



RESEARCH ARTICLE

FACTORS AFFECTING MATHEMATICS TEACHERS' USE OF TEACHING AIDS IN FACILITATING STUDENTS LEARNING: THE CASE OF JIMMA TOWN SECONDARY SCHOOL MATHEMATICS TEACHERS

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ABSTRACT

This study was conducted to investigate factors affecting teacher's use of teaching aids to facilitate students learning in Jimma town secondary schools. The sample for the study included 40 purposively selected mathematics teachers from the four secondary schools in Jimma town. A questionnaire that was adapted from the work of Kamla-Raj 2014 administered to solicit factors that affect teachers' use of teaching aids in creating mathematical sense. Five types of questionnaires on (perspectives of teacher variables, time and cost perspectives, motivation and attitudes towards mathematics, learner qualities and the nature of teaching aids) were distributed to the sample secondary school mathematics teachers to examine the level of their impacts. Percentage and descriptive statistics were applied to analyze the data. The results indicated that almost all teachers agree on the impacts factors such as (perspectives on teacher variables, time and cost perspectives, motivation and attitudes towards mathematics, learner qualities and the nature of teaching aids) on use of teaching aid to facilitate their students learning. Hence, school and teachers are expected to look for ways of using instructional aides to facilitate their students learning in mathematics class. To over com the problem time and cost perspectives, the school and teachers may need to look for ways of using locally available resources. College of Education and Behavioral Sciences need to collaboratively work on raising secondary school teachers on the importance of using teaching aids to facilitate students learning.

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INTRODUCTION

Mathematics teachers are constantly considering various ways of promoting their teaching and helping students to comprehend mathematical concepts. Researchers hold the view that mathematics lessons and student understanding are more effective if teaching aids are used (Steadly *et al.*, 2008). However, Maslen (2014) warned that teaching aids are potentially harmful if used inappropriately. Improperly used teaching aids are likely to persuade students that two mathematical worlds exist: teaching aids and symbolic (Milgram and Wu, 2008). Teaching aids must be relevant for the concept being developed and appropriate for the cognitive development level of the students. Thus, the utility of teaching aids in passing on mathematical concepts is deeply rooted in the teacher's ability to select, organize and make appropriate linkages. This research therefore attempts to gain insight into teachers' factors affecting mathematics teachers' use of teaching aids in facilitating learning mathematics. Teaching aids are considered as a means of rising mathematical

understanding (Lee, 2014). They are typically real-life objects that are used to represent mathematical concepts (Kosko and Wilkins, 2010). The benefits associated with the use of teaching aids can be attributed Bruner's (1973) investigations in which teaching to aids were used to develop deep understandings of certain mathematical concepts. Teachers utilize teaching aids to clarify abstract mathematical concepts that ordinarily may be difficult for students, such as adding and subtracting integers, solving inequalities, and simplifying algebraic expressions (Lira and Ezeife, 2008). The learning process involves transitioning from manipulating teaching aids to creating images from the student's perception of the concept, and finally to the development or adoption of some forms of symbolic notation representing the concept. Research indicates that students of all ages can benefit by first being introduced to mathematical concepts through physical exploration (Fraser, 2013). By planning lessons that proceed from teaching to pictorial to abstract representations of concepts, content mastery becomes more accessible to students (Goonen and Pittman Shetler, 2012). With teaching exploration (through touching, seeing, and doing), students can gain deeper and lasting understandings of mathematical concepts.

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Teaching aids are also perceived as hands-on models that appeal to the senses and can be touched by students (Heddens, 2011). Teachers should select these aids in such a way that they relate to a student's real world. The teacher's successful use of teaching aids occurs when they are used as symbols as opposed to literal representations of what they actually are. In order to gain mathematical understanding using teaching aids, learners need to identify the mathematical concept being learned with the teaching aids used (Martin *et al.*, 2012). Literature indicated that the use of teaching aids as teaching and learning aids can help teachers to create conducive class-room environments (Ross, 2008). Teaching aids can also serve as a means of motivating learners (Merriam and Brockett, 2011). Moyer (2001) observed that in lessons where teaching aids were used students appeared to be fascinated, active, and involved. Research also indicated that proper use of teaching aids yields on task behavior and student awareness. Students can only come to understand concepts when they are actively engaged in their own learning. They need to take control of their own learning and teachers must provide them with the opportunities to do so. Ferguson and McDonough (2010) supports the idea that teaching aids enhance teachers and students to bridge the gap that separates how mathematics is taught and how mathematics is learned. Strom (2009) also noted that use of teaching material in the classroom can help students to understand processes and communicate their mathematical thinking at all grade levels and extend their mathematical ideas to higher cognitive levels.

According to Moch (2001) some teachers perceive the use of teaching aids as a means to improve conceptual knowledge and help students to visualize abstract mathematics concepts (De George and Santoro, 2004; Suh and Moyer, 2007; Green *et al.*, 2008). Piaget (1952) proposed that children do not have the mental maturity that is required to understand abstract mathematical concepts that are presented to them only in words and symbols. Therefore they need the guidance of the teacher to manipulate teaching aids. The utilization of teaching aids enables the teacher and learners to break away from the traditional classroom setting and instructional style. Teacher's ability to use teaching aids appropriately in the classroom ensures that the learners grasp the mathematical concepts presented (Vinson, 2001). While a kinaesthetic involvement can enhance perception, thinking, and conceptual understanding, Lett (2007) however stated that understanding does not take place through activity based learning. Kerekes (2006) raised concern that teachers view teaching aids as magical tools that heal all the problems that students have in acquiring mathematical knowledge. Teaching aids need to be introduced and used properly in order for them to work. According to Kelly (2006) teaching aids selected must support the goals of teaching. Kelly (2006) further cautioned teachers who give students the aids and allow them to play with them without ensuring that learning is taking place. Teachers need to plan and conduct lessons using teaching aids (Boggan *et al.*, 2010). Students should be allowed an opportunity to discuss and share techniques and strategies related to teaching aids use. If there is no discourse between the teacher and students, the students are more likely to follow rote procedures for the use of the aids. Teachers using teaching aids in their class-rooms need to possess a deep conceptual understanding and have the ability to pass that along to their students (Hounsell, 2009). In addition to conceptual understanding, it is recommended that teachers should have a certain comfort level in handling teaching aids in order to use them properly. Ross (2008) noted

that teachers who are not comfortable with the use of teaching aids are likely to decrease the effectiveness of instruction, class-room management, and student achievement. Teachers trained to use and understand teaching aids properly may be able to override their natural tendency to teach the way they were taught (Borgen, 2006). Teachers must be able to demonstrate how to use the teaching aids as tools for better understanding and open doors for many students who struggle with abstract symbols.

Another critical component of the use of teaching aids is that the teacher must be able to build a connection between the mathematical concepts that is learned through the use of the teaching aids and the intended procedural knowledge. If teaching aids are utilized to bridge the two types of knowledge, then they can be an essential and enlightening component of the mathematics experience (Brown, 2007). Teaching aids should not be perceived as a means to quick fix or an exclusive method in solving mathematics problems; however they are to be used as building blocks to provide students with the conceptual understanding of mathematics content with the goal of enabling them to find their own efficient strategies for solving problems. Teaching aids are also for aiding teachers to impart knowledge to students with limited English-language skills as they can focus on an object and how it relates to the mathematical concept rather than interpreting the language even before getting to uncover the concept they are to learn (DeGeorge and Santoro, 2004). The use of teaching aids not only enhances the learning of average ability students, but also helps slow learners to develop their understanding without special modifications to the lesson for them. Teaching aids give the teachers and students a chance to work on teaching ideas, and slowly increase their abstract understanding, therefore scaffolding their learning (Moch, 2001). Working with teaching aids focuses the students' attention solely on the activity at hand, so the teacher needs to direct the students' attention to the big picture of the concept (Suh and Moyer, 2007).

Problem Statement

A teaching aid is a tool used by the teacher as a facilitator to the process of teaching and learning inside the classroom. It is one of the means by which teachers bring life into the theoretical texts by bringing environment inside the classroom indirectly. Also, it is a means of personification to the teaching texts in the students' books. The final purpose remains as a means of relating teaching with the environment that students live in and communicate with. Teaching aids are materials that the classroom teacher uses to help students understand the concepts she introduces during her lesson. These teaching aids can take numerous forms, from the beans students might count while learning simple math in kindergarten to the photos of famous people and places teachers might display during a history lesson. Teaching aids are instructional tools for learning abstract mathematical concepts, yet teachers tend to not use them due various explanations. They tend to hold various opinions about incorporating teaching aids in their teaching. There are conflicting views on the value of teaching aids for learning and transfer. Teachers face difficulties in deciding whether to present new knowledge in teaching terms (through teaching aids), when to present it in abstract terms, and when to combine these approaches. Knowledge of teachers' beliefs and teachers' teaching practices regarding the use of teaching aids

is not highly studied in literature. Normally teachers hold different perspectives about the use of teaching aids, on whether they impede or enhance lesson delivery. Such an unresolved situation continues to confuse teachers' decisions about incorporating teaching aids in their teaching. Therefore, this study seeks to investigate factors affecting mathematics teachers about the use of teaching aids to enhance learners understanding. It seeks to establish the views teachers hold about the use of teaching aids in facilitating mathematical knowledge. The views held by these teachers help to explain the presence or absence of teaching aids in mathematics classes.

Research Question

1. What are some of factors that are affecting mathematics teachers' use of teaching aids during mathematics instruction?
2. Do teacher variables, time and cost perspective, motivation and attitudes towards mathematics, learner qualities and the nature of teaching aids affect teachers' use of teaching aids during mathematics instruction?
3. Do teachers perceive the use of teaching aids during mathematics instruction more effective in improving mathematics achievement?

Objectives of the Study

The objectives of this study were:

- a) To examine factors that are affecting mathematics teachers' use of teaching aids during mathematics instruction?
- b) To investigate how teaching aids are being used in classroom, and teachers' perceptions of their effectiveness in enhancing the learning of mathematics.
- c) To gain a broad impression of the issues associated with teaching aids use from teachers' experiences.

Significance of the Study

The use of teaching aids has been proposed as worthwhile but teachers have different reasons for using or not using these tools during instruction. This study therefore sought to present possible reasons or explanations that teachers have for using or not using teaching aids in their classrooms.

Delimitation of the study

It would be more sounding if this study accommodates more secondary school teachers. However; so as the study is manageable the study is confined to only secondary schools in Jimma town.

Literature Review

Teaching is the process of attending to people's needs, experiences and feelings, and making specific interventions to help them learn particular things. Interventions commonly take the form of questioning, listening, giving information, explaining some phenomenon, demonstrating a skill or process, testing understanding and capacity, and facilitating learning activities (<http://infed.org/mobi/what-is-teaching>, March 7, 2017). Learning is at the heart of perception,

thinking, imagination, reasoning, judgments, attitudes personality traits, systems of value, and the development and organization of the activities that constitute personality of the individual. One of the characteristics that all of these processes have in common is that the individual is behaving in the light of his own past experience. These activities thus qualify as mental activities, or activities of the mind because they represent instances in which past experiences are used in the individual's behavioural adjustments to the world (Adepoju, 2002). Furthermore, it is explained that learning means an individual's developing a new knowledge, skill or attitude as a result of his/her interaction with his /her knowledge and environment. Learning may happen at any time. However what concerns the educators is the purposive learning realized through instructional efforts. The way we plan the instruction has an effect both on what has been learnt and on how an individual will use the things he/she has learnt. For this reason, teaching-learning process includes selection, arrangement transferring knowledge in a proper environment and interaction between this information and the individual. Learning environment means not only the place that instruction will occur but also the methods, instruments, equipment, and aids which will be used in transferring the knowledge and guiding the works of individuals in learning process

Definition

A teaching aid is a tool used by the teacher as a facilitator to the process of teaching and learning inside the classroom. It is one of the means by which teachers bring life into the theoretical texts by bringing situation inside the classroom indirectly. Also, it is a way of personification to the teaching texts in the students' books. The final purpose remains as a means of relating teaching with the environment that students live in and communicate with. "Teaching aids" is a generic term used to describe the resources teachers use to deliver instruction. Teaching aids can support student learning and increase student success. Ideally, the teaching aids will be tailored to the content in which they're being used, to the students in whose class they are being used, and the teacher. Teaching aids come in many shapes and sizes, but they all have in common the ability to support student learning (Duraković and Vidulin-Orbanić, 2011).

Importance of Teaching Aids

Teaching aids assist students in learning. These aids consist of video, audio and hands-on tools to help involve the students and enhance the learning experience. Teachers begin using visual, audio and hands on aids as early as preschool. Teaching aids can be as basic as a blackboard or whiteboard. Audio and visual equipment, such as DVD players and video projectors, are commonly used as tools for learning with a very effective output. Students tend to get more involved when learning if teaching aids are implemented into the curriculum. Hands on aids such as: computers, maps and other tools that require some sort of interaction from the students' have the highest levels of effectiveness. The tools are designed to involve the students, promote interaction, and promote faster learning and better comprehension. Being able to see, hear or get involved in a topic creates a much better method for learning. How a teacher chooses to use learning teaching aids in a classroom can vary dramatically. The main factor in the effective use of teaching aids is that a skilled teacher is behind the tools being used. By and large, teaching aids are important for motivation,

clarification, discouragement of cramming (teaching aids can facilitate the proper understanding to the students which discourage the act of cramming.) saves time and money as teaching through using teaching aids takes a shorter time than traditional teaching that depends on lecturing and more repetition from the side of the teacher. There will be no need to re-explain the lesson once more, as the learners have learnt the content through using all their senses and emotion. More over use of teaching aids keep classroom alive and active avoids boringness that is, it makes the lesson interesting and the learners more interested. Learners see the set-book text pictures and photographs speaking and acting.

Types of teaching aids: (Visual Aids, Audio Aids, Audio - Visual Aids)

Visual Teaching aids

The teaching aids which use sense of vision are called Visual teaching aids. For example :- actual objects, models, pictures, charts, maps, flash cards, flannel board, bulletin board, chalkboard, overhead projector, slides etc. Teaching Mathematics with visual teaching aids is really fun and interesting. Teachers use visual teaching aids to catch the attention of the pupils. Wise choice of instructional aids could maintain the alertness and interest of pupils during class hours. Pupils enjoy learning when they see real objects, pictures, and other forms of visual teaching aids. They can relate easily to the lesson with the use of these. They can easily respond to the lesson especially if they can manipulate the teaching aids used. Displaying the visual teaching aids and constantly seeing them can help the pupils master the skills. It is said that in Mathematics, real objects are the best visual teaching aids. There are so many skills in Mathematics that correlate with real objects. Using marbles, sticks and other aids in counting and in understanding the four fundamentals operations are some of these.

The use of different objects like balls, handkerchief, and other real objects help pupils recognize shapes and sizes. Determining the area can be best taught through farms, floor and ceiling. Slicing cakes, fruits and others help them relate with fractions. There are varieties of visual teaching aids in teaching Mathematics. They can choose and use different aids according to their creativeness. Teachers must be very careful in making and in presenting visual teaching aids. The aids should suit the teaching objectives and should carefully correlate with the techniques and methods that the teacher will use.

Here are some points to be considered in choosing and making visual teaching aids:

- Visual teaching aids must be big enough to be seen by everyone in the classroom. It should be seen even by the last pupil at the back.
- Visual teaching aids should clearly explain and transmit the concepts and ideas.
- Visual teaching aids should get everyone's attention.
- Visual teaching aids should be used according to the purpose it is intended for.
- Visual teaching aids must be communicative. It can transmit the ideas the teacher wants to convey.
- Visual teaching aids should be suited to the principles of teaching and learning.

The use of visual teaching aids in teaching mathematics plays a very significant ingredient in understanding the different skills. Just always remember that the effectiveness and the success of the visual teaching aids as a tool in teaching depend on how the teacher manipulate and use it.

Audio - Visual Teaching aids

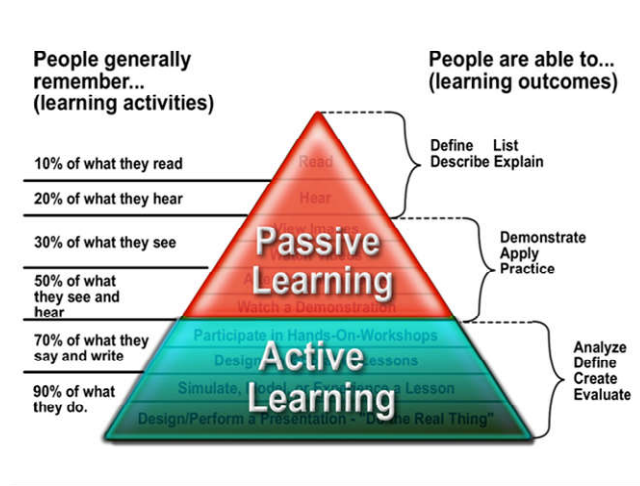
The teaching aids that involve the sense of hearing are called audio teaching aids. For example: radio, tape recorder, gramophone etc. Audio visual teaching aids are sensitive tools used in teaching and as avenues for learning. These are planned educational aids that appeal to the senses of the pupils and quicken learning facilities for clear understanding. The purposes of audio-visual are: to supplement and enrich teachers own teaching to make teaching-learning more appealing, to serve an instructional role in itself, to create interest among the group, and to make teaching as an effective process. Some of the advantages of using audio-visual teaching aids are: helps in effective perceptual and conceptual learning, helpful in capturing and sustaining attention of students, arouses interest and motivates students to learn, helpful in new learning, saving energy and time of both the teachers and students, provides near realistic experience and can meet individual demands. Audio-visual aids are only effective if they are appropriate to the situation and are used properly by the agent. Unsuitable aids or ones that are not used properly can at best distract and at worst mislead the audience. When selecting suitable audio-visual aids, the agent will be limited to what is readily available or can be made. Within that range, some aids are more suited to a particular objective than others. For example, if accurate detail is needed, a photograph, slides or a careful drawing may be more appropriate. If, on the other hand, the agent simply wants to highlight the structure of a talk or the main conclusions of a discussion, a blackboard or newsprint will be suitable. The agent should also consider where the aids will be used: indoors or outdoors, with or without electricity, at a large meeting or with a small group. All these factors will influence the choice of audio-visual aids. Proficiency in using audio-visual aids cannot be learned from a book; it comes only with practice.

In teaching, visual and audio aids have countless sound effects and significant in providing learning enduring. The more a learning activity addresses to the five senses the more the learning event becomes successful and enduring, and forgetting becomes less. owing to a research made in Texas University in the USA, when the time factor is taken stable, remembering was found out by percent as the following; Having human beings remember;

- 10 percent of they read
- 50 percent of they saw and heard
- 20 percent of they heard
- 70 percent of they said
- 30 percent of they saw
- 90 percent of they did and said

Figure that is addressed under has vividly explained the impact of using teaching materials on students learning and retention. It seems important that teacher she/he could arrange different teaching materials in order to make students remember their language they learned in foreign language teaching. Therefore, a good origin language teacher has to prepare the visual and audio materials she/he will use while she/he is preparing

his/her lesson plan. Also she/he has to know how and when she/he will use those materials, because the more she/he uses visual and audio materials during the course, the better students concentrate on the lesson. When we speak of/on evaluating or adapting teaching materials, we may be thinking of publishing a textbook, an exercise found in the book, or a classroom activity recommended by it.



Source: https://www.youtube.com/watch?v=p_85cnTM8pI 3/4/2017 4:18:05 PM

Figure 1. Dale's Cone of Experience

The most important consideration is that the materials should meet our students' needs as Cunnings worth puts it: "Students particularly more sophisticated adults and teenagers need to feel that the materials from which they are learning have to be connected with the real world and at the same time they must be related positively to the aspects of their inner make up such as age, level of education, social attitudes, the intellectual ability and level of emotional maturity." (Cunnings worth, 1984) Julia Dobson lists visual and audio aids as the followings:

Visual Aids: Blackboard, Bulletin Boards, Flannel Boards, Magne Boards, Realia, Pictures, Charts, Flash Charts, Maps, Calendars, Cartoon, Clocks, Sliders, Filmstrips. Audio Aids:

Radio, Phonograph, Records, Tapes. (Dibson Julia, 1988) The Purposes of Using Visual and Audio Materials

- Materials Provide economy in time and speech
- Materials simplify the course
- Make the course vivid and clear
- Materials increase students' interest and motivation
- Materials help to explain
- complex explanation easily
- Materials create desire of learning
- Materials make abstract concepts concrete
- Materials enrich the course
- Materials provide the chance for practicing on subjects. (Küçükahmet, 1995)

Audio - Visual Aids

The aids which involve the sense of vision as well as hearing are called Audio- Visual aids. For example: - television, film projector, film strips etc.

Research Methodology

The objective of this study was to investigate factors affecting mathematics teachers' use of teaching aids in facilitating learning mathematics.

Research Design

In this study descriptive survey design was employed and a quantitative research method was predominantly used to analyze the result.

Research Population and Sampling Techniques

Mathematics teachers from the selected secondary schools in Jimma town participated in this study. The sampling frame was obtained from the teachers record in each school included in the study. A sample of 40 mathematics teachers participated in the study. Census sampling technique was used to determine the sample to participate in the study. A census study occurs if the entire population is very small or it is reasonable to include the entire population. The researchers utilized this sampling technique as the best among other sampling techniques since the study was targeting secondary school mathematics teachers.

Instruments

Five-item Likert scale self-administered structured questionnaire (that is adopted from Kamla-Raj, 2014) was used to solicit data for the study. The first part of the questionnaire tapped data related to demographic and occupational variables. This data was tapped with a view to obtaining a clear understanding of the participants for the study. The other five parts of the questionnaire were used to address factors affecting mathematics teachers the use of teaching aids in facilitating learning mathematics. Interview was also carried out with two school principals and five mathematics secondary school teachers.

Data Analysis

Depending on the number of groups involved and the type of measurement used to measure the dependent variable (Nachmias, 1987), the following statistical techniques were used in this study. Percentage was used to address the demographic characteristics of the respondents and to show the disparity in responses among different groups of respondents. Percentage was also used to indicate students' participation in teacher education programme. A two tail one-sample t-test was employed to check whether there are statistically significant mean differences among the respondents responses on different factors contributing to high female retention rate in the tertiary education of Ethiopia and on the expected mean value for each factor. In all cases, the observed differences were tested for statistically significant at α 0.05 level since this level is conventionally used in social science research.

Ethical Consideration

Permission was sought and granted by the school principals of the selected secondary schools in Jimma town. Informed-consent protocols were sought with the participants. The researchers informed participants about the purpose of the research, expected duration and procedures. Participants' rights

to decline to participate and to withdraw from the research were respected.

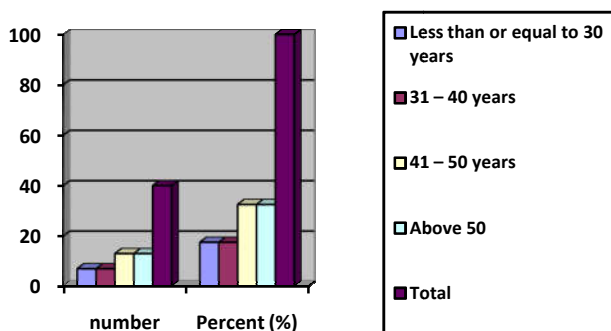
Data Interpretation and Analysis

A follow up of the questionnaires showed a good response rate from the research participants. At the end of the data collection phase, the total number of the completed questionnaires was 40. Given that the sample size of the study was 40, this represented a response rate of 100%. This was considered sufficient enough to continue with the analysis of the data as eluded by Fleiss *et al.* (2013) who posit that a response rate

Demographic variables: Gender, age and teaching experience

Table 1. Age and sex of the respondents

Age:		Number	Percent (%)
Less than or equal to 30 years		7	17.5
31 – 40 years		7	17.5
41 – 50 years		13	33
Above 50		13	33
Total		40	100
Sex:		Number	Percent (%)
Male		30	75
Female		10	25
Total		40	100



As can be seen from the above table some respondents' age that accounted for 7(17.5%) range from 31- 40 years, 13 (33%) that range from 41-50 years and, followed by 13 (33%) above 50 years. The figure following also table 1 clearly noted the age of the respondents. The data from table 1 also addressed that most of the respondents 30 (75%) are male and only 10 (25%) them are female teachers.

Table 2. Educational Qualification

Educational Qualifications:	Number	Percent (%)
Diploma	0	0
BSc/BA (First degree)	36	90
MSc/MA (Masters)	4	10
Above masters	0	0
Total	40	100

Qualification wise majority of the respondents who accounted for 36(90%) are BSc/BA (First degree) holders and only 4(10%) of the respondents are with MSc/MA (Masters).

Table 3. Mean result of Perspectives on Teacher Variables

One-Sample Statistics				
Perspectives on Teacher Variables	N	Mean	Std. Deviation	Std. Error Mean
	34	3.8794	.38595	.06619

<3 = Less impact; >3 = High impact

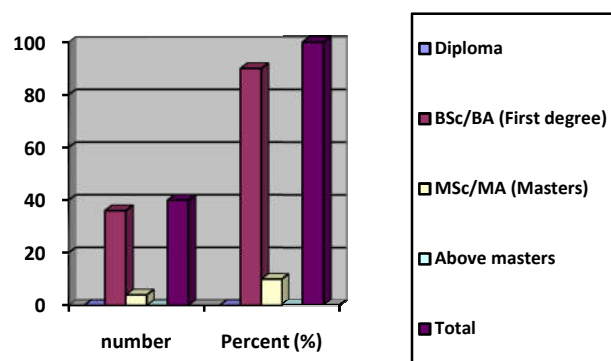


Figure 2. Educational Qualification

As can be seen inTable.3, the mean result of *perspectives on teacher variables* indicated that *teacher variables* do have high impact on the teachers' choice and use of teaching aids to facilitate students learning. Among the perspectives on teacher variables, variables such as: teachers' experience and expertise determines the use of teaching aids, teaching aid help teachers and students to bridge the gap that divides how mathematics is taught and how mathematics is learned, teaching aids allow the teacher and pupils to break away from the traditional classroom setting and instructional style, teachers using teaching aid in their classrooms need to possess a deep conceptual understanding and have the ability to pass that along to their students, and teachers must be able to build the a connection between the mathematical concepts and the procedural knowledge that the teaching aids are supposed to support noted with more impact. On the other hand, it has also seen that teachers reluctant to use teaching aids, teachers lack of adequate user guides to use teaching aids, teachers limited choice and variation of teaching aids use, teachers who are not comfortable with the use of manipulative aids are likely to decrease the effectiveness of instruction, classroom management and student achievement, and teachers who are not comfortable with the use of teaching aids are likely to experience classroom management problems as noted by the mean are a problem in selecting and using teaching to facilitate students learning. The interview result made with some of the school teachers and school directors has also confirmed that teachers' expertise and experience determine the choice and use of teaching aids to facilitate students learning. According to the result of the interview, there is variation on the use of teaching aid to facilitate students learning among the experienced teachers in secondary schools. Most of the newly employed teachers do not dare to use instructional aids.

Table 4. One-Sample Test of Perspectives on Teacher Variables

One-Sample Test						
Perspectives on Teacher Variables	Test Value = 3	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
		13.286	33	.000	.87941	Lower: .7447, Upper: 1.0141

A two-tail one sample t-test at .05 alpha levels was also conducted to check whether the teacher variables have significant impact and the expected mean (3). As the test indicated, teacher variables were found to be statistically significant impact on mathematics teacher's choice and use of teaching aids to facilitate students learning.

Table 5. Mean result of Time and Cost Perspective

One-Sample Statistics				
Time and Cost Perspective	N	Mean	Std. Deviation	Std. Error Mean
	31	3.2903	.79135	.14213

<3 = Less impact; >3 = High impact

As can be noted from Table 5, regarding time and cost perspective, the mean result for statements specified as time allocated for instruction (teaching/learning) is too short to include teaching aids, time to test the effectiveness of teaching aids use is limited, issue of cost or availability of teaching aids determines their presence in the class and activities involving teaching aids require more time that could be better utilized with other instructional approaches are confirmed as a problem by the respondents. In line with time and cost perspective the interview result carried with the school teachers, school pedagogical head, and the school directors noted that time is not impending factor the production and use of teaching aids. However, there is instance in which cost may be n as impending factors in case materials couldn't be produced from locally available resources.

Table 6. One-Sample Test Time and Cost Perspective

One-Sample Test						
Time and Cost Perspective	Test Value = 3		Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	t	df			Lower	Upper
	2.043	30			.050	.29032

A two-tail one sample t-test at .05 alpha levels was also conducted to check whether the time and cost perspective have significant impact at the expected mean (3). As the test indicated, time and cost perspective were not found to have statistically significant impact on mathematics teacher's choice and use of teaching aids to facilitate students learning. As noted by the response of the interviewed school respondents as there is an opportunity to use students to take part in the production of teaching aids such variable is not statistically significant as impending factors.

Table 7. Mean result of Motivation and Attitudes Towards Mathematics

One-Sample Statistics				
Motivation and Attitudes Towards Mathematics	N	Mean	Std. Deviation	Std. Error Mean
	37	4.1734	.64111	.10540

<3 = Less impact; >3 = High impact

As can be seen from Table 7, above, mean result on *motivation and attitudes towards mathematics* the use of teaching aid do have high impact in motivating and promoting students' attitudes towards mathematics learning. However, lack school pedagogical center may affect teachers to produce and use teaching aids. The actual observations made to the school pedagogical school center during the study have also noted schools do have remarkable problems with their pedagogical centers. Some schools do have no functional pedagogical centers others do have nominal pedagogical centers. Regarding the role of teaching aids to motivate students learning towards mathematics the interview response result noted that the use of

teaching aid really has tremendous role in promoting students learning. As one of the interview respondents said "use of teaching aid give live to teaching learning process". Hence, teacher is required to use teaching aids to facilitate their students learning. In fact, school pedagogical seen equipped with material to facilitate geometry contents. There are no materials to facilitate contents such as trigonometry, logarithmic functions etc. In general, the interviews held with the school principals and with that of the teacher also clearly noted that they do not have well established school pedagogical centers and they agree with the ideas mentioned above.

Table 8. One-Sample Test of Motivation and Attitudes towards Mathematics

One-Sample Test						
Motivation and Attitudes Towards Mathematics	Test Value = 3		Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	t	df			Lower	Upper
	11.133	36			.000	1.17342

<3 = Less impact; >3 = High impact

A two-tail one sample t-test at .05 alpha levels was also conducted to check whether *motivation and attitudes towards mathematics* have significant impact and the expected mean (3). As the test indicated, *motivation and attitudes towards mathematics* were found to be statistically significant impact on mathematics teacher's choice and use of teaching aids to facilitate students learning.

Table 9. One-Sample Test of Learner qualities

One-Sample Statistics				
Learner Qualities	N	Mean	Std. Deviation	Std. Error Mean
	36	3.6944	.55456	.09243

In line with learners qualities as can be seen from the mean result that is addressed in Table 9, it has clearly shown that, learners' prior knowledge affects their understanding of mathematics via the use of teaching aids, learners failure to identify the mathematical concept being learned with the teaching aids used, students treatment teaching aids as representations instead of symbols for mathematical concepts and teaching aids need to be introduced and used properly in order for them to work impact on mathematics teacher's choice and use of teaching aids to facilitate students learning. Regarding the learner qualities the interview response result noted that the use of teaching aid really has tremendous role in promoting students learning which is different from the result of inferential statistics. According to the interview result there are no learners with problem of being affected with use of teaching aids. That is secondary schools are qualified to be facilitated and understand with the use of teaching aids.

Table 10. One-Sample Test of Learner qualities

One-Sample Test						
Learner Qualities	Test Value = 3		Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	t	df			Lower	Upper
	7.513	35			.000	.69444

A two-tail one sample t-test at .05 alpha levels was also conducted to check whether learner qualities have significant impact and the expected mean (3). As the test indicated, learner qualities was found to be statistically significant impact on mathematics teacher's choice and use of teaching aids to facilitate students learning.

Table 11. Mean result of the Nature of Teaching aids

One-Sample Statistics				
The Nature of Teaching aids	N	Mean	Std. Deviation	Std. Error Mean
	35	3.4698	.56404	.09534

<3 = Less impact; >3 = High impact

As can be seen from Table-11, the mean result on the nature of teaching aids confirmed that, learners' prior knowledge affects their understanding of mathematics via the use of teaching aids, learners sometimes fail to identify the mathematical concept being learned with the teaching aids used, students sometimes treat teaching aids as representations instead of symbols for mathematical concepts, teaching aids need to be introduced and used properly in order for them to work, learners sometimes fail to identify the mathematical concept being learned with the teaching aids used, and teaching aids need to be introduced and used properly in order for them to work.

Table 12. One-Sample Test; the Nature of teaching aids

One-Sample Test						
The Nature of Teaching aids	Test Value = 3		Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	t	df			Lower	Upper
	4.928	34	.000	.46984	.2761	.6636

A two-tail one sample t-test at .05 alpha levels was also conducted to check whether the nature of teaching aids has significant impact and the expected mean (3). As the test indicated, the nature of teaching aids was found to be statistically significant impact on mathematics teacher's choice and use of teaching aids to facilitate students learning.

Summery, Conclusion and Recommendation

Summary

- Majority of teachers have noted that the use of teaching aids is certainly related with enhanced accomplishment and better attitudes towards mathematics.
- Responses to items regarding teachers prospective noted an overall consent that teacher experience and expertise determines their use of teaching aids as teaching and learning aids.
- Teachers' confirmed that the use of teaching aids can produce meaningful understanding and increase student concept development.
- Teachers recognized that the use of teaching aids enable students and teachers to represent teaching the abstract concepts that they are learning in mathematics class and to link these concepts to prior knowledge.
- The use of teaching during instruction has a positive influence towards shaping students' attitudes toward mathematics.

- In terms of time and cost, respondents confirmed that cost or availability of teaching aids determines their presence in the class. However, the t-test result addressed that the impact of time and cost is not significant.
- Respondents strongly agreed that activities involving teaching aids require more time that could be better utilized with other instructional approaches.
- Preparation time was also pointed out as limiting factor while instructional time was too short to accommodate the use of teaching aids and limited time and cost as impediments to the use of teaching aids.
- Regarding motivation and developing positive attitudes towards mathematics respondents reported that the use of teaching aids in teaching mathematics enhances students to work cooperatively in solving problems, discuss mathematical ideas and concepts.
- As far as the learner qualities findings revealed those learners' prior knowledge affects their understanding of mathematics via the use of teaching aids.
- Concerning of pedagogical point of view participants agreed that the use of teaching aids is potentially confusing to the learners if their presentation is haphazard and disorganized.
- Teachers are expected to present knowledge reasonably and endow with strong links between the concept and its actual world representation.
- The study also revealed that teachers perceive the use of teaching aids enhances student retention and understanding of mathematical concepts.

Conclusion

Perspectives on teacher Variables such as teachers experience and expertise, reluctant to use teaching aids, lack of adequate user guides to use teaching aids and limited choice and variation of teaching aids use, role of teaching aid bridge that divides how mathematics is taught and how mathematics is learned, role of teaching aids in allowing the teacher and pupils to break away from the traditional classroom setting and instructional style etc. has seen with due impact to either facilitate or to deter students learning. Time and cost perspective wise it has seen that limited time for preparation of and use of teaching aids and issue of cost or availability of teaching aids determines their presence in the class do not have due impact on facilitating students learning. In fact as to the interview result there is instance in which cost perspective may be seen as impending factor. Regarding the function of teaching aids in motivation and in raising students' attitude towards mathematics the study result indicated that the role of teaching aids in motivating learners towards mathematics is high. By and large response of majority respondents has shown that, the use of teaching aids in teaching mathematics can really help students learn to relate real world situations to mathematics symbolism, the use of teaching aids in teaching mathematics help students to work attentively in solving problems, discuss mathematical ideas and concepts, the use of teaching aids makes students retain the knowledge better and the use of teaching aids leads to improved attitudes towards mathematics. However, lack of school pedagogical center and lack of knowledge, skills and values of producing and using teaching aids from locally available resources may affect teachers to produce and use teaching aids. It has also seen that learner qualities such as learners' prior knowledge affects

students understanding of mathematics via the use of teaching aids failure of learners to identify the mathematical concept being learned with the teaching aids used found as a problem. Furthermore, the nature of teaching aids un planned use of teaching aids, lack of appropriate guidance and instruction from the teacher, the impact of class size to use teaching aids, impact of teaching aids to address abstract ideas etc have been agreed by most of the respondents. In general, the study has shown that perspectives on teacher variables, time and cost perspective, the impact of lack teaching aids on students' motivation and attitudes towards mathematics, problems emanated from learner qualities and the nature of teaching aids and their contribution in retention and understanding of mathematical concepts do have potential influences on students learning.

Recommendation

The major objective of this study was to undertake an investigation into the level of influences of perspectives on teacher variables, time and cost perspective, motivation and attitudes towards mathematics, learner qualities and the nature of teaching aids on teachers' selection and use of teaching aids. As noted in the above the impact of the mentioned factors on the teacher selection and use of teaching aids to facilitate students learning is high.

Hence, based on the findings the following recommendations have suggested.

- It has seen that teacher's experience and expertise determines the use of teaching aids hence experienced teachers are expected to share the experiences and expertise so that novice teachers could use instructional aides to facilitate their students learning.
- Majority of the respondents confirmed that teachers are reluctant to use teaching aids. Hence, there is a need of organizing awareness raising work shop on the use of instructional materials to facilitate students learning.
- The study result indicated that there is lack of adequate user guides to use teaching aids. Hence, it would be good if user guide on the use of teaching aid and on the importance of using teaching aid is produced by expertise in the area and provided to the schools.
- It has also seen that teachers have limited choice and variation of teaching aids use. Such problems seem emanated as far as teacher geared to use teaching aids which are products of manufacturing. To solve such problems it is better to provide training for secondary school teachers on how to produce teaching aid from locally available resources(TALULAR) which involves, human resources, animal resources, plants resources, material resources and non-material resources
- During the study time it has also seen that there are non-functional school pedagogical centers which directly affect teachers production and use of teaching aids to facilitate their students learning. Hence, such condition required to be improved by providing awareness raising short term training in cooperation with university instructors from the teacher education department on the role of teaching aids in facilitating students learning and on the role of school pedagogical centers as a place for production of instructional aid that facilitate students learning.
- Time allocated for instruction (teaching/learning) is too

short to use teaching aids seen as problem. Regarding such phenomena, teachers need to get training on how rather the use of teaching aids can easily facilitate and save their time of instruction.

- How the issue of cost or availability of teaching aids determines the presence and use of teaching in the class is also noted as a problem by most of the respondents. To overcome or reduce such issues of cost, awareness on how to produce teaching aid from locally available resources (TALULAR). Teacher should not always wait/ look for industrially produced teaching material unless and otherwise it is necessity to do so. So far the study result indicated that the use of teaching aids in teaching mathematics will help students learn to relate real world situations to mathematics symbolism, to work cooperatively in solving problems and leads to increased student mathematics performance and to improved attitudes towards mathematics.
- It has also observed that learners' prior knowledge affects their understanding of mathematics via the use of teaching aids. Hence, teachers need to be wise on how to exploit teaching aids and facilitate their students learning.
- From a pedagogical point of view the study result has also assured how the use of teaching aids is potentially confusing to the learners if their presentation is haphazard and disorganized. Thus teachers are expected to be well organized and use instructional aide in a way it facilitates their students learning.
- The surrounding higher institution such as in case of the secondary schools of Jimma town Jimma University specifically College of Education and Behavioral Sciences need to collaboratively work on raising secondary school teachers' awareness on the importance of using teaching aids to facilitate students learning.

REFERENCES

- Adepoju A.A. 2002. Motivation and learning. In Okoli C.E Ed Reading in Psychology of Learning. (A Simplified Approach) Lagos Gods Glory Publishing House
- Alderman MK 2013. Motivation for Achievement: Possibilities for Teaching and Learning. New York: Rout ledge.
- Allen C 2007. An action based research study on how using manipulative will increase students' achievement in mathematics. Retrieved from <[http:// files.eric.ed.gov/full text/ED499956.pdf](http://files.eric.ed.gov/fulltext/ED499956.pdf)> (Retrieved on 26 April 2014).
- Bobis J. 2002. Is school ready for my child? Australian Primary Mathematics Classroom, 7(4): 4.
- Boggan M, Harper S, White mire A. 2010. Using manipulative to teach elementary mathematics. Journal of Instructional Pedagogies, 3(1): 1-6.
- Borgen K 2006.From Mathematics Learner to Mathematics Teacher: Pre-service Teachers' Growth of Understanding of Teaching and Learning Mathematics. Doctoral Dissertation, Unpublished. Vancouver: University of British Columbia, BC.
- Brown SE. 2007. Counting blocks or keyboards? A comparative analysis of concrete versus virtual manipulative in elementary school mathematics concepts. ERIC Documentation Reproduction Service No. ED 499 231.

- Bruner JS 1973. *Beyond the Information Given: Studies in the Psychology of Knowing*. New York: WWN Orton & Company, Inc.
- Byers, A. 2002. *What is TALULAR?* Domasi: Malawi Institute of Education
- Cross CJ 2008. *The Effect of Mathematical Manipulative Materials on Third Grade Students' Participation, Engagement, and Academic Performance*. Florida: University of Central Florida.
- DeGeorge B, Santoro AM 2004. *Manipulative: A hands-on approach to math*. *Principal*, 84(2): 28-28.
- Department for Education and Skills, 2004. *Pedagogy and Practice: Teaching and Learning in the Secondary School, Unit 8 Explaining*. London: Department for Education and Skills. [http://webarchive.nationalarchives.gov.uk/20110809101133/http://nsonline.org.uk/node/96982?uc=force_uj. Retrieved: March 7, 2017].
- Dibson Julia, M. 1988. "Effective Teaching for English Conversation Groups", Washington D.C., 20547, P.: 67
- Dunlosky J 2013. *Strengthening the student toolbox: Study strategies to boost learning*. *American Educator*, 37(3): 12-21.
- Duraković, L. and Vidulin-Orbanić, S. 2011. Media in teaching: pedagogical-musicological aspects. In *Glazbenastava i nastavnatehnologija: mogućnosti i ograničenja/Music teaching and educational technology: opportunities and restrictions*. Sveučilište Jurja Dobrile u Puli, *Odjel zaglavbu*, 85-104.
- Ferguson S. and McDonough A 2010. *The Impact of Two Teachers' Use of Specific Scaffolding Practices on Low-Attaining Upper Primary Students*. Melbourne: Mathematics Education Research Group of Australasia.
- Fleiss JL, Levin B, Paik MC. 2013. *Statistical Methods for Rates and Proportions*. New York: John Wiley and Sons.
- Fraser DW 2013. *5 Tips for creating independent activities aligned with the common core state standards*. *Teaching Exceptional Children*, 45(6): 6-15.
- Furner JM, Yahya N, Duffy ML 2005. *Teach mathematics: Strategies to reach all students*. *Intervention in School and Clinic*, 41(1): 16-23.
- Goldstone RL, Son JY 2005. *The transfer of scientific principles using concrete and idealized simulations*. *The Journal of the Learning Sciences*, 14(1): 69-110.
- Goonen B, Pittman Shelter S 2012. *The struggling math student: From mindless manipulation of numbers to mastery of mathematical concepts and principles*. *Focus on Basics*, 4(5): 24-27.
- Green M, Piel JA, Flowers C 2008. *Reversing education majors' arithmetic misconceptions with short term instruction using manipulative*. *Journal of Educational Research*, 101(5): 318-318.
- Hattie J 2013. *Visible Learning: A Synthesis of over 800 Meta-analyses relating to Achievement*. New York: Routledge.
- Heddens JW 1986. *Bridging the gap between the concrete and the abstract*. *Arithmetic Teacher*, 33(6): 14-17.
- Hounsell D 2009. *Evaluating courses and teaching*. In: H Fry, S Ketteridge, S Marshall (Eds.): *A Handbook for Teaching and Learning in Higher Education. Enhancing Academic Practice*. New York: Routledge, pp.198-212. https://www.youtube.com/watch?v=p_85cnTM8pI3/4/20174:18:05PM
- Kamii C, Lewis BA, Kirkland L 2001. *Manipulatives: When are they useful?* *The Journal of Mathematical Behavior*, 20(1): 21-31.
- Kamla-Raj, 2014. *Developing and Assessing a Tool to Measure the Creativity of University Students*
- Kelly CA 2006. *Using manipulative in mathematical problem solving: A performance-based analysis*. *The Montana Council of Teachers of Mathematics*, 13 (2): 184-193.
- Kerekes J 2006. *The role of simple own constructed manipulative in improving student participation, understanding and mathematical effectiveness*. *Mathematics in School*, 11-14.
- Kerr A 2011. *The Power of Manipulative*. The Blog, November 7, P. 8.
- Kosko KW, Wilkins JL 2010. *Mathematical communication and its relation to the frequency of manipulative use*. *International Electronic Journal of Mathematics Education*, 5(2): 79-90.
- Küçükahmet Leyla, 1995. "Öğretim İlke ve Yöntemleri", 7th edition, Gazi Büro Kitabevi, Ankara, P.: 91-93.
- Lee SJ 2014. *Early childhood teachers' misconceptions about mathematics education for young children in the United States*. *Early Education and Development*, 18(1): 111-143.
- Lett SW 2007. *Using Manipulative Materials to Increase Student Achievement in Mathematics' Research*. Washington, DC: Education Resource Information Centre.
- Lippmann PC 2010. *Can the Physical Environment have an Impact on the Learning Environment?* New York: JCI Architecture.
- Lira J. and Ezeife AN 2008. *Strengthening Intermediate-Level Mathematics Teaching Using Manipulative: A Theory-Backed Discourse*. *Academic Exchange Extra. Ontario: Academic Exchange - EXTRA*.
- Martin T, Svihla V, Smith CP 2012. *The role of physical action in fraction learning*. *Journal of Education and Human Development*, 5(1): 1-17.
- Maslen H, Douglas T, Kadosh RC, Levy N, Savulescu J 2014. *The regulation of cognitive enhancement devices: Extending the medical model*. *Journal of Law and the Biosciences*, 1(1): 68-93.
- McNeil N, Jarvin L 2007. *When theories don't add up: Disentangling the manipulative debate*. *Theory into Practice*, 46(4): 309-316.
- Merriam SB, Brockett RG 2011. *The Profession and Practice of Adult Education: An Introduction*. New York: John Wiley and Sons.
- Milgram RJ, Wu HS 2008. *The Key Topics in a Successful Math Curriculum*. From <http://math.berke-ley.edu>. (Retrieved on 14 May 2014).
- Moch P 2001. *Manipulatives work!* *The Educational Forum*, 66(1): 81-87.
- Morris J 2013. *The use of virtual manipulative in fourth grade to improve mathematic performance*. *Journal of Educational Psychology*, 105(2): 380.
- Moyer PS 2001. *Are we having fun yet? How teachers use manipulative to teach mathematics*. *Educational Studies in Mathematics*, 47(2): 175-197.
- Mutodi P, Ngirande H 2014. *The nature of misconceptions and cognitive obstacles faced by secondary school mathematics students in understanding probability: A case study of selected Polo wane Secondary Schools*. *Mediterranean Journal of Social Sciences*, 5(8): 446-455.
- Nur MA 2013. *Factors that Influence Secondary School Students' Performance in Mathematics in Banadir Region, Somalia*. Department of Educational Communication and Technology. Nairobi: Kenyatta University.
- Ormrod JE 2014. *Essentials of Educational Psychology: Big Ideas to Guide Effective Teaching*. New Jersey: Pearson Higher Education.

- Perry B, Wong NY, Howard P 2006. Comparing primary and secondary mathematics teachers' beliefs about mathematics, mathematics learning and mathematics teaching in Hong Kong and
- Piaget J 1952. *The Origins of Intelligence*. 2nd Edition. New York: International Press.
- Ross CJ 2008. *The Effect of Mathematical Manipulative Materials on Third Grade Students' Participation, Engagement, and Academic Performance*. Doctoral Dissertation. Florida: University of Central Florida.
- Steadly K, Kyrie Drago M, Arafah S, Luke SD 2008. Effective mathematics instruction. *Evidence for Education*, 3(1): 1-12.
- Strom J 2009. *Manipulatives in Mathematics Instruction*. Master's Thesis, Unpublished. Bemidji, MN: Bemidji State University.
- Suh J, Moyer PS 2007. Developing students' representational fluency using virtual and physical algebra balances. *Journal of Computers in Mathematics and Science Teaching*, 26(2): 155-173.
- Thoron AC, Sarah E, Burleson SE 2014. Students' perceptions of agri- science when taught through inquiry based instruction. *Journal of Agricultural Education*, 55(1): 66-75.
- Tongco MDC 2007. Purposive sampling as a tool for informant selection. *Journal of Ethno pharmacology*, 114(3): 325-354.
- Trespalacios JH 2008. *The Effects of Two Generative Activities on Learner Comprehension of Part- Whole Meaning of Rational Numbers Using Virtual Manipulative*. Doctoral Dissertation. Blacksburg: Virginia Polytechnic Institute and State University.
- Uribe Flórez LJ, Wilkins JL 2010. Elementary school teachers' manipulative use. *School Science and Mathematics*, 110(7): 363-371.
- Vinson BM 2001. A comparison of persevere teachers' mathematics anxiety before and after a methods class emphasizing manipulative. *Early Child-hood Education Journal*, 29(2): 89-94.
- Wenglinsky H 2003. Using large-scale research to gauge the impact of instructional practices on student reading comprehension: An exploratory study. *Education Policy Analysis Archives*, 11(19): 1-19. ir students. The data in Table 3 indicates con-
