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Approaches of Classroom Activities in Mathematics Achievements in Ethiopian College of Teachers Education: An experimental Action Research

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Abstract

The objective of the study was to examine the effects of classroom activity on students' mathematics achievement. The study also sought to determine the classroom activity load that affects student mathematic achievement. In order to conduct the study an approach of action research was employed on two sections of first year students of Jimma College of teachers' education. First observation of students' activity and their perception towards mathematics classroom activity was made. Students' perceptions of classroom activity gave valuable information to improve the approaches of classroom activity so as to improve student achievement. In the first session of observation and focus group discussion the researcher at glance concluded that students were overloaded and they perceive negative attitude towards classroom activities that exhibit low achievement and next designed a strategy with partner researcher. Therefore, action was taken to improve approaches of classroom activities by dividing students as an experimental (40) and control group (38). An experimental group students were exposed two representative examples and two representative classroom activities with appropriate time allotment followed by evaluation, while the control group were continued as usual as on the same instruction, topics and sections of chapters for about six weeks and their three test scores given at the end of every two weeks were analyzed using independent sample t- test as shown in the methodology section. Furthermore, their perception before and after the new exposure of classroom activity intervention for experimental group was analyzed using dependent t-test The result shows that statistically significant difference test performance between an experimental and controlled groups of students. Moreover, students' perception towards classroom activities on mathematics course was significantly improved for an experimental group. The study revealed that only appropriate and relevant classroom activity with clear classroom demonstration, equitable activity followed with classroom evaluation and time allotment can improve students mathematics achievements than loading student with full of activities and classroom instructional obstruction.

Keywords: Classroom, Activities, Students' achievements, Approaches and Teacher education

1. 1. Introduction

Large-scale comparative international and national surveys continue to show poor performance of students in Mathematics. Given such consistently poor productivity, much research has sought to identify students in school and out-of-school experiences that influence achievement and related outcomes especially those that are alterable or partly alterable by educators and could be manipulated by policy makers (Silesh, 2001). Research in western countries has shifted attention away from school-lever factors to learning environment of the classroom (Saburoh, Shyoichi, 1984). In fact, all factors that contribute to educational outcomes exist in one way or another in classrooms that differ in terms of learning environments. They have unique effects on pupils learning independently of factors operating at school and individual levels (Richard, 1994).

The classroom activities influence on students' achievement is two or three times more than the school level. Classroom teaching is nearly a universal activity designed to help students to learn. It is the process that brings the curriculum into contact with students and through which educational goals are to be contacted with students and through which educational goals are to be achieved. The quality of classroom teaching is a key to improving students learning (Brown et al., 2003). Although, setting standards for content and performance is an important first step, but merely doing so and holding teachers accountable will not improve students' learning (Anderson

Brophy, 1998). Accordingly, particular attention should be paid to the actual process of teaching. However, a number of studies in classroom activities provide the critical link between students' achievement data and teacher practices at classroom level, this link is unfortunately lacking in most national education surveys (Deribssa, 2004).

Similarly, teaching and assessment are rarely studied at level, but education policy is often discussed nationally. It is important to know what aspects of teaching and assessment contribute significantly to achievement so that national discussions of classroom practices focus on the typical experiences of students (Silesh, 2001). Findings of research suggested that several classroom instructional activities were associated with achievement and noted that the ways in which instructional activities are presented in classroom context affects student achievement (Sewell, 1984; Anderson and Brophy, 1998; Cooper, 1998). Moreover, Sommer (1999) found that quality of instruction influence achievement at the class level. Instructional activities in class include variables that describe aspects of classroom instruction such as quality of teaching style and opportunity to learn (Belay, 2006).

The teaching context is established through preconceptions held by the teacher and students about the process of learning and how that might be facilitated. Perceptions of the learning process at various levels of constructive inform different teaching practices which in turn lead to modification of the students' perception of the learning environment. It found that quality of teaching was a significant predicator of student achievement even after controlling for effects of students characteristics (Boaler, 1998).

An important part of any instructional setting is the teaching style. Research results suggested that teaching style exerted effects on student achievement that were independent of students' characteristics (Smith 1987). The promise "one teaching style fits all" which is attributed to a teacher-centered teaching style is not working for a growing number of diverse student population. Problems occur when teaching styles conflict with students learning styles, often resulting in limited learning or no learning (Desalegn, 2006). Hufferd-Ackles, Fuson, and Gamoran-Sherin (2004) offers learner-centeredness as a model for responding to classroom challenges because of its viability for meeting divers needs. Both teaching styles (teacher and learner entered) recognize the student as a key factor in improving student achievement .The teacher–centred style places control for learning in the hands of the teacher who decided what students would learn and how the teacher uses his expertise in content knowledge to help learner make connections.

Teacher provides a variety of instructional methods and techniques for helping learners construct their learning and develop a system for applying knowledge and theory (Brown et al., 2003). Knuth (2003) found that student learn more in classes where they spend most of their time being taught or supervised by teachers, rather than working on their own**.** One of the main factors related to achievement scores is opportunity to learn which refers to the amount of time students are given to learn the curriculum. The extent of the students' opportunity to learn content bears directly and decisively on student achievement (Huntley & Rasmussen, 2000). Classroom activity is seen as a contribution towards students' learning, extending the curriculum, which is conceived as one opportunity to learn in those regular school hours. Class room activities could be considered as a proxy measure for the degree to which teachers academically challenged "pressed" their students. While doing class room activities in Mathematics course depends on the amount, type and efficiency of class room activities rendered in each contact hours during instruction.

The classroom assessment environment has been defined as the context created for learners by several aspects of teachers' use of formative and summative evaluations of their work, and assessment should as far as possible be integral to the normal teaching and learning programmed. For instance testing should be considered as an opportunity to learn (Villarubi & Fey, 2000). In addition, teachers know how students are progressing and where they are having trouble, they can use this information to make necessary instructional approaches of offering more opportunities for practice (Villarubi, 2000). Feedback is required because students need information about their accomplishments in order to grow and progress (Nathan, 2003). Feedback related to assessment outcomes helps learners become aware of any gaps that exist between their desired goal and their current knowledge understanding skills and guides them through actions necessary to achieve the goal (Richard, 2003).

1.1 The Problem and its Approach

Participation in classroom activities play meaningful role in satisfying educational objectives and raising students personality. Enhancing student's participation in different domains of classroom activities needs to be searched and studied to uncover its fact to know its characteristics and advantages. Effectiveness in learning depends up on teachers' ability to select appropriate time considering learners experiences and preferences (Firdissa, 2005). This implies that learners are the chief central foci of classroom instructional planning. Their

beliefs and motivation to learn their preferences and expectation should direct their instructors to design instructional strategies in general ,and that of particular classroom activities in particular (Derebssa, 2004).

Different literature recommends that active learning is the best instructional approaches in involving students in doing things and thinking about the things they are doing. It implies learners' active participation, involvement and thinking and doing what they think and sharing responsibilities for their learning rather than passively absorbing the supposedly rich contents provided by their instructors (Firdissa, 2005). Furthermore, scholars are acknowledging class room action research to enhance how an active learning approach improves student performance, preferences and beliefs which in turn can shape the instructional approaches of instructors. The process of teaching and learning in any setting can often encounter barriers that disrupt teachers' plans, students' achievement or the institutional goals. In such circumstances it is necessary for instructors and others to investigate the nature of the problems that arise and seek solutions through action research.

Ernest Stringer (2007) describes action research as a systematic investigation into problems that come up in education or other social endeavors which then informs careful experimentation with likely solutions to those problems. In this fashion instructors are able to more fully understand the problems they have encountered, prepare a likely solution to them, and evaluate the results. If the results are successful, then the instructor can move forward. If not, then those results constitute relevant data for another cycle of inquiry. Therefore, in order to better understand the successes and difficulties the instructors at higher education institution, the integration of active learning and action research in improving students' achievement in any courses in general and that of mathematics in particular (Stringer, 2007).

However, the existing situation does not reveal the reality of mathematics course instruction. The observation made during class room instruction shows that students are forced to do class room activities. They consider class room activities as extra curricula of the courses. The instruction given to the students in actual classroom refers to traditional approaches which may deny the classroom activities. Most students are complaining of mathematics courses as difficult subject. They always busy in studying mathematics course during examination time only. These facts are the real situation observed in Jimma College of teachers' education which needs intervention in class room activities so as to enhance students' achievement in mathematics course. Thus, this study focuses to realize how classroom activity affects achievement in mathematics course.

The present study is trying to answer the following questions:

1. What are the perceptions of students towards classroom activities?
2. To what extent classroom activities affect the performance of students in mathematics achievements?

1.2. Objectives of the Study

The objectives of the present study can be summarized in two items as follow:

1. To observe perception of students towards classroom activities in mathematics course.
2. To analyze whether or not approaches of classroom activity affect achievements in mathematics course.

1.3. Significance of the Study

As the approaches of the study follows experimental based action research approaches it will have a basis for practitioners to practice experimental action research in their respective classroom. Moreover scholars can extend experimental action research to improve the students' mathematics achievements at higher education at larger scale. Thus, the study was considered of vital importance for the following reasons:

It lights on the important domains of the students' participation in classroom activities that instructors of mathematics use in their classrooms. It lights on the role of mathematics instructor towards enhancing students' participation in classroom activities so as to enhance their achievements. The results of this study are going to contribute to putting solutions in how to enhance students' participation in classroom activities and better performance at large scale.

1.4. Delimitation of the Study

Even though variables attributing students' performance in mathematics course are multidimensional and controversial, the study was delimited to classroom activities loads during instruction only. Furthermore study was carried out only in two sections; one as experimental and the other as controlled, of first year students of Jimma College of Teacher Education.

1.5. Limitation

Some extraneous variables that affect classroom activities and student test score were not controlled. The study was carried out in short period of time, for about two months. As a result data of student test score limited to only three test score which was given consecutively within 6 weeks.

2. Action Research Design and Methodology

The design of the study was static-group comparison -experimental action research approach which fit the nature of the study. The description of a proposed study design was to determine students' perception and classroom activity approaches that predict students' achievement. The approaches of classroom activity were considered as independent variable while student achievement on the tests was seen as dependent variable.

2.1. Participants

Based on the nature of the topic and the researcher interest to apply action research approaches, purposive sampling techniques was employed for deeper understanding of effects of classroom activities on mathematics achievement for articulating an area of intervention. The target participant that was studied includes 40 experimental groups and 38 controlled group which represent a total population of 78 students of first year students of Jimma College of teachers' education of male and female students collectively. These students were selected because of the fact that they have been with the researcher for the previous semester with similar courses. Thus, the principle of experimental based action research on actual classroom basis was believed to be effective, irrespective of students' various socio-economic backgrounds.

2.2. Description of Instrument

The first step in the study was inventory of class room activity approach observation and focus group discussion was made by the researcher how the students perceive mathematics classroom activities at glance. Furthermore the instrument comprised of 10 items was developed for experimental groups to answer, which helps to compare students' perception before and after intervention strategies. The instrument were partly adopted based on Likert scale form range of five point scale from strongly disagree to strongly agree to examine students' perception towards mathematics classroom activities.

2.3. Procedure of the Study

2.3.1. Procedure -1

Instruments: Students' questionnaire were administered twice i.e.; before and after the intervention activities for experimental group. Students' questionnaires focus on gathering data concerning perception of students towards classroom activities. Focus group discussions have been made with both experimental and control group of students to get areas of class room intervention approaches. The result of data gathered by questionnaire and focus group discussion were used as an instrument to design an intervention strategy for classroom activities for an experimental group.

The data gathered based on focus group discussion and question showed that:

> *'Students were loaded with lots complex exercises and examples the whole period/ 50minute/ every session of mathematics class to cover the length portion of the course. The opportunity to relax on few classroom group activity and evaluation were totally neglected to cover the course'*. (Bolender, 1997).

This made the students' perception negative to mathematics class, which on the other hand made them low achievement in mathematics tests

2.3.2. Procedure -2

First round observations were conducted for 3 consecutive days to observe how their regular instructor delivers classroom activities and evaluation approaches. Based on the result of physical observation and focus group discussion, intervention strategies were designed by the researchers while one of them had an experience of teaching with college mathematics/maths102/. Accordingly, for a period of six weeks classroom activity intervention followed with three tests within a difference of two weeks as shown below. The following procedures were employed for experimental group:

- 50 minutes of total instruction time allotment was ensured
- 20 Minute discussion/lecture / with two clear examples were demonstrated to the class
- Two questions were given for classroom activity to be done in group for 15 minutes

- 15 minutes were allotted for evaluation of the work of each group
- Furthermore the students were ordered to practice similar activities in their text book

The following procedures were employed for control group were as usual i.e.

- 50 minutes of total instruction time allotment was ensured
- Full lecture/discussion/ and example without time allotment for each activities
- Lots of computational exercise was given as a home work
- No evaluation was made during classroom activity
- Furthermore the students were ordered to practice similar activities in their text book

It noted that the intervention strategy were time allotment, two representative practical examples and classroom group activities and evaluation which were employed on experimental group. On the other hand no intervention was made for control group .All approaches were as usual, and i.e. no time allotment for every activity, full lecture with unlimited example, and lots of computational exercise as a home work, no classroom group activities and evaluation were made for the controlled group.

2.3.3. Procedure-3

At the end of every second week test evaluated corrected from 10% was given to both of an experimental and controlled groups. In preparing the tests care was taken into consideration in selecting test item directly from their text book and topic covered which corresponds to examples given during their instructional periods. All the tests were multiple type alternative, four choices accompanied each item of the test. Students took the test in independent classes every two weeks in the afternoon at the same time. All the three tests had constituted 10 items to be corrected from 10%, and the time allotted for each test for both experimental and controlled group was 60 minutes. Each of the test score of the experimental and controlled group were recorded.

2.4. Methods of Data Analysis

First of all the score of second semester mid-examination of both experimental and control group was analyzed using independent sample t- test as a bench mark achievement before intervention. The perception and performance of students before and after classroom intervention and the result of test score were analyzed by statistical tools such as dependent and independent t-tests, respectively.

3. Results and Discussion

Before class room intervention students' perception has been analyzed. The pre-intervention and post - intervention of students' perception towards classroom activities analyzed as is shown in Table1. 40 students from experimental group were involved in rating the items before and after intervention, and dependent t-test employed to show how classroom intervention improve students' perception towards classroom activities in mathematics class.

Table1 shows that students' perception towards class room activities significantly improved on items 2, 3, 4, 5, and 10. One can deduce that the intervention made has developed positive attitudes of students towards mathematics class room activities. Comparatively however, still there are some students who are hesitating classroom activities to be performed by classroom teachers referring to item7, while others have believe that classroom activities to be performed by naturally talented/gifted/individuals as referred in item8 in Table 1.

In order to compare the result of students achievement after intervention mid -semester examination result (30%) was taken as a basis of the study and the result is shown in Table 2.

The Table2 above shows that there is no statistically significant difference observed between experimental and controlled groups in their mid-semester achievements': (mean= 18.58& std.dev.=6.366 and mean=18.54 & std.dev.=5.296 (t=0.032, p=0.974),respectively. Thus it is easy to justify whether classroom intervention can improve students' achievement by comparing both experimental and controlled groups achievement after intervention: The three mean score tests for 40 students (experimental group) and the mean score for 38 students/controlled croup/were analyzed. Independent t-test was employed to test whether statistically significant achievements on tests were observed or not, the result was shown in Table 3 below.

The result in Table3 indicate that there is statistically significant difference observed between an experimental group and controlled group in all the three tests: for test 1 (Mean=6.56 & std.dev.=2.48 and mean=4.o4& std.dev.=2.17, and t=5.333, p=0.001), for test2 (Mean=8.24 & std.dev.= 2.05 and mean=4.97& std.dev.=1.69,t=8.026, p =0.003), respectively. Especially, Table 3 clearly shows that students who have got treatment in their respective classroom have improved their academic achievement better than those who didn't get classroom activity treatments. This fact demonstrate that the effect of appropriate classroom activity improve

the performance of students in mathematics course. Overall, the experimental group students have shown better performance in the three tests persistently.

This short term study indicates that appropriate classroom activities improve students' academic achievement in mathematics. This finding goes with that study which recommends classroom instruction a base for mathematics achievement (Silesh, 2000). As observed there is statistically significant difference in perception of students about classroom activities in mathematics class before and after the intervention. The fact is that, previously, the students were not well treated or exposed to classroom activities and the type of test given to them might be textbook or module based which can only achieved by prove reading.

From the focus group discussion made homework activities predominated classroom activities which encourage students to exercise mathematics computations without understanding in the classroom. Because of this tradition students have developed negative perception in classroom activities. However, after classroom intervention made and the students have observed their performance, they become a good stand of classroom activities. As observed in Table2, there is no statistically significant difference between experimental and controlled group in their mid-semester mathematics achievement (mean= 18.58& st.dev.=6.366 and mean=18.54 & st.dev.=5.296 (t=0.032, p=0.974),respectively. Meanwhile, after an experimental group became exposed/intervened/ to classroom activities, statistically significant difference in achievement of mathematics test observed in all the three tests: for test 1 (Mean=6.56 & st.dev.=2.48 and mean=4.o4 & st.dev.=2.17, and t=5.333, p=0.001), for test2 (Mean=8.24 & st.dev.= 2.05 and mean=4.97& st.dev.=1.69,t=8.026, p =0.003), respectively These facts clearly demonstrated how classroom activities have an effect in performance of students in mathematics course. This short term study reveals that classroom activity and test score in mathematics course have strong relationship.

The literature points to the fact that the classroom activities, teacher instructional quality and student attitude are part of the many areas that affect student achievement in mathematics (Fraser, 1998). Classroom activities and evaluation are not only provides information on how to measure the students' performance, but also information on the teachers' competences to create the positive learning outcomes. The objective of the study was to examine effects of classroom activity approaches and student mathematics achievement. From the findings of the study, the researcher concludes that: 1) the independent variables, approach of classroom activity and evaluation is statistically significant to student mathematics achievement scores, 2). the classroom activity exercises in group and task orientation and time allotment for activities had an interesting contribution on students' mathematics achievement. Although accuracy of students' performance in the three test score improvement were observed in limited weeks and limited class, it is a footstep to exercise at large scale in time and size to reach a clear conclusion.

4. Implications of the Study

The data collected and the results of the study have many prospective implications for the improvement of students' performance in mathematics course and instructors of mathematics courses. The importance of creating and maintaining appropriate classroom activity, time allotment of each activity and evaluation are crucial to ensure and maintain a positive impact on student achievement. However, there are still many questions that are still unanswered relating to approaches of classroom activities and mathematics achievement.

Hence, other factors exist that can affect classroom activities and student mathematics achievement in our colleges of teacher education. These include factors such as teacher effectiveness, socio-economic and classroom physical setting. Therefore, there is a need for subsequent studies that will support this study and add the development of practical experimental action research and additional classroom instructional studies and findings for the development of mathematics education in our country at larger scale. Thus, the study has several implications for current and future research practice that follows below.

The following points are emerged from this short term study:

- Mathematics teachers had better encourage appropriate classroom activities that initiate students' performance
- Students should exercise mathematics activities with their teacher in the class rather than reserving as a homework
- Teachers need to identify desirable and undesirable practices in classroom activities in order to improve their students mathematics achievement.
- Teachers need to ensure that students are equitably relaxed on few representative practical examples and classroom activities within specified time.

- Simple experimental research related to students mathematics performance should be encouraged at College and high school levels
- Create a classroom learning context in which students can construct meaning. Students can learn important mathematics both in contexts that are closely connected to real life situations and in those that are purely mathematical.
- The abstractness of a learning environment and how students relate to it must be carefully regulated, closely monitored and thoughtfully chosen.
- The research output gained at one institution should be disseminated to the rest of other academic institutions, so as to improve students mathematics performance at large-scale.

In general as theories of classroom instructional activity continue to develop and evolve, the need to examine, create and validate more classroom instruction in mathematics course continues to grow. This includes both opinion and perception that will form a wide- ranging and comprehensive representation of student achievement and success in mathematics. The importance of classroom instruction and students' mathematics performance and performance in other subject areas is very important in making meaningful strides of mathematics and other computational courses in college education. Specific attention must be given to understanding the dynamics of the classroom instructional approaches so that instructors will operate in an effective manner in order to produce the desired effects for upward movement in student achievement holistically.

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Table1: Dependent t-test Analysis Students Perception towards Classroom Activities

Items	Intervention cases	N	Mean	St. dev	t	p.
1. Classroom activity can improve students achievement in mathematics	pre-intervention	40	3.89	1.09834	0.892	0.376
	post – intervention	40	3.97	1.2799		
2. Class room activity is to kill or waste time	pre-intervention	40	2.8611	1.01848	3.649	0.001
	post – intervention	40	1.8611	1.29069		
3. No need of giving classroom activities in mathematics period	P # +re-intervention	40	2.9167	0.93732	5.447	0.001
	post – intervention	40	1.5833	1.13074		
4. Home work is preferable to classroom activities	pre-intervention	40	3.1111	1.237	0.993	0.324
	post – intervention	40	2.8333	1.13389		
5. No need of giving mathematics activities during classroom instruction	pre-intervention	40	2.8333	0.84515	6.835	0.001
	post – intervention	40	1.4722	0.84468		
6. Most students who perform classroom activities are not successful in examination	pre-intervention	40	2.6944	1.09073	4.8	0.001
	post – intervention	40	1.6111	0.80277		
7. Classroom activities must be performed by class room teachers only	pre-intervention	40	2.1111	1.21368	0.743	0.460
	post – intervention	40	1.9167	0.99642		
8. Classroom activity is only for gifted individuals	pre-intervention	40	1.8611	1.15022	0.793	0.431
	post – intervention	40	2.0833	1.22766		
9. Always I disturbed when classroom activity is given	pre-intervention	40	2.3333	0.92582	1.488	0.141
	post - intervention	40	1.9167	1.40153		
10. I dislike classroom activity at all	pre-intervention	40	2.1667	0.87831	1.994	0.052
	post intervention	40	1.6944	1.11661		

Table 2. Mid-examination Analysis as a bench mark for intervention

Test	Groups	N	Mean	Std. Dev.	T	p.
Mid-Exam	Experimental group	40	18.58	6.366	0.032	0.974
	Control group	38	18.5417	5.295		

Table 3: comparison of students' achievement during classroom intervention

Tests	Groups	N	Mean	Std. Dev.	T	p.
Test1	Experimental Group	40	6.56	2.48	5.333*	0.001
	Control Group	38	4.04	2.17		0.001
Test2	Experimental Group	40	8.24	2.05	8.026*	0.003
	Control Group	38	4.97	1.96		0.002
Test3	Experimental Group	40	8.58	1.66	3.192*	0.002
	Control Group	38	7.18	2.57		0.002

std.dev= standard deviation, * $p<0.05$: shows statistically significant