

Influence of Positive Reinforcement Technique on Motivation and Performance in Mathematics among Junior Secondary School Students in Kaduna State, Nigeria

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Abstract

The major aim of this researchers is to investigate the influence of positive reinforcement technique on motivation and performance in Mathematics among junior secondary school students in Kaduna State Nigeria. Quasi experimental research design involving pre-test and post-test was used and the sample size was 67 JSS two students in Giwa Education Zone. Four objectives, research questions and hypotheses were raised to guide the researchers and two instruments were used namely Students Performance Test (SPT) and Students Motivation Questionnaire (SMQ). The two instruments were validated by experts while reliability was established using PPMC which was found to be 0.87 and 0.89. The four null hypotheses were tested using U-test and t-test statistics, which showed significant difference in all the hypotheses which led to the rejection of all the hypotheses. The researchers concluded that, Positive Reinforcement Technique has significant influence on students' motivation and performance in mathematics. The researchers recommended that teachers of secondary schools should include different types of positive reinforcement in teaching of mathematics.

Keywords: positive, reinforcement, technique, motivation, mathematics

Introduction

Learning is a fundamental process in human behaviour; it penetrated everything one does and thinks. It may be defined as any relatively permanent change in behaviour through experience (Osarenren, 2002 as cited in Rosi & Sari, 2019). Good teaching/learning process can change students' behaviour into positive one. Positive change in behaviour occurs mostly at early age of the students (Prasetyo, 2011). This positive change is needed in young mathematics learner. Teaching mathematics for young learners may be challenging since young learners tend to have enough physical energy, have short attention span, they easily get bored and are unpredictable (Qinglan et al., 2010). Based on these reasons, all mathematics teachers that are teaching young mathematics learners must have experience and ability to manage classroom, so that the students can get motivation in learning mathematics.

If students are motivated well to learn, they will find learning of mathematics easy. According to Hapsari and Widhianningrum as cited in Rosi and Sari (2019), reinforcement is a response to a behaviour which increases the likelihood of its recurrence. In the learning process particularly mathematics, provision of reinforcement is a form of positive response of teachers to the behaviour of students so that students' behaviour can be repeated again at a later time. That is, when students are motivated enough to participate in the classroom discussion, then, that reinforcement will make the students to participate again.

Rosi and Sari (2019) said that designing the environment of the class properly, the students can be motivated to learn. Reinforcement is one factor to create a good environment of teaching process in the class. However, reinforcement is a stimulus or event that follows the occurrence of a response and maintains the strength of that response occurring again. For instance, if a student attracts the attention of his classmates (the reinforcer) by arguing with the mathematics teacher (response) in class (stimulus situation) by saying "sir the solution is not correct," the frequency of the student arguing with the teacher in class may increase because the student enjoys argument. Similarly, if a mathematics teacher gives a prize (reinforcer) to any student that answers all the questions (response) in class (stimulus situation), the response is likely to increase in order for such student to continue to win prizes.

Reinforcement always determine the strength of classroom behaviour and management. Therefore, it can affect students' motivation toward learning of mathematics. This is because, if a teacher tells the students that a prize will be given to any of them who attempts and gets all the solutions to these questions correctly, all the students will be highly motivated toward learning of mathematics in order to win the prize (reinforcer). When he/she gets solutions to the questions correctly (response) and he is given the prize as promised, the entire class will likely be motivated (stimulus condition) just to keep earning the reward. Reinforcement may not only affect the student's motivation but also the performance in mathematics.

Based on the foregoing, Goodluck, and Ateh-Abang (2017) define reinforcement as the procedure or process of increasing or stamping in desirable behaviour of an individual. Nwankwo (2005) and Bluestein (2004) maintained that reinforcement is the addition of pleasant stimulus to a situation or the withdrawal of an unpleasant stimulus from a situation in order to increase the desired response. In reinforcement, combinations of rewards and/or punishments are used to reinforce desired behaviour. Nwankwo (2005) further explained that behaviour of people is normally influenced by its immediate consequences of reinforcement. He argued that those consequences could be pleasurable to the organism and thus strengthen or encourage the repetition of such behaviour; or the consequences could be aversive or unpleasant to the organism and thus, reduces the occurrence of the maladapted behaviour. Tara et al. (2010) declared that the delivery of praise as positive reinforcement for students' appropriate behaviours can lead to a decrease in students' inappropriate behaviours, as well as an increase in their appropriate behaviours.

Theoretically, this study is built on the principle of reinforcement, originated from the theory of reinforcement by Thorndike (1975), Skinner (1954) and others. Skinner (1954), as cited in Amuma and Idoli (2013), believed that human behaviours could be controlled, changed or

modified by the principle of reinforcement. The behaviourist focused on the relationship between any particular response and the consequences that preceded it. Behaviourist like Thorndike and Skinner cited in Amuma and Idoli (2013) maintained that man is primarily a product of learning shaped by external variables, genetic factors and environmental influences on man's behaviour. They (behaviourists) also emphasized on the prediction and control of observable and measurable behaviour followed by a reinforcing stimulus resulting in an increase in the probability of future occurrence of that behaviour; in the same vein, behaviour devoid of reinforcing stimulus results in a decreased probability of future occurrence of such behaviour.

Empirically, the researchers reviewed some related works such as the work of Rezaul Hoque (2013) who conducted a research on the effect of reinforcement on teaching – learning process. A total of one hundred (100) students of class – IX were taken who had been equally divided into experimental groups and control groups. He found that there was a positive effect of reinforcement on the experimental than the control group. Also there exists a significant difference in the attendance of experimental group and control group at 0.01 level of significance.

Amuma and Idoli (2013), conducted a research on the effects of material and non-material reinforcers on academic performance of Abia State Senior Secondary Schools girls on health science. They found that the mean scores of students materially reinforced and students that were non-materially reinforced differ significantly; the former had higher achievement score more than the latter and the mean scores of students taught using material reinforcement differ significantly from the control group.

Sri et al. (2022) investigate the use of classroom instruction reinforcement strategies by two English language teachers and their perceptions at a state secondary school in Semarang in the academic year of 2019. The two English teachers were observed in five different lessons. The teachers were interviewed to explore their perceptions of using reinforcement in the classroom. The instruments of this study were observation sheet, interview guideline, and audio-video recordings. The findings showed that the teachers reinforced the students in three types of classroom instruction reinforcement. The three types of reinforcement strategies were: praise or other verbal reinforcement, tangible rewards, and token rewards. The reinforcement strategy mostly used was praise, followed by tangible rewards and token rewards. Based on the interviews, the teachers perceived that giving positive reinforcement to the students was important. The findings suggest the teachers implement the reinforcement strategies fairly to increase teacher-students' interaction.

Goodluck and Ateh-Abang (2017), conducted research on reinforcement and its educational implications. The research focused on the nature and concept of reinforcement and its educational implications. Reinforcement is the process of increasing or stamping in desirable behaviour of an individual through the mechanisms of positive, negative, primary or secondary reinforcers. A reinforcer is the pleasurable stimulus that leads to an effect called reinforcement. Conditions or patterns of administering reinforcement are continuous schedule and partial (intermittent) schedule patterns. Partial schedule is sub-divided into ratio and interval with each

having fixed and varied schedules respectively. There are also interactions between the conditions of reinforcement. A list of educational implications of reinforcement were outlined. Reinforcement as a behaviour modification technique can be applied to a wide range of behaviour problems and can be used in every human setting but its monotonous application makes reinforcement to lose its values before the client.

According to Lindsey (2017), positive reinforcement positively helps students in the classroom. Based on the researchers' experiences, many of junior secondary schools teachers are struggling to identify and use teaching strategies that can motivate and improve the students' performance in mathematics. Although the choice of teaching strategy to the younger generation may be simple, it is actually the application that is proven to be difficult. Teachers, new and old, are experiencing adversity when applying current teaching techniques such as positive reinforcement in their classrooms. Teachers of junior secondary schools may need to be effectively trained to teach with these unfamiliar strategies, so that the teaching and learning of mathematics will become simple to teachers and students. Although it takes time to become fluent in any teaching strategy, it is vital that teachers start with building a positive relationship between their students, and their teaching peers as well. It is only when a student trusts their positive role model that they are able to benefit from positive reinforcement in their classroom. Various studies using positive reinforcement, either material or non-material, confirmed their effectiveness (Bear, 2006). In this research, the researchers are trying to find out the influence of positive reinforcement on students' motivation and performance in mathematics among junior secondary schools.

Statement of the problem

It has been observed by the researchers that some students have developed hatred towards learning of mathematics as a result of poor motivation from the side of the teachers particularly at lower secondary schools. This in turn, accounts for the degree of overall poor motivation and performances of male and female students in mathematics even in teacher-made achievement tests from time to time. It becomes worrisome when the engineering and science-related careers of young students are at stake due to defective foundation in the knowledge of mathematics. Poor motivation (reinforcement) strategy, non-conducive learning environment and poor teaching and learning facilities are some of the contributing factors that lead to the hatred of mathematics by the students and poor performance of students in mathematics. In view of the challenges enumerated above, this study seeks to investigate the influence of positive reinforcement on the motivation and performance of students in mathematics.

Objectives of the study

1. Find out the difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique.
2. Determine the difference between the motivation of male and female students in mathematics after exposure to positive reinforcement technique
3. Examine the difference between the performance of students in mathematics before and after exposure to positive reinforcement technique.
4. Find out the difference between the performance of male and female students in mathematics after exposure to positive reinforcement technique

Research questions

1. What is the difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique?
2. What is the difference between the motivation of male and female students in mathematics after exposure to positive reinforcement technique?
3. What is the difference between the performance of students in mathematics before and after exposure to positive reinforcement technique?
4. What is the difference between the performance of male and female students in mathematics after exposure to positive reinforcement technique?

Hypotheses

Ho1: There is no significant difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique.

Ho2: There is no significant difference between the motivation of male and female students in mathematics after exposure to positive reinforcement technique.

Ho3: There is no significant difference between the performance of students in mathematics before and after exposure to positive reinforcement technique.

Ho4: There is no significant difference between the performance of male and female students in mathematics after exposure to positive reinforcement technique.

Methodology

The researchers adopted pre-test and post-test quasi experimental research design. An intact class of JSS2 students was used. The sample size of the study was 67 students which included 42 male and 25 female students. Before the treatment, the researchers conducted a pre-test on the students using Students Performance Test (SPT) and Students Motivation Questionnaire (SMQ).

SPT consist of two sections, Section A and Section B. Section A consists of the respondents' bio data while section B consists of 30 multiple choice items with option A-D. SPT was used to measure students' performance before and after the treatment. SMQ is the second instrument; it consists of two sections - sections A and B. Section A consists of respondents' bio data while B consists of twenty items on motivation in form of Likert scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). The two instruments were validated by experts in the Department of Science Education, Ahmadu Bello University Zaria. The instruments were pilot tested using test re-test method in one school outside the zone using 30 students. The results from the pilot testing were used to determine the reliability of the instruments using PPMC which were found to be 0.87 and 0.89.

After the pre-test, the researchers administered the treatment (teaching using conventional method) using positive reinforcement as a means of motivation for six weeks after which post-test was administered. The data collected from pre-test and post-test were analyzed using both descriptive and inferential statistics. Mean, standard deviation and mean rank were used to answer the research questions while the hypotheses were tested using t-test and U-test statistics. Hypotheses one and two were tested using U-test while hypotheses three and four were tested using t-test statistics.

Presentation of results

Ho1: There is no significant difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique.

To test the null hypothesis, Mann-Whitney test was used. The summary of the test analysis is shown in table one.

Table 1: Summary of Mann-Whitney test analysis of students’ motivation in Mathematics before and after exposure to positive reinforcement technique

Groups	N	Mean rank	Sum of rank	χ^2_{cal}	Df	P-value	Decision
Pre-test	67	34.62	2319.50	41.50	131	0.000	Rejected
Post-test	67	100.38	6725.50				

Significant at P< 0.05 level

Table 1 revealed that analysis of Mann-Whitney test with χ^2_{cal} values of 41.50 and p-value of 0.000 at df of 132. The p-value is $0.00 < 0.05$. Therefore, the null hypothesis was rejected. This implies that there is a difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique. This shows that use of positive reinforcement technique while teaching mathematics improves students’ motivation toward learning of mathematics.

Ho2: There is no significant difference between the motivation of male and female students in mathematics exposed to positive reinforcement technique.

To test the null hypothesis two, H-test statistic was used. The summary of the test analysis is shown in table two.

Table 2: Summary of Mann-Whitney test analysis of male and female students’ motivation in Mathematics exposed to positive reinforcement technique

Groups	N	Mean rank	Sum of rank	χ^2_{cal}	Df	P-value	Decision
Male	42	103.06	317.81	21.50	65	0.000	Rejected
Female	25	31.86	120.80				

Significant at P< 0.05 level

Table 2 presents the summary of Mann-Whitney test analysis of male and female students’ motivation in mathematics exposed to positive reinforcement technique. It shows $\chi^2_{cal} = 21.50$ at $df = 65$ and $p = 0.00$. This shows that the p-value is less than the α -value ($0.000 < 0.05$). Therefore, based on this evidence, the null hypothesis is rejected. Hence, there

is significant difference between the motivation of male and female students in mathematics exposed to positive reinforcement technique.

Ho3: There is no significant difference between the performance of students in mathematics before and after exposure to positive reinforcement technique.

To test the hypothesis three, t-test statistics was used. The summary of the test analysis is shown in table three.

Table 3: Summary of t-test of students' performance in Mathematics before and after exposure to positive reinforcement technique

Groups	N	Mean	SD	df	t-value	p-value	Decision
Pre-test	67	20.25	4.59	132	38.39	0.000	Rejected
Post-test	67	51.79	4.79				

Significant at level of ≤ 0.05

Table 3 revealed that calculated value of t is 38.39 and the P-value is 0.000. Therefore, the P-value of 0.000 is less than alpha value of 0.05. Based on this evidence, the null hypothesis was rejected. This implies that there was significant difference between the performance of students in mathematics before and after exposure to positive reinforcement technique. This showed that those students exposed to positive reinforcement performed better in mathematics. Therefore, use of positive reinforcement technique has a significant effect on students' performance in mathematics.

Ho4: There is no significant difference between the performance of male and female students in mathematics after exposure to positive reinforcement technique.

Data on male and female students' performance in mathematics after exposure to positive reinforcement were collected. To test the null hypothesis four, t-test statistic was used. The summary is presented in Table 4.

Table 4: Summary of t-test of male and female students' performance in mathematics before and after exposing to positive reinforcement technique

Groups	N	Mean	SD	Df	t-value	p-value	Decision
Male	42	20.45	4.44	65	0.46	0.65	Ho4 is retained
Female	25	19.92	4.92				

Significant at level of ≤ 0.05

From table 4, the p-value (0.65) is greater than the alpha-value (0.05). Therefore, the null hypothesis was retained. This means that there is no significant difference between the performance of male and female students exposed to positive reinforcement technique. This shows that, the use of positive reinforcement technique while teaching of mathematics has no

gender difference in terms of performance of students. The implication of this is that both male and female students performed equally in mathematics.

Discussion of the findings

The present study investigated the influence of positive reinforcement technique on motivation and performance in Mathematics among Junior Secondary School Students in Kaduna State, Nigeria. The data collected based on the influence of positive reinforcement on motivation and performance were analyzed and presented in tables and the discussion is as follows: The testing of null hypothesis one presented in table 1 shows that there is significant difference between the motivation of students in mathematics before and after exposure to positive reinforcement technique. The finding of this present study is line with the finding of Rezaul Hoque (2013) who found that there was a positive effect of reinforcement on the experimental than the control groups. This indicated that there is positive change in students' behaviour toward learning.

The testing of null hypothesis two presented in table 2 shows that there is significant differences between motivation of male and female students in mathematics after exposure to positive reinforcement technique. The finding of this research is in line with the finding of Sri et al. (2022), who reported that the teachers perceived that giving positive reinforcement to the students was important. This means that it has positive effect on male and the female students' behaviour toward learning.

The finding in respect of null hypothesis three presented in table 3 shows that there is significant difference between the performance of students in mathematics before and after exposure to positive reinforcement technique. This finding agreed with the finding of Amuma and Idoli (2013), who found that the mean scores of students materially reinforced and students that were non-materially reinforced differ significantly; meaning that the former had higher achievement score more than the latter and the mean scores of students taught using material reinforcement differ significantly from the control group.

The analysis of null hypothesis four presented in table 4 shows that, there is no significant difference between the performance of male and female students exposed to positive reinforcement technique. The finding of this study agreed with finding of Devi and Agung (2022). They found from interview that the teachers perceived that giving positive reinforcement to the students was important irrespective of gender. Therefore, if reinforcements are given to the students irrespective of gender, then, the effect will not differ.

Conclusion

The researchers concluded that positive reinforcement technique has positive effect on students' motivation and performance in mathematics among Junior Secondary School students in Kaduna State, Nigeria irrespective of gender.

Recommendations

The researchers recommended that teachers in junior secondary school should start using positive reinforcement technique in teaching mathematics in order to improve male and female students' motivation and performance particularly the female students.

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