



RESEARCH ARTICLE

EFFECTIVENESS OF FORMATIVE ASSESSMENT TECHNIQUES USED BY HIGH SCHOOL MATHEMATICS TEACHERS IN JIMMA AT CBTP AND PRACTICUM ZONE SITES

\*Ademe Kebede, Abere Tegegn and Keno Awol

Department of Mathematics, Jimma University, P.o.Box 378, Ethiopia

ARTICLE INFO

Article History:

Received 27<sup>th</sup> May, 2016  
Received in revised form  
10<sup>th</sup> June, 2016  
Accepted 27<sup>th</sup> July, 2016  
Published online 31<sup>st</sup> August, 2016

Key words:

Formative assessment,  
Formative assessment techniques,  
Academic achievements in mathematics.

ABSTRACT

This study was conducted to examine the effectiveness of formative assessment techniques used by high school mathematics teachers in Jimma at CBTP and practicum zone sites. Specifically, the study sought to gain an understanding of the extent to which the teachers use different assessment techniques and to support both the learning and teaching process in mathematics. Questionnaire was the main data gathering instrument for this study. Thus, all mathematics teachers' 94 were included in the sample by using availability sampling technique since they are few in number and 253 students were selected by systematic random sampling technique to fill in questionnaire. Class room observation and interview was also conducted to enrich the quantitative data. The data gathered through interview and class room observation was discussed in line with questionnaire. As a result, the main findings come out from this study were: teachers' perception of formative assessment and its connectedness with students learning and achievement in mathematics is insufficient; assessment for learning techniques help to encourage the necessary classroom environment for effective learning is not good enough. Finally, to minimize and if possible to solve the problems, the following recommendations were drawn; teacher and school administrator assessment literacy was a prerequisite for successful formative assessment implementation and hence Zone Education Departments and the regions in collaboration with schools should give training for the teachers and school administrator, all the zones can take the following tangible steps now to begin to implement research-based formative assessment strategies in their schools and districts that can yield positive results.

Copyright©2016, Ademe Kebede et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Ademe Kebede, Abere Tegegn and Keno Awol, 2016. "Effectiveness of formative assessment techniques used by high school mathematics teachers in Jimma at CBTP and practicum zone sites", *International Journal of Current Research*, 8, (08), 36968-36978.

INTRODUCTION

Mathematics education researchers have emphasized equipping teachers with knowledge and skills associated with formative assessments of students' mathematical understanding (Carpenter, Fennema, & Franke, 1996; National Research Council, 2001). Research also indicates that student achievement significantly increases when teachers use formative assessments appropriately (Black & Wiliam, 1998). As a result, there has been a great focus on developing teachers' knowledge and skills on formative assessment (Thames & Ball, 2010). Black and William (1998) posit that appropriate use of formative assessment is an essential component for learning. While formative assessment has become identified as a critical part of the practice of teaching, very few teachers utilize it in constructive ways (Huinker & Freckmann, 2009; Wiliam, 2007). Mathematics teaching

assumes that students do not arrive at sessions as 'blank slates', but as actively thinking people with a wide variety of skills and conceptions. Research shows that teaching is more effective when it assesses and uses prior learning so that the teaching may be adapted to the needs of students (Black & William, 1998). Prior learning may be uncovered through any activity that offers students opportunities to express their understanding and reasoning. It does not require more testing. For example, it can take the form of a single written question given at the beginning of a session to elicit a range of explanations that may then be discussed. This process, often referred to as formative assessment, may be defined as:

"... all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. Such assessment becomes 'formative assessment' when the evidence is actually used to adapt the teaching work to meet the needs." (Black & William, 1998)

\*Corresponding author: Ademe Kebede,  
Department of Mathematics, Jimma University, P.o. Box 378,  
Ethiopia.

Effective assessment begins with clear goals. It usually takes some hard thinking before teachers can articulate the specific skills and competencies they hope to teach and what students should really learn. Class room assessment Techniques give faculty feedback on how they are achieving their teaching goals. Black & William, 1998 pp.8 – 9 Stiggins recommend a list of actions to teachers, who want to use the assessment to advance student learning. These actions include: explaining achievement targets to students, educating themselves on accurate uses of assessment and on using it to strengthen students' confidence as learners, translating assessment in frequent feedback, adjusting instruction based on assessment ,engaging students in self-assessment and teaching students to communicate with them and with family members regarding their learning progress 2002 . Rich questioning refers to questioning technique that requires students to analyze problem, instead of just guessing an answer which teacher will like. Mathematical problems that confuse students are usually avoided by teachers. However, ''tricky' 'questions are available part of rich questioning because they provoke deep thinking ,and help teachers in assessing their pupils' true understanding of Math. Other techniques of rich questioning include: allowing for long conversions to grow from one students' question, giving ample time for students to think about a question, asking students to come up with questions, and framing questions as statements to provoke discussions. Feedback given to students can take different forms. Based on clear research, William suggests letting student know what they need to do improve, instead of praising them or computing to others, and design feedback so it instills in students belief that they can improve their mathematical skills with practice. He also insists that students have an important role in assessment for learning .Thus, sharing assessment criteria with students and letting them monitor their own progress is essential.

### Statement of the problem

Implementation of class room assessment techniques tells the students why you are asking them for information .i.e. you will be assessing their learning in order to help improve and not to grade them; usually ask for anonymous responses; teach them how to do the assessment before applying it; let them know what you learned and what difference that information will make ,i.e. how will change your teaching/the class to respond to the information they provide, so they know that information they provided ,so they know that their participation in the class room assessment can have a positive impact on your teaching and their learning (Black & William , 1998, pp. 29-30)

So, here are some aspects connected to assessment that I would like to investigate in the process of my research:

1. What instrument do Mathematics teachers use at Jimma CBTP and Practicum zone sites Secondary schools to assess their student's knowledge in mathematics (comments, grade, praise, and credit, etc.)?
2. What professional development materials will be required to disseminate principles for improving formative assessment across a wide range of schools?
3. What kinds of assessment methods and tools do mathematics teachers use to assess their students?

### Definition of Terms

1. **Black slate** is Undeveloped, free of information or associations; the idea that all knowledge is learned, that you're born knowing nothing.
2. **Classroom Assessment Techniques** are formative evaluation methods that serve two purposes. They can help you to assess the degree to which your students understand the course content and they can provide you with information about the effectiveness of your teaching methods.

### Methodology

#### Research Design

In this study, since both quantitative and qualitative research designs were employed to investigate the practice and challenges of effective formative assessment techniques used in Jimma at CBTP and practicum zone sites. Cross-sectional study design was employed.

#### Study Site, Study Participants and Sampling techniques

The study covers 6 different schools which are found in four different zones. Accordingly, the schools included in the study were: from south western showa Zone Dechachi Geresu Duki preparatory and Secondary school which is found 240 km away from Jimma town, from Gurage zone Wolkite preparatory and secondary school which is found 165 km away from Jimma town, from jimma zone Jiren secondary school which is found nearby Jimma University, from Illuababora zone Bedele and Mettu secondary school which is found 138 km and 254 km away from jimma town respectively and from Kefa zone Bonga preparatory and Secondary school. The total number of participants involved were 347 of these 253 of them were students (134 males and 119 females) and all mathematics teachers' 94 of these (84 males and 10 females) were included in the sample by using availability sampling technique since they are few in number and 253 students were selected by systematic random sampling technique to fill in questionnaire. Class room observation and interview was also conducted to enrich the quantitative data. The data gathered through interview and class room observation was discussed in line with questionnaire

#### Study instruments

Both quantitative & qualitative methods were used to analyze the data. The collected data through close-ended items of the questionnaire were organized, tabulated, tallied, & counted. A questionnaire which consists of four levels likert scale (never, sometimes, frequently& always) was prepared to be filled out by mathematics teachers that measure degree of hindering factors that hamper teachers from perception of classroom assessment and classroom assessment practices and a questionnaire which consists of four levels likert scale (Strongly agree, agree, undecided, disagree strongly & disagree) was prepared to be filled out by sampled students. For each hindering factor, the number/percentage of respondents in accordance with the indicated degree of

influence was calculated & tabulated. The data obtained through interview, open-ended items of the questionnaire & document inventory were stated qualitatively (narratives & quotations were the main ways to illustrate the results) to supplement & enrich information gained through close-ended items of the questionnaire. Generally, descriptive statistics, mainly percentages were employed as appropriate to the collected data. In addition, findings were also demonstrated using tables, bar graphs & pie chart for their convenience to summarize & to compare. Whenever relevant, results from quantitative & qualitative methods supplemented each other in the analysis

### Study procedures

In order to achieve the objectives of the study, the researcher will use the procedures which are the same to the standard techniques. These procedures are

#### Procedure -1

**Instruments:** The study employed different instruments so as to assess the effective use of assessment techniques used by mathematics teachers'. These are interview, questionnaire and observation

#### Procedure -2

Class room observations will be done two hours a week, alternating days and classes to assure broad coverage of collected information .One a week students-teachers will swap coordinating teachers in order to increase validity. During class room observations student-teachers will take notes writing down every instance teacher is giving any type of verbal feedback to students or that of students giving feedback to each other whether promoted or not. Copies of various assignments will be made for analysis.

#### Procedure-3

Interviews will be conducted after class room observations are done and assignments studied, in order to ask teachers and students for any clarification and elaboration. Interviews will start with general questions: What is formative assessment? What instrument do you use to assess your student's knowledge (grade, comments, grade, praise, and credit, etc?) How often do you assess each of your students (every day, week, month, etc.) Do you use such techniques as self-assessment and peer-assessment? Students will be asked some questions that are similar, for example: How often do receive feedback from your teacher and what kind of feedback is it (grade, comment, etc.)? Some questions can be quite different, for example: Did you teacher clearly communicate the learning objective for this week (unit)? Does your teacher explicitly tell you whether you are and your learning progress with your teacher and your family? In order to increase validity, student-teachers will transcribe and analyze them together

#### Data from the Questionnaire

As seen from item1 of Table-1 about 30.85 % of the teachers' respondents responded that they never design lesson to allow

them to monitor the students' progress, but below half of the respondents 31.91 % responded that they sometimes design lesson to allow them to monitor the students' progress. Moreover, the table shows 19.5 % and 18.09 % of the teachers' respondents responded that they frequently and always design lesson to allow them to monitor the students' progress respectively. Hence the data show that the majority of the respondents responded that they never and sometimes, with 62.76 percent design lesson to allow them to monitor the students' progress.

**Table 1. Mathematics teachers Teaching experience in the actual class**

Items	Alternatives	Number of Respondents	Percentage
1 I design my lesson to allow me to monitor student progress	Never	29	30.85%
	Sometimes	30	31.91%
	Frequently	18	19.15%
	Always	17	18.09%
	Total	94	100
2. My instructional strategies and activities reflect attention of access, equity and diversity	Never	42	44.60%
	Sometimes	23	24%
	Frequently	18	21%
	Always	17	10.40%
Total	94	100	
3.The design of my lessons in corporate tasks, roles, and interactions consistent with investigative mathematics	Never	52	55.31%
	Sometimes	24	25.53%
	Frequently	11	11.70%
	Always	7	7.46%
Total	94	100	
4. I probe students' reasoning	Never	8	8.51 %
	Sometimes	11	11.70 %
	Frequently	52	55.32%
	Always	23	24.47%
	Total	94	100

This result is in line with the finding of Walter, L.J who reviews research on the approaches teachers' uses to plan instruction and make changes and other decisions. Cites several findings, including that teachers do not generally plan activities based on learning objectives, and that they are reluctant to make changes in lessons once these are planned even when instruction and learning are progressing poorly .and other scholar Fuchs (2002) conducted an analysis of research on student progress monitoring that considered only experimental, controlled studies. These researchers concluded that when teachers use systematic progress monitoring to track their students' progress in reading, mathematics, or spelling, they are better able to identify students in need of additional or different forms of instruction, they design stronger instructional programs, and their students achieve better. (p. 1) As indicated by item 2 of table-1, 44.6% of teachers respondents responded that their instructional strategies and activities reflect attention of access, equity and diversity never. While 24 %, 21%, and 10.4 % of the respondents responded that their instructional strategies and activities reflect attention of access, equity and diversity some times, frequently, and always respectively. Sometimes, teachers find it difficult to engage all students in a given lesson because of the extent of heterogeneity in their classes. Here this data shows that the majority, with 44.6 % of the respondents responded that their instructional strategies and activities reflect attention of access,

equity and diversity. These results confirmed earlier work of (Potter, 2007; Reifel, and Brown, 2004) that Professionals recognise that equity and diversity require responsive, individualised care and education meaning that there is no one correct approach or theory to working with families who have diverse needs. and Imtoul, *et al.*, 2009; Freeman and Bochner, 2008 adds there is no one correct way to incorporate and value Aboriginal culture in the curriculum but it must be an active process that values diversity, encourages differentiated practice and actively involves families and the community in the education and care of their children. Item 3 of table- 1 indicated that, the teachers respondents asked whether they design lessons which in corporate tasks, roles, and interactions consistent with investigation or not. As a result, 55.31 %, 25.53 %, 11.70 %, and 7.46 % of the respondents revealed that they never, sometime, frequently, and always design lessons which in corporate tasks, roles, and interactions consistent with investigative.

Probing help students to clarify their thinking, surface their reasoning, and explore alternative perspectives or solutions. According item 4 of table-1 most of teachers, probe students' reasoning is important, with 79.79 percent indicating always or frequently. 20.21 percent of the teachers indicate sometimes and never. The finding of the present study is consistence with the finding of some previous studies. Stein, Grover and HenningSen (1996) shows consistent engagement in thinking practices lead to a better understanding as well as the ability to demonstrate communication skills.

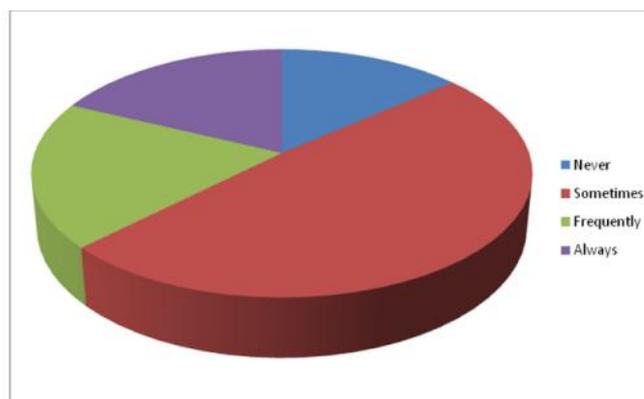
**Table 2. Respondents view on how long the teacher had been teaching mathematics**

Items	Alternatives	Number of Respondents	Percentage
5. The instructional strategies and activities I use reflect attention to students' experiences and readiness	Never	30	31.91%
	Sometimes	11	11.70%
	Frequently	17	18.09%
	Always	36	38.30%
	Total	94	100.00%
6. I provide adequate time and structure for reflection	Never	6	6.38%
	Sometimes	44	46.81%
	Frequently	30	31.92%
	Always	14	14.89%
	Total	94	100.00%
7.I interact with my students	Never	8	8.51%
	Sometimes	44	46.81%
	Frequently	28	29.79%
	Always	14	14.89%
	Total	94	100.00%
8. I give students immediate feedback when they need directions to proceed	Never	4	4.25%
	Sometimes	40	42.55%
	Frequently	22	23.41%
	Always	28	29.79%
	Total	94	100.00%

As shown in Table-2 of item 5 about 38.30 % of the teachers respondents responded that their instructional strategies and activities they used always reflect attention to students' experiences and readiness. Whereas, 31.91 %, 18.09 % and 11.70 % of the teachers' respondents responded that they never, frequently, and sometimes carry out instructional strategies and activities that reflect attention of students' experiences and readiness respectively. This data shows that

the majority of the respondents, with 56.39 % of respondent responded that they frequently or always use instruction strategise and activities that reflect attention to students' experiences and readiness. According to item 6 of table-2 (46.81%) of teachers' respondents responded that sometimes they give adequate time and structure for reflection for their students, while 6.38 %, 31.92 %, and 14.89 % of the respondents responded that they give adequate time and structure for reflection never, frequently, and always respectively. As Item 7 of table -2 indicated that, the teachers respondents asked whether they interact with their students or not. As a result, 8.51%, 46.81%, 29.79%, and 14.89% of the respondents revealed that they never, some time, frequently, and always interact with their students.

This data indicates that ongoing interaction or communication between students and teachers is often difficult to achieve. Giving specific feedback on work or assessment is considered one of the effective formative assessment methods. Accordingly table- 2 of item 8, 4.25%, 42.55 %, 23.41 %, and 29.79 % of the respondents revealed that they never, some time, frequently, and always give their students immediate feedback when they need directions to proceed. This data indicated that the majority of the respondents responded agree with the idea that giving students immediate feedback when they need direction to proceed is necessary



**Fig. 1. I take into account prior knowledge of my students**

As shown in Fig. 1, 44 (46.80 percent) of the respondents responded that they take into account prior knowledge of their students sometimes or never, and more than half 50 (53.20 percent) teachers respondents take into account prior knowledge of their students frequently or always. This is confirmed by (Shield & Galbraith, 1998) Understanding mathematics learning generally involves knowing the concepts and principles and making meaningful connections between prior knowledge and concepts being learn

As revealed in Table 3 whether respondents make the pace of lesson which is appropriate for development level/needs of students and the purpose of the lesson or not. With this regards, 13.83%, 48.93 %, 19.15 %, and 18.9 % of respondent responded that they never, some time, frequently, and always make the pace of lesson is appropriate for development level/needs of students and the purpose of the lesson.

**Table 3. Respondents view on whether they make the of pace lesson which is appropriate for development level/needs of students and the purpose of the lesson**

Choices	Number of Respondents	Percentage
Never	13	13.83%
Sometimes	46	48.93%
Frequently	18	19.15%
Always	17	18.09%
Total	94	100.00%

**Table 4. Respondents' opinion on whether their questioning strategies are likely to enhance the development of students conceptual understanding/problem solving or not**

Choices	Number of Respondents	Percentage
Never	11	11.70%
Sometimes	30	31.91%
Frequently	17	18.09%
Always	36	38.30%
Total	94	100.00%

As revealed in table-4 on the respondents response whether their questioning strategies are likely to enhance the development of students conceptual understanding/problem solving or not. With this regards, 11.70 %, 31.91 %, 18.09 %, and 38.30 % of respondent responded that they never, sometime, frequently, and always their questioning strategies are likely to enhance the development of students conceptual understanding/problem solving.

**Table 5. My lessons progress based on students' responses**

Choices	Number of Respondents	Percentage
Never	10	10.64%
Sometimes	46	48.93%
Frequently	18	19.15%
Always	20	21.28%
Total	94	100.00%

As revealed in table-5 on the respondents response whether their lessons progress based on students' responses or not. With this regards, 10.64 %, 48.93 %, 19.15 %, and 21.28 % of respondent responded that they never, sometime, frequently, and always their lessons progress based on students' responses

**Table 6. The in class activities consolidate the main ideas of the lesson**

Choices	Number of Respondents	Percentage
Never	18	19.15%
Sometimes	38	40.42%
Frequently	18	19.15%
Always	20	21.28%
Total	94	100.00%

As can be observed from table-6 whether there is the in class activities consolidate the main ideas of the lesson or not. With this regards, 59.57 % of the respondents responded that they never or sometimes there the in class activities consolidate the main ideas of the lesson and 40.43% of respondent responded frequently or always the in class activities consolidate the main ideas of the lesson.

As it is clearly observed from item15 of table-7 about 53.19% of the teachers respondents responded that they identify

students who have difficulties in understanding the main ideas of the lesson. Whereas, 6.38%, 19.15% and 21.28 % of the teachers' respondents responded that they never, frequently, and always identify students who have difficulties in understanding the main ideas of the lesson respectively. Item 16 of Table-7 illustrates (44.68%) of teachers' respondents responded that they sometimes used Classroom Assessments, while 5.32 %, 27.66 %, and 22.23 % of the respondents responded that they never, frequently, and always used Classroom Assessments respectively. The importance of Classroom Assessments for learning on students' achievement as Ehrenber, Brewer, Gamoran, and Willms (2001) identified is the effect of assessment for learning on student achievement is four to five times greater than the effect of reduced class size. The results also show that while all students show achievement gains, the largest gains are made by the lowest achievers in class.

**Table 7. Classroom assessment practices**

Items	Alternatives	Number of Respondents	Percentage
15. I identify students who have difficulties in understanding the main ideas of the lesson	Never	6	6.38%
	Sometimes	50	53.19%
	Frequently	18	19.15%
	Always	20	21.28%
Total		94	100.00%
16. How often should Classroom Assessments be used?	Never	5	5.32%
	Sometimes	42	44.68%
	Frequently	26	27.66%
	Always	21	22.34%
Total		94	100.00%
17. The teacher encouraged students to talk and share ideas	Never	3	3.19%
	Sometimes	58	61.70%
	Frequently	21	22.34%
	Always	12	12.77%
Total		94	100.00%
18. The instructional strategies and activities reflected attention to issues of access, equity, and diversity for students(e.g. "wait time" cooperative learning)	Never	5	5.32%
	Sometimes	44	46.81%
	Frequently	21	22.34%
	Always	24	25.53%
Total		94	100.00%

- When consistently carried out as a matter of routine within and across
- Classrooms, this set of practices has been linked to achievement gains of
- One-half to two standard deviations on high-stakes tests, and the largest gains made are by low achievers. (2005, p. 328)

As Item 17 of Table -7 indicated that, the teachers respondents asked whether they encouraged their students to talk and share ideas or not. As a result, 3.19 %, 61.70 %, 22.34 %, and 12.77% of the respondents reviled that they never, some time, frequently, and always they encouraged their students to talk and share ideas. When participants were asked whether their instructional strategies and activities reflected attention to issues of access, equity, and diversity for students (e.g. "wait time" cooperative learning) or not in general, nearly 5 % of the participants respond never, while 46.81 %, 22.34 %, 22.34 % and 25.53 responded that sometime, frequently and always

respectively as shown in table -7 of item 18. This result congruent to with the Research findings of (Rubie-Davis, 2006; Berzin, 2010), which is identified as A key factor in equity and diversity is having high expectations for every child. Children's self-esteem and motivation to achieve is linked to early childhood professionals having high expectations and communicating these to every child. This means that early childhood professionals recognise that some children may need additional or specialised support to reach their full potential also (Rowe, 1986) adds several significant educational benefits result when faculty members extend the wait time following a question from less than one second to 3-5 seconds (Rowe, 1986).

As can be seen from Table-9, the majority of the respondents 172(69.92%) respondents responded that when the teacher asks a question in class he/she always Wait for a few hands up then pick one of them to answer. Whereas, a few 10 (4.07 %) of the respondents responded that the teacher in the class never asks a question the students by giving them a few minutes to discuss with a parting before giving answer. This data show the majority of the teachers' asks a question in a class wait for a few hands up then pick one of them to answer. As depicted in item 5 of table-10 about 41.47 % of the students' respondents responded that they disagree with the idea that they have a pretty good idea about what they expected to learn in this class.

**Table 8. On average, how often do you teachers assess your work?**

Item	Once a week	Once every month	Once every semester	Once a year
3 On average, how often do you teachers assess your work	1 (0.41%)	40 (16.26%)	188 (76.42%)	17 (6.91%)

**Table 9. When the teacher asks a question in class, what does he/she normally do?**

Choices	always	often	sometimes	seldom	Never
a. Wait for a few hands up then pick one of them to answer	172 (69.92%)	41 (16.67%)	26 (10.57%)	4 (1.62%)	3 (1.22%)
b. Give us a few minutes to discuss with a parting before giving answer	10 (4.07%)	16 (6.5%)	50 (20.33%)	80 (32.52%)	90 (36.58%)

**Table 10. How long the teacher had been teaching mathematics**

Items	Alternatives	Number of Respondents	Percentage
5. I usually have a pretty good idea about what I am expected to learn in this class	Strongly agree	30	11.86
	Agree	24	9.48
	Undecided	20	7.91
	Disagree strongly	77	30.43
	Disagree	102	40.32
	Total	253	100
6. I find it helpful when a teacher does lots of small assessments throughout a topic, rather than a big assessment at the end.	Strongly agree	78	30.83
	Agree	95	37.56
	Undecided	9	3.56
	Disagree strongly	66	26.09
	Disagree	5	1.96
	Total	253	100
7. I believe that I am more motivated to learn when I know I will be assessed.	Strongly agree	57	22.53
	Agree	113	44.67
	Undecided	13	5.15
	Disagree strongly	62	24.52
	Disagree	8	3.13
	Total	253	100
8. I feel good about my learning when I get a good mark in an assessment.	Strongly agree	126	49.8
	Agree	104	41.11
	Undecided	13	5.14
	Disagree strongly	4	1.58
	Disagree	6	2.37
	Total	253	100
9. I believe that increasing the amount of testing will help my learning	Strongly agree	20	7.91
	Agree	58	22.92
	Undecided	2	0.79
	Disagree strongly	59	23.32
	Disagree	114	45.06
	Total	253	100

As table-8 revealed the majority of the respondents 188(76.42%) responded that their teachers assess his/her work once every semester, while 0.41%, 16.26%, and 6.91% responded that they assess their work once a week, once every month, and once a year respectively.

While, 11.86%, 9.84%, 7.91 % and 30.43% of the students' respondents responded that they strongly agree, Agree, Undecided and disagree strongly the idea that they have a pretty good idea about what they expected to learn in this class. Item 6 of table-10 illustrates (37.50 %) of students respondents

responded that they agree that it helpful when a teacher does lots of small assessments throughout a topic, rather than a big assessment at the end. while 30.83 %, 3.58 %, 16.09% and 1.96 % of the respondents responded that they strongly agree, Undecided, disagree strongly and Disagree respectively. As shown in table-10 of item 7 about 44.67 % of the students respondents responded that they agree with the idea that they are motivated to learn when they know what they will be assessed. Whereas, 22.53 %, 5.15 %, 24.52 % and 3.13 % of the teachers' respondents responded that they Strongly agree, Undecided, Disagree strongly, and Disagree that they are more motivated to learn when they know what they will be assessed. As Item 8 of table -10 indicated, the students respondents asked whether they feel good about their learning when they get a good mark in an assessment or not. As a result, 49.8 %, 41.11 %, 5.14 %, 1.58 %, and 2.37 % of the respondents reviled that they strongly agree, Agree, Undecided, Disagree strongly, and disagree that they feel good about their learning when they get a good mark in an assessment. When participants were asked whether their the increasing in the amount of testing will help them to learning or not, nearly 22.92 % of the participants agree, while 7.91 %, 0.79 %, 23.32 % and 45.06% respondent Strongly agree, Undecided, Disagree strongly and Disagree respectively as shown in table -10 of item 9

**Data from the interview**

**Data collected from teachers through interview**

1.What is formative assessment?

- When the interviewed mathematics teachers of the sampled schools' were asked they all had experienced some formative assessment in class before but did not know the terminology; that means they simply could not understand the phrase.

2.What instrument do you use to assess your student's knowledge (grade, comments, praise, and credit, etc.)?

When the interviewed teachers were asked,

- The majority of them said we use grade and credit to assess our student's knowledge in mathematics.
- Some of them said we use grade and comments to assess their student's knowledge in mathematics. the general perception of formative assessment was skewed in that too many teachers still had a traditional notion of an assessment's purpose. Traditionally, assessments were for grades, not continued learning.

3.How often do you assess each of your students (every day, week, month, etc?)

Assessment may differ in purpose and frequency. But, the interviewed participants pint out that even if the assessment may differ in purpose and frequency the common trained we experienced was assessing our students per semester once. But, (Ainsworth, 2007) assert that regular use of classroom assessments can have a positive effect on student achievement. Marzano (2007) surmises that one to two formative assessments per week will have the strongest impact on student achievement. The research on formative assessments supports the need for frequent assessments, at least several times a month, to impact student achievement

4. Do you use such techniques as self-assessment and peer-assessment?

One of the interviewed participants asserts that most of the mathematics teachers in our school have no experience this much in implementing self-assessment and per-assessment in the actual class room. Whereas, Harrison and Harlen (2006) conclude that self-and peer –assessment both engage children in being reflective, both about the task in hand and more broadly about the way the learn [and therefore] encourage a deep rather than a surface approach to learning' (p. 190)

**Data collected from students through interview**

1.How often do receive feedback from your teacher and what kind of feedback is it (grade, comment, etc.)?

- Here as the interviewed participants said we always receive the feedback from our mathematics teacher on the on the assignment or home work given to us and the kind of feedback we received is graded
- One of the interviewed participant different school also reviled that we always the students received feedback from m our mathematics teacher and the kind of feedback given to us is always grade.

2.Some questions can be quite different, for example: Did you teacher clearly communicate the learning objective for this week (unit)?

The interviewed students reviled that almost all the teachers do not tell them the learning object of the content they taught.

**Data from Class room observation**

As clearly discussed above, besides the fore mentioned instruments I have already used observations check list for 3 consecutive day's one class from different grade level from each six sample schools to get clear information. Accordingly,

Item	yes	No	Total
1 Students are engaged.	6(33.33%)	12(66.67%)	18(100%)
2 Students use a variety of mathematical tools.	4(22.22%)	14(77.78%)	18(100%)
3 Misconceptions, limited understandings, and/or flawed reasoning surface.	13(77.22%)	5(27.78%)	18(100%)
4 Students reflect on their learning	6(33.33%)	12(66.67%)	18(100%)
5 Students look at problems and ideas in different ways.	10(55.56%)	8(44.44%)	18(100%)
6 Wrong answers are viewed as worthwhile	3(16.67%)	15(83.33%)	18(100%)
7 Students are equitable in their spoken and unspoken messages about all students' mathematical potential	16(88.89%)	2(11.11%)	18(100%)
8 Students respect each other student's thinking.	7(38.89%)	11(61.11%)	18(100%)

Table -11, shows the details of teaching and learning in mathematics classes of the selected sample schools. As

indicated in Table -11 of item 1 in the class observed two third of the students are not engaged. Since most of the teachers use lecture method in class observed there is not this much engagement this implies in turn the effective use of formative assessment across the class observed is limited whereas, as (Protheroe, 2007) indicates in an effective mathematics classroom, the students are actively engaged in doing mathematics. As can be seen from Table- 11 of item 2 the majority Students, with (77.78%) is not used a variety of mathematical tools in mathematics class. But, Stein and Bovalino (2001) indentify “Manipulative can be important tools in helping students to think and reason in more meaningful ways. By giving students concrete ways to compare and operate on quantities, such manipulative as pattern blocks, tiles, and cubes can contribute to the development of well-grounded, interconnected understandings of mathematical ideas.” As depicted in Table-11 of item 3.item 4, item 5, item 6, the class observed, with (77.22%) reviled misconceptions, limited understandings, and/or flawed reasoning surface is observed, (66.67%) reviled that there is no Students reflect on their learning, (55.56%) reviled Students look at problems and ideas in different ways and (83.33%) reviled that no wrong answers are viewed as worthwhile. As one can see from Table-11 of item 7 and item 8, the class observed indicates that (88.89%) Students are equitable in their spoken and unspoken messages about all students’ mathematical potential and (61.11%) Students not respect each other student’s thinking.

## DISCUSSION

The data gathered from different sources has been subjected to both qualitative and qualitative data analysis. This has been carried out to assess the Effectiveness of Formative Assessment Techniques used by High School Mathematics Teachers in Jimma at CBTP and Practicum Zone Sites. The discussion is made on the results acquired through qualitative and quantitative data analysis techniques. The quantitative data analysis was made on the data obtained through the questionnaire. The qualitative data analysis mostly relied on the results of class room observation checklist and interview.

### Teaching experience

The purposes of formative assessment are to help teachers target instruction that meets specific learning goals, support student learning, check for progress and detect learning gains, identify strengths and weaknesses, check for misconceptions following instruction, differentiate instruction, evaluate the effectiveness of instructional methods or programs, and transform curriculums (Gallagher & Worth, 2008). The result from table -1 of item 1 shows that the majority of the respondents responded that they never and sometimes, with 62.76 percent design lesson to allow them to monitor the students’ progress. This result is in line with the finding of Walter, L.J whose reviews research on the approaches teachers uses to plan instruction and make changes and other decisions. Cites several findings, including that teachers do not generally plan activities based on learning objectives, and that they are reluctant to make changes in lessons once these are planned even when instruction and learning are progressing poorly and

other scholar Fuchs (2002) conducted an analysis of research on student progress monitoring that considered only experimental, controlled studies. These researchers concluded that when teachers use systematic progress monitoring to track their students’ progress in reading, mathematics, or spelling, they are better able to identify students in need of additional or different forms of instruction, they design stronger instructional programs, and their students achieve better. (p. 1) Sometimes, teachers find it difficult to engage all students in a given lesson because of the extent of heterogeneity in their classes. The result as indicated by item 2 of table-1 shows, 68.6% of teachers respondents responded that their instructional strategies and activities reflect attention of access, equity and diversity never or sometimes. These results confirmed earlier work of (Potter, 2007; Reifel, and Brown, 2004) that Professionals recognize that equity and diversity require responsive, individualized care and education meaning that there is no one correct approach or theory to working with families who have diverse needs. and Imtoul *et al.*, 2009; Freeman and Bochner, 2008 adds there is no one correct way to incorporate and value Aboriginal culture in the curriculum but it must be an active process that values diversity, encourages differentiated practice and actively involves families and the community in the education and care of their children. The finding from Item 3 of table -1 indicated that, the teachers respondents asked whether they design lessons which in corporate tasks, roles, and interactions consistent with investigation or not. As a result, 80.84 % of the respondents reviled that they never or sometimes design lessons which in corporate tasks, roles, and interactions consistent with investigative.

Probing help students to clarify their thinking, surface their reasoning, and explore alternative perspectives or solutions. And the result from item 4 of table-1 shows that most of teachers, probe students’ reasoning is important, with 79.79 percent indicating always or frequently. The finding of the present study is consistence with the finding of some previous studies. (Stein, Grover and HenningSen (1996)) shows consistent engagement in thinking practices lead to a better understanding as well as the ability to demonstrate communication skills.

### How long the teacher had been teaching mathematics

The finding in table-2 of item 5 shows that the majority of respondents 56.39 % reviled that they frequently or always use instruction strategies and activities that reflect attention to students’ experiences and readiness and according to item 6 of table-2 more than half of the respondents 53.19 % responded that they sometimes or never give adequate time and structure reflection for their students. As Item 7 of table -2 indicated that, the teachers respondents asked whether they interact with their students or not. As a result, 8.51%, 46.81%, 29.79%, and 14.89% of the respondents reviled that they never, some time, frequently, and always interact with their students. This indicated that the majority (55.32 percent) of the respondents responded that they never or sometimes provided his/her students adequate time and structure for reflection. Giving specific feedback on work or assessment is considered one of the effective formative assessment methods where as table- 2

of item 7 illustrates 53.2 % of the respondents revealed that they frequently or always give their students immediate feedback when they need directions to proceed. This data indicated that the majority of the respondents agree with the idea that giving students immediate feedback when they need direction to proceed is necessary

### Perception of classroom assessment

As shown in fig 1, 44 (46.80 percent) of the respondents responded that they take into account prior knowledge of their students sometimes or never, and more than half 50 (53.20 percent) teachers respondents take into account prior knowledge of their students frequently or always. In line with (Shield & Galbraith, 1998) confirmed that Understanding mathematics learning generally involves knowing the concepts and principles and making meaningful connections between prior knowledge and concepts being learn. As revealed in table-3 whether respondents make the pace of lesson which is appropriate for development level/needs of students and the purpose of the lesson or not. With this regards, 62.76% of respondent responded that they never or some time make the pace of lesson is appropriate for development level/needs of students and the purpose of the lesson. As revealed in table-4 on the respondents response whether their questioning strategies are likely to enhance the development of students conceptual understanding/problem solving or not. With this regards, 11.70 %, 31.91 %, 18.09 %, and 38.30 % of respondent responded that they never, sometime, frequently, and always their questioning strategies are likely to enhance the development of students conceptual understanding/problem solving. As revealed in table-5 on the respondents response whether their lessons progress based on students' responses or not. With this regards, 10.64 %, 48.93 %, 19.15 %, and 21.28 % of respondent responded that they never, sometime, frequently, and always their lessons pr As can be observed from table-6 whether there is the in class activities consolidate the main ideas of the lesson or not. With this regards, 59.57 % of the respondents responded that they never or sometimes there the in class activities consolidate the main ideas of the lesson and 40.43% of respondent responded frequently or always the in class activities consolidate the main ideas of the lesson.

### Classroom assessment practices

As it is clearly observed from item15 of table-7 about 53.19% of the teachers respondents responded that they identify students who have difficulties in understanding the main ideas of the lesson .Whereas, 6.38%, 19.15% and 21.28 % of the teachers' respondents responded that they never, frequently, and always identify students who have difficulties in understanding the main ideas of the lesson respectively. Item 16 of table-7 illustrates (44.68%) of teachers' respondents responded that they sometimes used Classroom Assessments, while 5.32 %, 27.66 %, and 22.23 % of the respondents responded that they never, frequently, and always used Classroom Assessments respectively. The importance of Classroom Assessments for learning on students' achievement as Ehrenber, Brewer, Gamoran, and Willms (2001) identified the effect of assessment for learning on student achievement is

four to five times greater than the effect of reduced class size. The results also show that while all students show achievement gains, the largest gains are made by the lowest achievers in class.

- When consistently carried out as a matter of routine within and across classrooms,
- This set of practices has been linked to achievement gains of one-half to two standard
- Deviations on high-stakes tests, and the largest gains made are by low achievers. (2005, p. 328)

As Item 17 of table -7 indicated that, the teachers respondents asked whether they encouraged their students to talk and share ideas or not. As a result, 3.19 %, 61.70 %, 22.34 %, and 12.77% of the respondents revealed that they never, some time, frequently, and always they encouraged their students to talk and share ideas. When participants were asked whether their instructional strategies and activities reflected attention to issues of access, equity, and diversity for students (e.g. "wait time" cooperative learning) or not in general, nearly 5 % of the participants respond never, while 46.81 %,22.34 %, and 25.53 %responded that sometime, frequently and always respectively as shown in table -7 of item 18. This result congruent to with the Research findings of (Rubie-Davis, 2006; Berzin, 2010), which is identified as A key factor in equity and diversity is having high expectations for every child. Children's self-esteem and motivation to achieve is linked to early childhood professionals having high expectations and communicating these to every child. This means that early childhood professionals recognize that some children may need additional or specialized support to reach their full potential also (Rowe, 1986) adds several significant educational benefits result when faculty members extend the wait time following a question from less than one second to 3-5 seconds (Rowe, 1986).

### Summary

This study was aimed to assess the Effectiveness of Formative Assessment Techniques used by High School Mathematics Teachers in Jimma at CBTP and Practicum Zone Sites. To this result, the following basic research questions were formulated to carry out the study.

1. What instrument do Mathematics teachers use at Jimma CBTP and Practicum zone sites Secondary schools to assess their student's knowledge in mathematics (comments, grade, praise, and credit, etc.)?
2. What professional development materials will be required to disseminate principles for improving formative assessment across a wide range of schools?
3. What kinds of assessment methods and tools do mathematics teachers use to assess their students?

In order to deal with these basic questions, related literature was properly reviewed and questioner, interview and observation check list were prepared to collect the data. The instruments used were a questionnaire for mathematics teachers' in six sampled schools and semi-structured interviews with mathematics teachers and students of these

selected sample schools and class room observation. Samples were all mathematics teachers of these sampled schools. Participants involved in the interviews were selected based on the number of sections exists in six schools.

- The findings of the study indicated that the mathematics teachers of the selected sample schools did not design lesson which allow them to monitor the students' progress(see table-1)
- Table-1 indicates that mathematics teachers of the selected schools face difficult to engage all students in a given lesson because of the extent of heterogeneity(issues of poverty, gender, language, culture, race, ability, disability, and living context) in their classes
- There exists a special link between formative assessment and its connectedness with students learning and achievement in mathematics.
- There exists a relation between giving students feedback on work or assessment and effective formative assessment method in students' achievement (see table-2).
- The majority of the teachers focus on convergent problems, are completely teacher directed, and don't provide opportunities to explore ideas before instruction. Teachers often miss opportunities to pose questions to students or they make generic inquiries
- The research findings demonstrates that most of the mathematics teachers could not simply understand the phrase formative assessment and there is some gaps to implement it in the actual class room as clearly indicated in the interview part.
- the effects of formative assessment show that teachers and administrators graduating from certification programs lack the necessary skills to make formative assessment about students
- Over 80% of mathematics teachers interviewed do not conduct any additional feedback collection techniques outside of the semester-end method. Only obtaining feedback once per semester could prevent instructors from implementing teaching improvements in their courses on multiple occasions.

In conclusion, the majority of the problems mathematics teachers encounter to effective use formative assessment in class is when the plan planned is not implemented in a systematic, continuous manner and the feedback provided during the learning process is not to identify students' strengths, weaknesses, and gaps in learning. Formative assessment also has been shown to improve learning outcomes for various student groups, such as those who are struggling with learning, English learners, and students with disabilities. Regardless of the type of formative assessment practice utilized, it should be aligned with a state's comprehensive assessment system and should be seen as only one approach among many that may be used to improve student achievement.

### Recommendations

- Training should be given on the importance of formative assessment

- Formative assessment is and how to do it are important steps in launching a successful formative assessment program.
- Teacher and school administrator assessment literacy was a prerequisite for successful formative assessment implementation.
- All the zones can take the following tangible steps now to begin to implement research-based formative assessment strategies in their schools and districts that can yield positive results:
- The teachers must adjust instruction immediately based on formative assessment data in order to enhance learning
- The mathematics teachers should pose a lesson problem or investigation without giving students the steps to deriving a solution so that all students can engage at their own.
- The mathematics teachers must Promoting students to articulate their thinking, to listen to different perspectives of others, to adapt their thinking ,and to refine their under sting
- The regional government and local governments should strictly implement rules

The mathematics teachers should in co-operate different lesson design strategies

### Acknowledgments

The authors acknowledge Jimma University and college of Natural sciences for allowing us this great support (funding) to carried out this research project and participants of the study for filling out the questionnaire.

### REFERENCES

- Angelo, T. A., & Cross, K. P. 1993. Classroom assessment techniques: A handbook for College teachers (2nd ed.). San Francisco: Jossey-Bass Publishers.
- Ball, D. L., & Bass, H. 2000. Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In J. Boaler (Ed.), multiple perspectives on the teaching and learning of mathematics (pp. 83-104). Westport: Ablex.
- Black, P. & William 1998. Inside the black box: Raising standards trough class room assessment. *The phi Delt Kappan*, 80(2).139148.Retrieved from
- Black, P. J. & Wiliam, D. 1998b. Inside the black box: raising standards through classroom assessment. *Phi Delta Kappan*, 80(2), 139-148.
- Black, P., & Wiliam, D. 1998a. Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7-74.
- Black, P., & Wiliam, D. 1998b. Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, 80(2), 139-148.
- Boaler, J. 2008. Task-involving and ego-involving properties of evaluation: effects of Different feedback conditions on motivation perceptions, interest, and performance. *Journal of Educational Psychology*, 79 (4), 474482. doi: 10.1037/0022-0663.79.4.474.

- Brown, G. T. L. 2006. Measuring attitude with positively packed self-report ratings: Comparison of agreement and frequency scales. *Psychological Reports*, 94, 1015-1024
- Chappuis, J. 2009. *Seven Strategies of Assessment for Learning*. Portland: Educational Testing Service.
- Clarke, D. 1996. Assessment. In A. Bishop (Ed.), *International Handbook of Mathematics Education* (pp. 320-370). Dordrecht, the Netherlands: Kluwer.
- Clarke, D., & Hollingsworth, H. 2002. Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, 18(8), 947-967.
- Clarke, D., Goos, M. & Morony, W. 2007. Problem solving and working mathematically: An Australian perspective. *ZDM: The International Journal on Mathematics Education*, 39(5-6), 475-490.
- Cunningham, G. K. 1998. *Assessment in the classroom*. London: Falmer Press
- de Lange, J. 2000. Framework for classroom assessment in mathematics. Retrieved June 2, 2008, from [www.fi.uu.nl/catch/products/framework/de\\_lange\\_framework.doc](http://www.fi.uu.nl/catch/products/framework/de_lange_framework.doc)
- Doganay, A. Bal. A.P. 2010. The measurement of students' achievement in teaching primary school fifth year Mathematics classes. *Educational Sciences: Theory and Practice*. 10 (1).
- Fuchs, L.S. & Fuchs, D. 1986. Effects of systematic formative evaluation: A meta-analysis. *Exceptional Children*, 53(3), 199-208.
- Harrison, C. and Harlen, W. 2006. 'Children's self- and peer-assessment.' In: Harlen, W. (Ed) *ASE Guide to Primary Science Education*. Hatfield: Association for Science Education
- Kaur, B. 2005. Assessment of mathematics in Singapore schools .The present and future, ICMI-EARCOME3
- Natriello, G. 1987. The impact of evaluation processes on students. *Educational Psychologist*, 22(2), 155-175.
- Pophan, W. 2006. Assessment for learning: An Endangered species? *Educational Leadership*, 63(5), 82-3
- Sadler, D. R. 1998. Formative assessment: Revisiting the territory. [Electronic version]. *Assessment in Education*, 5(1), 77-84.
- Stiggins, R.J. 2002. Assessment crisis: The absence of assessment for learning. *Phi Delta Kappan*, 83(10), 758-765.

\*\*\*\*\*