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CONTENTS

RESEARCH REPORTS

Effect Of Daily And Weekly Testing On Students Mathematics Achievement At Upper Basic Level

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Abstract

Assessment is a systematic basis for making inference about the learning and development of students towards increasing students' learning and development. Teachers should therefore realize that assessment is the quickest strategy to improve student learning, hence this study examined an assessment strategy on Upper Basis School Mathematics achievement. The subjects in this study were upper basic school students from four Mathematics classes. All the students were taught by the same teacher, and the experimental duration was for three months or equivalent of one term. The four classes comprise two control groups and two experimental groups. In the control group, students took weekly tests every Friday, and in the experimental groups, students took daily tests during the last twelve minutes of the stipulated forty-five minutes allowed per period of the class teaching. The researcher examined whether the daily tests had significant impact on students' mathematics achievements as measured at the end of term examination. The researcher also examined whether daily testing had any effect on students' homework grades. The study found that daily testing significantly improved students' mathematics grades/score and home work grades.

Introduction

Scholars and researchers in the field of mathematics and mathematics education have been on the quest for finding lasting

Keywords: *Assessment Strategy, Upper Basic School, Mathematics Achievement, Students, Weekly Tests, Daily Tests and Home Work.*

solution to perennial underachievement and students' poor performance in mathematics. Among strategies suggested are participatory teaching methods, technological teaching-based strategy using computer assisted instruction, use of instructional teaching materials and others. Apart from the above mentioned strategies, this study looked at other probable solutions in terms of student assessment in mathematics. Though there are many ways by which assessment of students in mathematics could be undertaken, either through class-work, quiz, test, take-home assignments, project, terminal examination and so on. The literature has documented various strategies for improving school mathematics test scores. One important factor that affects student learning is assessment (Van De Walle, 2004). Elton and Lauvillard (1979) stated that the easiest and quickest strategy to increase student achievement is by implementing an effective assessment strategy. The National Teachers' Institute (NTI) has advocated for the use of school-based assessment as a means for teachers to guide their instruction (NTI, 2009), and they have suggested that assessment should occur in a classroom daily (NTI, 2009). One of the key requirements of the National Policy on Education (NPE, 2004) is the implementation of school-based assessment (SBA). This involves the identification of the stakeholders and their responsibilities. Effective implementation of SBA is the responsibility of all the relevant stakeholders. The stakeholders involved are the Ministries of Education or School Boards, School inspectors, Principals, Head Teachers, Mathematics Teachers and parents. Equally important are when SBA should be used in teaching and how prior to teaching mathematics teacher is expected to assess his students with a view to determining their readiness for the lesson to be taught. SBA could be used before teaching a lesson to achieve this and other goals. Also corroborated by the above-mentioned assessment strategies is the National Council of Teachers of Mathematics (NCTM, 1989). This study documents the effects of daily testing on final examination scores

and homework grades in Upper Basic School Mathematics classes.

Research on the effect of frequent testing on student achievement started in the 1920s (Deputy, 1929). A review of the literature revealed, however, that over 80% of studies on the effects of frequent quizzing focused on college students, with less than 20% having focused on elementary and secondary school students (Bangert-Drowns, Kulik, and Kulik, 1991). Prequizzing that ranged from administering tests more than once a semester, to tests once a week to daily quizzes.

Frequent tests has a mediating effect on students engagement. Research has shown when students are engaged in a lesson, students would academically outperform passive learners (Shirvani, 2007). Another study showed that when the frequency of testing increases, then there would be an increase in involving students, responding to questions, and discussing reading materials (Marcell, 2008). Denham and Liberman (1980) found that engagement time is the second important factor, besides student ability, which affects student learning. In addition, a study found that students' engagement and participation in the classroom discussion improved when the researcher implemented online web quizzing in a psychology class (Urtel, et al., 2006). Haigh (2007) found that regular testing is popular with students because it reinforces student engagement with the course and provides immediate positive feedback.

Monitoring and better organizing of materials are other mediating effects of frequent testing. Frequent testing helps students to better monitor their learning by providing immediate feedback (Leeming, 2002). Frequent quizzing also encourages students to better monitor their study times, which results in better study habits, and encourages more effective organizational strategies, while infrequent assessment encourages cramming (Geist and

Soehren, 1997). Wesp (1986) found that daily quizzes will help learners in managing their study time for the course. Daily quizzes would also provide students with a good indication of which subject they need to focus on. Another study found that students will use a test as a learning tool, and the missed questions will guide learners to better manage their time with respect to learning lesson content (Roediger and Karpicke, 2006). Good and Brophy (1990) stated that students tend to procrastinate their studying if there is no test, and they will study more often when given frequent quizzing. In another study, Bangert-Drowns et al. (1991) found that students are better able to monitor their weaknesses and strengths when teachers employ frequent testing.

Another benefit of frequent testing is its effects on test anxiety. Research has shown that test anxiety and students' achievement are highly correlated (Cassady and Johnson, 2002; Deffenbacher, 1980). A study has shown that more frequent short testing tends to significantly reduce student anxiety (Dempster, 1992). Moreover, Dustin (1971) showed that student's anxiety decreased in classes where frequent testing was used. Connor-Greene (2000) found that daily quizzing was a major factor of student motivation in learning the material. Many students have stated that frequent quizzing is a motivator for them to study more and they learn more (Feldhusen, 1964). Glenn (2007) has stated that frequent testing forces students to study more for the tests and recall the content materials more efficiently.

Research has also shown that frequent testing will improve retention of the material tested (Roediger and Karpicke, 2006; Spitzer, 1939). Roediger and Karpicke (2006) have stated that frequent testing have a positive impact on future retention of the material. This positive effect is greater than the same amount of time spent studying the material, even when there is no feedback on errors made on the test. Because retention of material is an

important component of mastery learning, Wolf (2007) has stated that frequent testing is an important ingredient for mastery learning. Wolf has stated mastery learning is an important variable in student learning (2007). Richards (1979) found that even when there is no feedback for the frequent quizzes, students tend to better recall the information, and thus achieve higher scores on tests.

Ma (1995) found that in high school mathematics classes, frequent oral tests increased performance in problem solving skills of students in the treatment group compared with the control group. Townsend and Wheatley (1975) compared four types of treatment group compared with the control group. Townsend and Wheatley (1975) compared four types of treatments in frequent testing in college calculus classes. Group 1 had daily quizzes for 5-10 minutes and a midterm test. Group 2 took quizzes every four or five sessions and a midterm test, group 3 took 40-50 minute tests with a midterm test, and group 4 had only the midterm test. This study showed that group 1 had the highest achievement in mathematics. Another study also found more frequent testing had a favorable effect in high school mathematics classes (Khalaf and Hanna 1992).

One study found that daily quizzes did not significantly improve students' scores in upper level mathematics courses in high school, but it improved scores of students in the lower level courses such as in algebra classes (Dineen, Taylor, and Stephens, 1989). Furthermore, Kika, Mclaughlin, and Dixon, (1992) compared two groups of students with different testing strategies in high school mathematics classes. In the first two months, the group 1 students took algebra quizzes once a week and in group 2, students took quizzes every two weeks. During the second two months the frequency was reversed, meaning that group 2 received weekly tests while group 1 received biweekly tests. A questionnaire was

administered in order to find students' preferences for the type of testing, and the results showed that learners preferred weekly quizzes. This study also found that there was a higher rate of improvement for lower ability students than for higher ability students.

The literature shows very few studies regarding the effect on student achievement of giving quizzes daily rather than weekly. Dineen, Taylor, and Stephens (1989) found that students taking daily quizzes outscored the students taking weekly quizzes. Mawhinney, Bostow, Laws, Blumfield, and Hopkins (1971) compared three groups of students. One group had daily quizzes, the second group had weekly quizzes, and the third group had a test every three weeks. They found out students taking daily quizzes had more consistent learning habits and studied more daily.

Not all research studies show frequent quizzing to have significant benefit on student learning. Burk (1987) found that practice tests did not significantly improve students' actual tests and found that reviewing for a test was as effective as frequent testing. Bangert-Drowns, Kulik, and Kulik (1991) found that even though in a number of studies frequent testing improved student achievement, however, the effect sizes for these were not considerably large. In regards to final examination results, another study found there were no significant differences between frequent and infrequent quizzes (Grover, Becker, & Davis, 1989). Kulik and Kulik (1991) also found there is a diminishing return when increasing the number of quizzes. In another study, Noll (1939) states that frequent testing may have a negative effect on student learning since instructional time are reduced.

This study is significant due to the lack of any research comparing the effect of daily tests versus weekly tests on students' mathematics achievement, particularly in this part of the world,

Nigeria. The Millennium Development Goals (MDGs) and Education for All (EFA) Acts advocate closing the gap between lower and higher achiever in four key subjects, mathematics inclusive. The study also should provide insight into the role of assessment in improving the mathematics achievement of Upper Basic Students. This study sought to answer two questions that are related to student mathematics achievement:

(1) What is the effect of daily testing on students' learning as measured by the final year examination scores in mathematics?

(2) What is the effect of weekly testing on students' learning as measured by the final year examination scores in mathematics?

(3) Did the treatment have any effects on students' homework assignment grades?

Method

This study adopted the control group quasi-experimental design.

1. Independent variable: There is one independent variable (method of assessment), which was varied at two levels as follows:
   (i) Daily tests assessment
   (ii) Weekly tests assessment
2. Dependent variables: There are two dependent variables viz:
   (i) Students' achievement scores/grades in daily and weekly tests
   (ii) Students' achievement scores/grades in home works.

Sample:

Participants in this study were eighty-nine (89) Upper Basic three students from one teacher's mathematics classes. There were forty-one (41) male students and forty-eight (48) female students. The upper basic school was located in Ido Local Government Area

of Oyo State and it is a private school at the time this study was conducted.

Instruments:

Five instruments were used to gather information (data) for the study. They are final examination scores, students' last term exam scores, weekly tests score, daily tests scores and students' homework grades.

Final examination: At the end of the three months (a term), students in all four classes received the same examination. The final examination was a comprehensive test which covered all the concepts taught throughout the entire duration of the term.

Students' last term scores: These scores are the ones that students received on their report cards in the previous term.

Weekly tests: Students took a 45-minute test, which included lessons taught from Monday through Thursday.

Daily test: Every day during the last 12 minutes of class time, the teacher administered test, and students received their grades the following school day.

Students' homework grades: In both groups, students were given the same homework assignment. There were about 13 homework grades during the treatment. The policy for grading homework assignments was that if students completed just a few questions, they received 25, if they did half or about half, they got a score of 50, and if they did more than half of the assignments, they received a score of 75. If they did all or almost all homework assignments, they received a score 100. The SPSS program was used to find the mean scores of homework assignments for both groups, and then applied a pair-independent t-test to examine whether the mean difference was significant or not. They received a score of zero for not turning in an assignment.

Procedure

One mathematics teacher was selected in the school who taught upper basic classes 1 3 to participate in this study. Upper basic 3

was selected because they were more academically comparable and also preparing for public examinations, while two classes were selected for control group and another two classes for the experimental group was carried out by random selection.

In the treatment group, the trained teacher administered a 12-minute daily test at the end of the class period to all students, while the control group received a 12-minute worksheet and a test on every Friday. At the beginning of the class period, the teacher returned the graded test to all students and spent about 5 10 minutes explaining the solution for each question for the students in control group, the teacher spent the amount of time explaining the solutions for the questions on the worksheets. During the study, both groups were exposed to the same teacher using the same textbook (Effective Mathematics for Junior Secondary Schools) materials, lesson contents and home works. The duration of the treatment was for one term, that is, three months of intensive teaching.

Method of Data Analysis

At the end of the term, all the students in the control and experimental groups took the same final examination. Their grades were subjected to SPSS version 19 program to find the mean scores of final examinations for both groups, and then examined whether the difference between the mean scores of the two groups was significant. An independent t-score was used to examine the students' previous term scores to ensure that the two groups were academically comparable.

Results:

The previous term final scores from two classes in the control group and from the other classes in the experimental group were examined to determine whether the two groups were different with respect to mathematics achievement at an alpha level of 0.05,

which is a measure of probability error and found p of .032 indicating the two groups are not significantly different with respect to mathematics achievement.

The first research question was whether the treatment had any significant effect on students' mathematics achievement as measured by the final examination.

Table 1: The mean scores of final exams for two groups

Variables	N	Mean	S.D	ES	t_{cal}
Experimental group	44	87.66	12.97		
Control group	45	80.51	12.62	0.44	0.034*

ES denote Effect Size

*denote significant mean difference at 0.05 alpha level

Table 1 shows that the mean of the final examination scores for the control group was 80.51, and the mean of the treatment group's final examination scores was 87.66. Since the p-value is 0.034 and is less than alpha level of .05, it is an indication that there is a significant difference in the two groups' performance. The treatment group, which used daily testing, outperformed the control group. The effect of the size (ES) for this test is 0.44, indicating a moderate significance between the two groups.

The second research question was whether the treatment had any effects on students' homework assignment grades.

Table 2: The mean scores of Homework assignments for two groups

Variables	N	Mean	S.D	ES	t_{cal}
Experimental group	44	97.36	12.46		
Control group	45	85.38	16.56	0.034	0.51*

*denote significant mean difference at 0.05 alpha level.

Table 2 shows that the mean score of homework assignments for the control was 85.38, and the mean score for the treatment group was 97.36. The independent t-test indicates that the treatment group had significantly higher scores on the homework assignments than the control group. The p-value is 0.034 which is less than the alpha level of .05. The effect of the size for this test is 0.51, indicating that daily testing had a moderately significant effect on homework assignment scores.

Summary and Implications:

The results of this study indicated that using daily testing as an assessment strategy would significantly increase students' mathematics achievement. Another finding was that students' scores on homework assignments for the experimental group significantly outperformed the control group. The findings from this study are in agreement with other researchers' studies (Dineen, Taylor, and Stephens, 1989; Kike et. al., 1992), which indicate that frequent testing improves academic achievement.

From the summaries of research studies, a model that incorporates the effects of daily testing on students' mathematics achievement could be used. This model is based on five mediating variables which are related to the effects of daily testing on students' achievements. The model is called EMMARP. The letters stand for five mediating factors: monitoring (M), engagement (E), Motivation (M), Retention (R), Procrastination (P), and Anxiety (A). Figure 1 shows the relationship of variables in the EMMARP with student achievement. The effects of these five mediating factors on mathematics achievement were previously discussed.

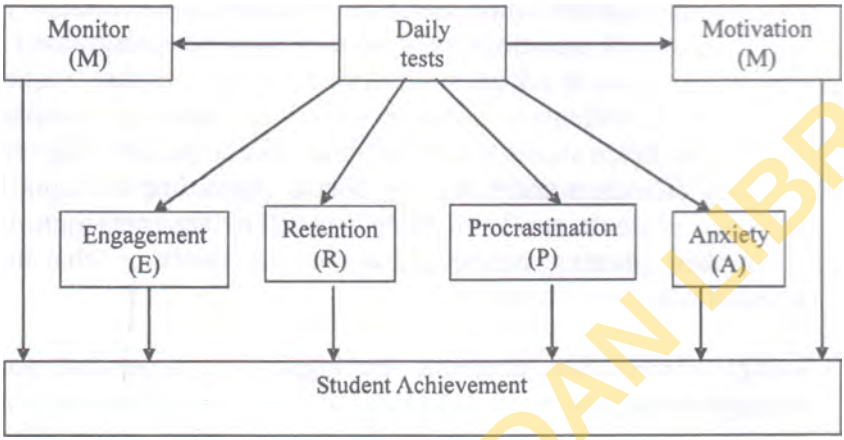

Fig 1: The EMMARP Model

Implications for Mathematics Teachers:

The results from this study have several implications for secondary school mathematics teachers. Teachers should realize that assessment is the quickest strategy to improve student's learning (Elton and Lauvilland, 1979). Research has shown that students tend to procrastinate in their studies (Townsend and Weatley, 1973; Akinsole, Tella and Tella, 2007). Therefore, by administering daily tests, teachers can motivate their students to study daily rather than cramming at the end of the week or month. Fitch, Drucker and Norton (1951) found that frequent testing reduced procrastination and increased daily study.

One of the Gardner's multiple intelligence is intrapersonal intelligence, and students with this type of characteristics tend to be introverted and quiet in the classroom and hesitant to answer questions when a teacher asks a question. These children may benefit from daily tests because they could monitor their understanding of the concepts by getting immediate feedback from the teachers.

Also, many students would pretend they understand a concept, yet are afraid to ask questions because they may be embarrassed or feel it is not good to ask question. A study had shown that frequent testing helps students to better monitor their learning. Frequent testing also helps students to better retain the content in long term memory (Roedlger and Karpicke, 2006). According to cognitive scholars, students can learn more when they are metacognitive about their learning, meaning that they are aware of what they know or what they do not know.

Lastly, mathematics concepts are highly interdependent so a concept taught today will be a prerequisite for future's/tomorrow's concept. Therefore, daily testing can help students to correct their errors, get immediate/expedient feedback and inform them of which content is more important.

Limitations and Suggestions for Future Research:

The duration of treatment for this study is a limiting factor, which was a term. Also, one private school of four classes and one mathematics teacher is not enough for the generalization of results.

Marking of daily testing is also an herculean task but this could be overcome by liaising with National Open University of Nigeria (NOUN) on how they conduct their e-examination with immediate feedback. Future studies however were required in the following areas:

(1) Investigation of the effects of daily testing across geopolitical zones in Nigeria;

(2) Comparing students with daily testing with those without but with daily homework;

(3) Also, there should be involvement of parents on daily homework to monitor their children by signing a monitoring sheet indicating that they had received their

children's daily grades. Such studies could add to the body of research indicating that daily testing significantly improves student mathematics achievement.

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