mean Gain
PBIS	112	35.19	13.85	51.88	13.37	16.69
Convectional	132	30.06	13.96	40.37	13.05	10.31

P<.05

H_{01}: There is no significant difference between the performances of students taught circle theorems using PBIS and those exposed to conventional method. *t-test* results in Table 2 show that there was a significant difference in the performance of students taught circle theorems with PBIS and those taught with conventional method ($t(242)=2.87$; $p< .05$), this is because the p-value of 0.004 is less than .05 significance level. Hence, H_{01} is rejected. This implies that students gained significantly when exposed to PBIS compared to those not exposed to PBIS.

Table 2. t-test Statistics Result between Students Taught with PBIS and Those Taught Conventional Method

Group	N	Mean	Std.	df	*t*	Sig.	Remark
PBIS	112	51.88	13.37				
				242	2.87	.004	S
Convectional	132	40.47	13.05				

Research Question 2: Does the students' performance in the experimental group differ when taught circle theorems based on gender?

The mean score of male students taught with PBIS is (M=51.19, SD=15.38) while that of female students taught PBIS is (M=52.51, SD=11.36). The female students had higher standard deviation but lower mean, while that of male students were vice versa as shown in Table 3.

Table 3. Mean and Standard Deviation Score of Students taught with PBIS based on Gender

PBIS	N	Mean	Std.
Male	53	51.19	15.38
Female	59	52.51	11.36

H_{02}: There is no significant difference between the mean gain scores of male and female students taught circle theorems using Problem-Based Instructional Strategy.

Table 4 reveals the results of students when taught circle theorems using PBIS based on gender ($t(110)=0.52$; $p> .05$). It shows that there was no significant difference based on gender as the p-value of 0.60 greater than .05 level of significance, therefore, H_{02} is retained. This means that both gender had better improved performance when taught circle theorems using Problem-Based Instructional Strategy.

Table 4. t-test Analysis Results of Students' Gender when taught with PBIS

Gender	**N**	**Mean**	**Std.**	**df**	***t***	**Sig.**	**Remark**
Male	53	51.19	15.38				
				110	.52	.60	NS
Female	59	52.51	11.36				

p> .05

Research Question 3: Is there any difference in the performance of students based on score levels when taught circle theorems using PBIS?

Based on the results presented in Table 5, high scoring students had a mean score of 61.56, followed by moderate scoring students with 49.43, while low scoring students had the lowest mean score of 36.43 when they were all taught using PBIS.

Table 5. Mean Difference of Students' Score-level when taught with PBIS

Score Level	**N**	**Mean**	**Std.**
Low	30	36.77	7.50
Moderate	28	49.43	8.05
High	54	61.56	9.10

H_{03}: There is no significant difference among the performance of low, moderate and high scoring students when taught circle theorems using problem-based instructional strategy.

The results of one-way ANCOVA revealed that there was no significant difference ($F(2,108)=2.31$; $p>0.05$) among the low, moderate and high scoring students when taught circle theorems using PBIS as the p-value of 0.10 is greater than 0.05 level of significance, thus, H_{03} is retained. This indicates that, despite the difference in their mean scores, the three scoring levels of students still have improved performance in circle theorems when taught with PBIS.

Table 6. ANCOVA Analysis Results of Students' Score-level when taught with PBIS

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.
Corrected Model	15529.55a	3	5176.52	129.60	.000
Intercept	2108.94	1	2108.94	52.80	.000
Pre-test	3453.62	1	3453.62	86.46	.000
Score Level	184.49	2	92.25	2.31	.104
Error	4313.94	108	39.94		
Total	321341.00	112			
Corrected Total	19843.49	111			

a. *R* Squared = .783 (Adjusted *R* Squared = -.777)

Summary of the Results

The following are the summary of the major findings:

1. There exists significant difference in the performance of students taught circle theorems using PBIS and those taught with conventional method ($t_{(242)}$=2.87; p< .05);
2. There was no significant difference in the performance of male and female students taught circle theorems using PBIS ($t_{(110)}$=0.52; p> .05); and
3. There exists significant difference among the low, moderate and high scoring students when taught circle theorems using PBIS ($F_{(2,108)}$=2.31; p> .05).

Discussion

The main focus of this study was to examine the effects of Problem-Based Instructional Strategy on Senior School Students' Performance in circle theorems in mathematics. The findings revealed that there was a significant difference in favour of PBIS in the performance of students taught circle theorems using PBIS and those taught with the conventional method. The probable reason could be that the use of PBIS create rooms for students to analyze the problem before attempting to solve it and by so doing, it gives them the confidence to trying to solve it, and also raises their understanding the underlying reason for solving the problem which later leads to improved performance in circle theorems. Therefore, this implies that PBIS is more effective than the conventional method in teaching circle theorems. This is supported by constructivist theories. This agrees with the findings of Ajai, Imoko and O'kwu (2013), Alfred, David and Abayomi (2013) and Iji, Emiakwu and Utubaku (2015) who concluded that PBIS enhanced students' achievement in mathematics than the traditional method. Also, Ahmad,

Shahrill&Prahmana (2017) who concluded that students' performance was improved in learning geometry as gain and retention of knowledge was observed.

The findings further revealed that there was no significant difference in the performance of students taught circle theorems using PBIS based on gender. This was based on the fact that PBIS is gender-free or friendly, that is, students irrespective of their type were able to breakdown the problems and later forged ahead to solving it, hence, their performance improved across board in circle theorems in mathematics. It therefore implies that PBIS is more needed when performance is interested in, and not male only or female only dominated field is required. This supports the findings of Salman (2008) &Ajai and Imoko (2015) concluded that gender has no effect on students' performance in mathematics. Also, Abubakar (2007), Amelink (2009) &Iji, Emiakwu and Utubaku (2015) concluded that gender have effect on students' performance in mathematics as male students performed better in some topics, while female students performed better in some other topics.

Finally, the findings indicated that there was no significant difference in the performance of students based on scoring level when taught circle theorems using PBIS. This may be possible as the strategy simultaneously remediate the students' scoring abilities as the difference in their scores is small. Hence, it improves their performance collectively. The finding implies that the low, moderate and high scoring students had similar better performance when taught with PBIS. This support the findings of Ali, Hukamdad, Akhter, and Khan (2011) &Oloyede, Adebowale and Ojo (2012) who concluded that there is no difference in the performance of students in the three ability levels after receiving the treatment. This disagrees with the studies of Sam-Kayode and Salman (2015), their findings showed that there is significant difference in the performance of students after receiving treatment.

CONCLUSION

The following conclusions have been made based on the findings of this study:

1. PBIS is more effective in teaching circle theorems than the conventional method;
2. Male and female students had better improved performance when taught circle theorems using PBIS;
3. Students' performance based on score levels were positively improved when taught circle theorems using PBIS; and
4. There was no significant interaction effect among the PBIS, score-level and gender when taught circle theorems using PBIS.

Based on the conclusion of this study, the following suggestions were made:

1. Mathematics being an indispensable tool in science and technological advancement, students should be encouraged to take the study of mathematics seriously by exposing them to instructional strategies that stimulate and sustain their attention in the study of circle theorems in mathematics.
2. Teachers and facilitators are encouraged to adopt the use of PBIS to teach circle theorems in mathematics and all other related topics to enhance improved performance;
3. Teachers and facilitators are expected to provide level playing ground for male and female students while using PBIS as research have proven that gender equality is needed to develop science and technology of the nation; and
4. Professional bodies, Government and non-governmental organization should mount seminars, workshops and conferences on the use of PBIS, this will enable mathematics educators, serving teachers students and all to benefit from this approach; and
5. Since score level and gender did not influence the effectiveness of

PBIS, it is expected to adopt the use of it as it will work without hindrance of external variables such as the ones considered in this study..

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