INVESTIGATION OF BONUS MARK ON ACHIEVEMENT IN MATHEMATICS

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Abstract

The research investigated the impact of Bonus mark on students' achievement in mathematics. A population of 141 mathematics students was used for the study. 60 students were sampled out and equally separated into experimental and control groups. The experimental group was taught using Bonus mark and the control group was not. The students' examination scores were used for the study. Data analysis was based on z-test at $\alpha=0.5$. The group taught with bonus mark performed better than the other group. Boys and girls achieved at the same rate. Students who believed in mathematics ability achieved higher than those who believed in mathematics effort. In conclusion, bonus marks is capable of boosting students' motivation leading to better achievement in mathematics. It was recommended that teachers should be exposed to bonus mark strategy of teaching mathematics in order to encourage the usage in schools.

In Nigeria today, there is greater emphasis on acquisition of excellent mathematical knowledge in order to meet the quest for science and technological development. As a result, mathematics learning has received recent attention by the government most especially at both primary and secondary education levels which indicates the importance attached to the subject. Despite students' awareness that mathematics is important, the number of students who want to take more mathematics in higher schools is declining steadily (Dossey, Mullis, Lindquist, and chambers, 1988).

However, those students who eventually found themselves in mathematics class, are therefore one reason or the other and not because they are interested or good in the subject. The outcome of this trend is persistent underachievement in the subject.

Underachievement in mathematics in schools is a global problem and is especially prevalent in developing countries like Nigeria. Ojonubah (2009) stated that mathematics achievement of most mathematics students in almost all schools in Nigeria today can be described as persistently low. In addition, National assessment data from the 1980s (Carpenter, Corbitt, Kepner, Lindquist, and Reys, 1981; Dossey Mullis, Lindquist, and chambers, 1988) have indicated that American children tend to enjoy mathematics in the primary grades but that this level of enjoyment tends to fall dramatically when children progress into and through high school.

Available literatures have revealed several factors that are responsible for students' underachievement in mathematics. Some of these factors includes volume of work completed, student task orientation and skill acquisition, students personality and self concept (Moore, 1973), students feeling of inadequacy and perceptions about the subject (Callahan, 1971), motivation and self-confidence

(Aiken, 1976), anxiety (Aiken 1970), shortage of qualified mathematics teachers, (Ohuche, 1978; Ale, 1989), poor facilities, equipment and instructional materials for effective teaching (Oshibodu, 1984; Akpan 1987; Odogwu, 1994), use of traditional chalk and talk methods, (Oshibodu, 1988; Edwards and knight, 1944), large pupils to teacher ratio (Alele-Williams, 1988), mathematics fright/phobia (Georgewill, 1990) and so on. The above factors are capable of negatively affecting students' interest in mathematics. According to Wentzel (1998) interest in activities tends to increase the likelihood that individuals formulate goals relating to that activity and invest time and effort to achieve them. Among the factors enumerated above, factors that are related to individual students' characteristics such as motivation is considered the most important factors that can lead to students' underachievement in mathematics. This was supported by Tella (2003) when it was stated that of all the factors that have attracted researchers in this area of educational achievement, motivation seems to be gaining more popularity and leading other factors.

Motivations are reasons individuals have for behaving in a given member in a given situation. They exist as part of one's goal structures, one's beliefs about what is important, and they determine whether or not one will engage in a given pursuit (Ames, 1992). To be motivated means *to be* moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized or activated toward an end is considered motivated. People have not only different amounts, but also different kinds of motivation. That is, they vary not only in level of motivation (i.e., how much motivation), but also in the orientation of that motivation (i.e., what type of motivation). Orientation of motivation concerns the underlying attitudes and goals that give rise to action-that is, it concerns the why of actions.

Deci and Ryan (1985) distinguish between different types of motivation based on the different reasons or goals that give rise to an action. The most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome. Students who are intrinsically motivated engaged in academic tasks because they enjoy them. They feel that learning is important with respect to their self-images, and they seek out learning activities for the sheer joy of learning (Middleton, 1992/1993a). Their motivation tends to focus on learning *goals* such as understanding and mastery of mathematical concepts (Ames and Archer, 1988; Duda and Nicholls, 1992; Dweck, 1986). Students who are extrinsically motivated engage in academic tasks to obtain rewards (e.g., good grades, approval) or to avoid punishment (e.g., bad grades, disapproval). These students' motivations tend to center on such performance goals as obtaining favorable judgments of their competence from teachers, parents, and peers or avoiding negative judgment of their competence (Ames, 1992; Ames and Archer, 1988; Duda and Nicholls, 1992; Dweck, 1986). However, experience has show that extrinsic motivation can irreversibly lead to intrinsic motivation. In which ever case, students are likely to achieve better if either motivated intrinsically or extrinsically.

There are so many ways of getting students of mathematics motivated. One of them is reward in form of bonus mark which emphasizes extrinsic motivation used in this research. This is because, many of the tasks that mathematics educators want their students to perform are not inherently interesting or enjoyable. Thus, knowing how to promote more active and volitional (versus passive and controlling) forms of extrinsic motivation becomes an essential strategy for successful teaching.

Bonus mark is an extra mark in form of a reward which a mathematics teacher awards his/her students for performing a desired task in the course of mathematics learning. It possesses the following criteria:

- It must not be a school sponsored event
- It must not involve cost
- It must not be outside the classroom
- It must take certain amount of effort
- It has to be related to mathematics
- It has to be throughout the semester when started.

It is aimed at motivating the students so as to achieve superior performance. Deci, Koestner and Ryan (1999) stated that the use of incentive to achieve superior performance assumes that rewards for specific high performance are an active way to alter behavior.

In contrast, reward has been challenged by suggestions that reward reduces interest in tasks for their own sake. Deci, Koestner and Ryan (1999) presented a meta-analysis concluding that expected tangible rewards, such as monetary award, and prizes decrease intrinsic motivation. However, reward based on meeting a performance

objective was not found to reduce individual task interest (Deci et al., 1999). It is on this basis that the present research is carried out which is an effort to investigate the impact of bonus mark on achievement in mathematics.

Statement of the problem

Available literature has shown that there is declined students' motivation to study mathematics in schools most especially in Federal College of Education, Okene. Carpenter, Corbitt, Kepner, Lindquist and Rey (1981); Dossey et al (1988) have indicated that American children tend to enjoy mathematics in the primary grades but that this level of enjoyment tends to fall dramatically when children progress into and through high school. In addition, although students feel that mathematics is important, the number of students who want to take more mathematics in school is declining steadily (Dossey et al., 1988). As a result, there is under achievement in mathematics. Ojonubah (2009) stated that mathematics achievement of most mathematics students in almost all schools in Nigeria today can be described as persistently low. Several measures were used to boost student's motivation in mathematics; yet, the situation has not changed. Bonus mark is the only strategy that is rarely integrated in mathematics learning. Does bonus mark positively influence students' motivation as well as achievement in mathematics? This is the main problem under study.

Purpose of the study

Reward increases perceived self-determination and task interest (Deci et al., 1999). In addition, a mathematics student who is self-determined and interested in performing tasks required in mathematics learning is said to be motivated. Bonus mark is used as a reward in this research; thus, this study becomes necessary in order to:

- Investigate the difference in the achievement in mathematics of students taught with bonus mark strategy and those taught without bonus mark.
- Investigate bonus mark influence on mathematics achievement of boys compared with girls.
- Investigate bonus mark influence on mathematics achievement of boys compared with girls.
- Investigate bonus mark influence on mathematics achievement of students who attribute achievement in mathematics to ability compared with students who attribute achievement in mathematics to effort.

Research hypotheses

In this study the following research hypotheses were raised:

1. H_o: There is no significant difference in the achievement in mathematics of students taught with bonus mark strategy and those taught without bonus mark.
2. H_o: There is no significant difference in mathematics achievement of boys compared with girls for the group of students taught with bonus mark strategy.

3. H_o: There is no significant difference in mathematics achievement of students who attribute achievement in mathematics to ability compared with students who attribute achievement in mathematics to effort for the group of students taught with bonus mark strategy

Research Methods

The research design used for this study is descriptive survey methods. This is because, the variables which were tested upon the groups tend to describe and interpret the effects that were being felt or the trends that were developed.

Population and Sample

The population used for this study are one hundred and forty one (141) students of mathematics department of Federal College of Education, Okene. Sixty (60) mathematics students in NCE 1 were sample out for the study using cluster sampling. The target population was then, randomly separated into two groups of students taught with bonus mark method and those taught without bonus mark method. Based on personal interaction with the students, the group of students taught with bonus mark method was further separated into two groups of students who attribute achievement in mathematics to ability and another group of students who attribute achievement in mathematics to effort.

Instrument

The instrument used to collect data for this study was the examination question of MAT 122 for the two groups. The examination questions were moderated by external moderators and consisted of five questions to answer three according to National Commission of Colleges of Education (NCCE) examination laid down rules and regulations.

Procedure for Data Collection

The two groups were independently taught MAT122 for the period of a semester; one group with the method of bonus mark as a reward for performing desired task and the other group with the usual lecture method. The first group is considered as the experimental group and the second group as the control group.

At the end of the semester, the students were examined using the same question. The examination scripts were objectively marked, recorded and moderated. The mean achievement in the course for each group of the students was computed and noted for data analysis.

Data Analysis

The data collected were organized and then analyzed using statistical tools, z-test at significant level of $\alpha = 0.05$.

Results

H_{o1}: There is no significant difference in the achievement in the mathematics of students taught with bonus mark (TWBM) and those taught without bonus mark (TWTBM).

Table I: Difference between mean achievement in the mathematics of the students in group TWBM and TWTBM.

Group	N	Mean	SD	Z_c	Z_t	α	Remark
TWBM	30	46.2	5.48	9.68	±1.96	0.05	S
TWTBM	30	32.5					

Table I revealed that $Z_c = 9.68 > Z_t = 1.96$. Thus, it can be concluded that there is evidence at 5% level of significance that a difference in population means significantly exists; i.e., there is a difference in the mean performance of students in the group TWBM and TWTBM.

H_{O2}: There is no significant difference in mathematics achievement of boys compared with girls for the group of students taught with bonus mark method.

Table II: Difference between mean achievements in mathematics of boys compared with girls for the group of students taught with bonus mark method (TWBM).

Group	N	Mean	SD	Z_c	Z_t	α	Remark
Boys	18	46.8	2.3	1.75	±1.96	0.05	NS
Girls	12	45.3					

The result of table II showed that $Z_c = 1.75 < Z_t = 1.96$. This implies that, there is no significant evidence at 5% level that the population means achievement of boys and girls in TWBM group are different. Hence, it can be concluded that the performance of boys and girls in TWBM group are the same. That is, though the achievement mean score of 46.8 for boys is not exactly the same with the mean score of 45.3 for girls, the difference is insignificant.

$H_{03:}$ There is no significant difference in mathematics achievement of students who attribute achievement in mathematics to ability (SAMA) compared with students who attribute achievement in mathematics to effort (SAME) for the group of students taught with bonus mark method.

Table III: Difference between mean achievements in mathematics of SAMA compared with SAME for the group of students taught with bonus mark method (TWBM).

Group	N	Mean	SD	Z_c	Z_t	α	Remark
SAMA	24	47.4	3.48	3.77	±1.96	0.05	S
SAME 6	6	41.4					

The result of table III showed that $Z_c = 3.77 > Z_t = 1.96$. This implies that, the difference observed in the performance for the two groups is significant at $\alpha = 0.05$. In conclusion, the achievement in mathematics for SAMA group is significantly higher than the achievement in mathematics for SAME group.

Findings

1. Bonus mark strategy of teaching mathematics has positive impact on students' achievement in mathematics such that students taught with the strategy achieved significantly better than the students taught without the strategy.
2. Both boys and girls react to bonus mark strategy of teaching mathematics and achieved at the same rate.
3. Students who attribute achievement in Mathematics to ability performed relatively higher than those who attribute achievement in mathematics to effort though the two groups were both exposed to bonus mark strategy of teaching.

Discussion

The result of the hypothesis (H_{01}) tested revealed that students who were rewarded with bonus mark for successful completion of a specific task achieved relatively higher than students who were not rewarded with bonus mark. Harackiewicz and Sansone (1991) stated that performance – contingent reward increases intrinsic motivation by causing individuals to care about doing the task well. Eisenberger and Cameron (1996) similarly suggested that reward on reaching a specific criterion of performance increases perceived self-determination. The reward therefore, serves as a motivation for the students. According to Bandura (1997), Rosenfeild, Folger and Adelman (1980) reward might increase intrinsic motivation by leading individual to believe they are competent or self-efficacious. If students are motivated they tend to enjoy learning mathematics. In addition, since the reward is awarded only for successful completion of a specific task, students become more determined in order to benefit from the bonus mark. By so doing, students obviously achieved better in mathematics than their counterparts who were less motivated in accordance with the findings of this research

Bonus mark is gender friendly as indicated in the finding of the hypothesis ($\mathbf{H}_{02}$) tested. The findings revealed that both boys and girls achieved and react at the same rate or level to reward strategy of teaching mathematics using bonus mark. This finding is in agreement with Eisenberger and Cameron (1996) who said that reward increases students' motivation to perform a given task and achieve highly irrespective of their sexes. This is because bonus mark is a type of reward which gives instant judgment of a student action in a mathematics class unlike examination result which comes at the end of the semester or session. As a result, all the students irrespective of their gender tend to sit-up and determined to achieve.

The result of the hypothesis (H_{03}) which compares the impact of a bonus mark as reward on students who attribute achievement in mathematics to ability and students who attribute achievement in mathematics to effort is found to be significant. The finding shows that bonus mark has more positive impact on academic achievement of the first group than the later. According to Middleton (1995) students in the lower elementary grades are generally highly motivated to learn mathematics and they believe that they are competent and that working hard will enable them to succeed. In addition and unlike students of higher institution (e.g Federal College of Education, Okene), many first and second graders do not distinguish between effort and ability as cause of success in mathematics (Kloosterman, 1993). However, there is considerable evidence that some students begin to differentiate ability for different content domains as early as kindergarten or first grade (Wigfield et al., 1992). By the middle grades, many students begin to perceive mathematics to be a special domain in which students with ability succeed and other students merely "get by" or fail. In agreement with this research finding, they begin to believe that success and failure are attributable to ability and that effort rarely results in a significant change in their success patterns (Kloosterman and Gorman, 1990). When students attribute their successes to ability, they tend to succeed; when they attribute their failure to lack of ability, they tend to fail.

Conclusion

The findings of this research justify the importance of bonus mark as a reward strategy to achievement in mathematics. The role of a teacher in the learning process therefore placed the teacher as the fulcrum to the success of this strategy. Thus, it was concluded that, if bonus mark is judiciously applied to the learning of mathematics by a competent mathematics teacher, it is capable of boosting students' motivation which can result to better achievement in mathematics.

Recommendations

Based on the research findings, the following recommendations were made:
Mathematics teachers should be exposed to bonus mark strategy of teaching mathematics through training workshops in order to encourage the usage in schools for better students' achievement in mathematics.

All mathematics students irrespective of gender should be given opportunity to benefit from the bonus mark.

Mathematics students should be properly guided in other to correct their wrong perception about mathematics.

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