

ANALYSIS OF SENIOR HIGH SCHOOL MATHEMATICS TEACHER CHARACTERISTICS AND UTILIZATION OF ASSESSMENT PRACTICES

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ABSTRACT: *The study sought to examine mathematics teacher characteristics that influence their use of assessment procedures in teaching and learning. The study adopted the descriptive survey design and the participants were 88 senior high school mathematics teachers sampled from the randomly selected schools from the Sunyani municipality. A four point Likert scale questionnaire was used to collect data from the respondents. The internal consistencies of the various sections of the instrument ranged from 0.69 to 0.78. The data collected were analysed using the independent t-test and one-way of variance ANOVA. The results from the study showed that assessment practices were not influenced by teacher characteristics such as gender and years of teaching. It was however found that professionalism of the teacher and exposure to INSET on classroom assessment influenced the use of assessment in the classroom. The recommendations drawn are that teachers must be encouraged and supported to participate in in-service training which retrains them on the need to involve assessment practices in teaching and learning. It is also recommended that professional teachers must be recruited to teach all subjects especially mathematics.*

KEYWORDS: Teacher Characteristics, Assessment, Feedback, Classroom Practice

INTRODUCTION

As teachers strive to achieve the goal of mathematics education, there is the need to monitor students' progress in terms of achieving specific instructional objectives. Monitoring students' progress with instruction enables one to determine the extent to which learning outcomes are being achieved in relation to the goals of teaching mathematics in general (Kolawole, 2010). Achievements of these objectives do not happen by chance. It happens through deliberate attempt to work towards it. The instructional objectives and the goals in general are achieved by constantly collecting and analyzing data about students learning which is often used to determine learning progress towards the achievement of these set goals (Okyere & Larbi, 2016). The process of collecting data about students to appraise their performance is known as assessment (Kyriacou, 1991). According to Okyere, Kuranchie, Larbi and Twene (2015), assessment enables students' competence to be determined. In addition to making decisions about students' learning, assessment guides teachers and stakeholders of education to determine the effectiveness of curricula and ways of improving upon them where necessary. Hence, assessment is often seen as an integral part of teaching and learning. It is a tool used to inform teaching and learning. Assessment enables teachers to make accurate decisions to enhance effective teaching and learning. According to Nsikak-Abasi and Akanaono (2017), the managerial role played by teachers requires making several decisions in class which cannot be done without assessment.

Worthy teaching requires that teachers create an enabling environment for all students to learn at their own pace. Not all students learn the same way due to individual differences. Constant gathering of information about students therefore enables teachers to develop instructions that

meet the various learning needs of the individual students (Eggen & Kauchack, 2004; Larbi & Okyere, 2014). Thus, effectiveness of teaching can be ascertained when assessment is made part of the teaching and learning process. Data about students' learning can be obtained through multiple procedures such as observation, tests, oral questions, projects, homework, exercises and many more. Using different assessment procedures enable teachers to develop deep understanding of students' learning and capabilities (Okyere *et al*, 2015).

Assessment can be conducted at any time of instruction. That is before, during and after instruction. In brief, teachers assess students before instruction to enable them identify what students already know to enable them build further learning on, which enhances meaningful learning. Assessment during instruction enables students' progress with instruction to be ascertained, and assessment after instruction is used to determine what have been acquired after being exposed to the learning experiences (Nitko, 2001; Joshua, 2005; Okyere, *et al*, 2015).

In terms of studying teachers' integration of assessment into teaching and learning, not much has been done in Ghana. It is therefore believed that findings of this study would contribute to better understanding of teachers' utilization of assessment into teaching and learning with the aim of improving upon their performance. The findings of this study would also be helpful to supervisors of education and head teachers on teachers' behaviour in integrating assessment into teaching and put in more effective measures on its incorporation into teaching if need be. It would further enable curriculum developers or planners to include more enrichment programmes for teacher development either in course of training or in-service training for practicing teachers.

Statement of the Problem

Classroom assessment provides valuable information to both teachers and students. Assessment informs students about their learning progress and also about the effectiveness of the teaching activities to the teacher (Okyere & Larbi, 2016). Thus, not only is assessment conducted to obtain information about students' learning but also to help in teachers' professional development. Assessment serves as pivotal tool to almost every decision made in the classroom (McMillan, 2008).

Recent past researches indicate some associated problems of teachers' classroom practices which have been attributed to lack of adequate knowledge on assessment, insufficient training on assessment, and failure to integrate assessment into teaching and learning (Campbell & Evans, 2000; Stiggins & Chappuis, 2005; Koloi-Keaikitse, 2012). This, to some extent, cast doubt on the methods used by teachers to monitor their students' learning. Teachers play critical role in the implementation of the mathematics curriculum. They are the key drivers of the educational processes. They play a primary role of working towards achieving the main goal of mathematics education by frequently ensuring the achievement of instructional objectives set daily for each interaction (Koloi-Keaikitse, 2012; Okyere *et al*, 2015).

Okyere and Larbi (2016) in a study found a positive but weak correlation between teachers' perception and assessment practices. Thus, although teachers have positive perception about assessment and its importance in teaching and learning, it was least practiced in their duties. This finding therefore calls for a study to investigate into what teacher characteristics influence their assessment practices.

Research Hypothesis

The study aimed to test the hypothesis:

There is no significant difference between mathematics teacher characteristics (gender, teaching experience, professionalism, INSET) and their utilization of assessment practices in teaching and learning.

REVIEW OF RELATED LITERATURE

Assessment and Feedback

Assessment impacts on almost all activities in the classroom. One major duty of the teacher is to assess the effectiveness of his teaching activities. Teaching effectiveness cannot be determined without assessing the learning progress of the students. Through assessment, teachers get immediate feedback about the quality of their work. Similarly, students need feedback about their progress in learning. Immediate feedback therefore plays a critical role in classroom assessment. As assessment is necessary for effective teaching and learning, so is feedback in assessment (Okyere & Larbi, 2016). Assessment plays a crucial role in teaching when it focuses on providing sound feedback to both the teacher and the learner.

Students need to know their strengths and weaknesses in learning. Students tend to learn better when they are constantly pointed to their mistakes. Feedback in assessment therefore provides constructive guidance to the learner. For this reason, feedback is an optimal element of formative assessment which is often called 'assessment for learning' (Joshua, 2005; Okyere *et al*, 2015). According to Gipps (1994), feedback assists students to become aware of any deficiencies in their current state of learning and guides them to take necessary actions for remediation to enable them achieve their desired learning goals. Reece and Walker (2003) add that feedback is most useful when teachers provide specific comments about errors in students' solutions or contributions in class and provide suggestions for improvement. This makes students to focus attention on providing meaningful solution to questions rather than simply getting the right answer. Feedback promotes reflection in learning which enables one to learn from past experiences. Reflection is self-awareness of oneself in learning or teaching and leads to informed decisions about development (Wilson, 2008). Both the student and the teacher reflect on teaching and learning for personal and professional development respectively. One strategy that can be used to alleviate students' fear and dislike for mathematics (Eshun, 2000) is continually assessing and providing constructive guidance to students learning. Students gain more confidence in learning when they are made aware of their learning progress.

Many researchers argue that students who are constantly assessed during instruction and have their learning difficulties remedied tend to perform better in end of term and national examinations. For this reason, Nsikak-Abasi and Akanaono (2017) investigated the impact of classroom assessment, management and control on academic performance. Data were collected from 400 secondary school students who were randomly selected for the study. The study revealed that classroom assessment, management and control significantly influenced students' academic performance. According to the authors, poor classroom assessment management can result in poor academic performance of students. The recommendation drawn from the study was that, teachers should incorporate assessment especially 'formative' into teaching and learning. In a related study, Rodriguez (cited in Nsikak-Abasi & Akanaono) conducted a study

to ascertain the relationship between assessment practices and achievement with mediating roles of students' self-efficacy and effort. A significant relationship was found to exist between the variables studied.

Assessment and Teaching of Mathematics

Teaching mathematics basically aims at communicating mathematical concepts, knowledge and skills to the students. Assessing students therefore must focus on the objectives of teaching mathematics. Teaching gains its effectiveness when its objectives are achieved. One factor that enhances meaningful teaching is having a clear understanding of the entry characteristics of the students. This enables mathematics teachers to design instructions that facilitate students' learning. Understanding students' entry characteristics is made possible through assessment. Assessment can therefore be conducted during anytime of instruction. According to Fennema and Franke (1992), students learn with understanding when they are guided by teachers to relate the mathematics to be learnt to what they already know. New mathematical ideas when explained in the context of existing knowledge enable students to perceive mathematics as interrelated body of knowledge and learn with understanding. Knowledge cannot be forced into heads of students, unless they themselves construct their own knowledge based on current or past experiences (Bruner, 1966). Reviewing skills or knowledge necessary for specific topics is an important assessment strategy needful for effective teaching.

Understanding mathematical concepts do not come as a one shot bullet for many students. This demands that teachers adopt strategies to constantly assess students' progress with understanding leading to their improved performance (Tahir, 2012). Constant monitoring of students' learning enables their learning difficulties to be dealt with. This avoids the situation where students struggle with learning difficulties till the end of terms' test often known as summative assessment. Summative assessment seeks to measure what has been acquired at the end of instruction (Okoye *et al*, 2015). Many researchers have the belief that teachers must focus their attention more on formative assessment than summative assessment. Formative assessment by its name 'assessment for learning' seeks to diagnose students learning difficulties and be remedied (Adjogbeje, 2013; Azuka, 2014). This provides avenue for the teacher to encourage and support students to learn. This type of assessment is motivational to students since it is seen as a review for learning rather than account of learning (Wilson, 2008; Amua-Sekyi, 2016). Thus formative assessment provides opportunities for students to develop habit of self-monitoring of their own learning progress leading to the achievement of self-set learning goals. Incorporating formative assessment into mathematics teaching will possibly reduce the fear students have for learning mathematics (Eshun, 2000) and their perception as a subject with many terms difficult to remember (Yara, 2009). Assessing mathematical understanding of students will be a waste of time if it does not contribute to teaching and learning process. Students' mathematics learning can be improved when they are constantly assessed using procedures such as questioning, quizzes, tests during teaching (Azuka, 2014). Obtaining information about students learning using different instrument enhances teachers' knowledge gain about their students' learning.

Teachers' Practices of Assessment

According to Bassey, Joshua and Joshua (2011), current educational initiatives across the globe have made assessment reforms domineering. These have called for responses from experts in educational assessment to advocate a change in assessment from 'assessment of learning' to 'assessment for learning'. Practising assessment for learning also known as formative

assessment enables teachers to use the scores obtained to identify students' learning difficulties, effectiveness of teaching methods, and inadequacies in the measuring instrument. It also enables teachers to negotiate learning targets with the learner, assess students' preparedness for future lessons and provide appropriate guidance to students' learning (Kyriacou, 1991; Bloor, 2002; Joshua, 2009). Teachers play a critical role in determining students' learning progress in terms of knowledge, attitudes, skills and competencies possessed. It is needful then to understand how assessment practices are carried out in the classroom (Koloi-Keaikitse, 2012). For teachers to integrate the best assessment practices in teaching and learning, they need to possess some basic competencies in classroom assessment (Nitko, 2001; McMillan, 2008).

Rowntree (cited in Koloi-Keaikitse, 2012) classifies assessment into five dimensions which contribute to teachers' knowledge in assessment.

- (1) *Why assess*: deciding why assessment is to be carried out and what outcomes the assessment is expected to produce.
- (2) *What to assess*: deciding, realizing or otherwise coming to an awareness of what one is looking for in people being assessed.
- (3) *How to assess*: selecting from among available means, those assessments we regard as being most truthful and fair for various sorts of valued knowledge.
- (4) *How to interpret*: Making sense of the outcomes of the observations or measurement or impressions we gather through whatever means we employ; explaining, appreciating, and attaching meaning to the raw 'events' of assessment.
- (5) *How to respond*: finding appropriate ways of expressing our response to whatever has been assessed and communicating it to those concerned (p. 14).

In addition to serving as specific knowledge base for teachers, these dimensions also serve as a framework for measuring classroom assessment practices. Still on how to conduct classroom assessment, Stanley and Hopkins (cited in Bassey, *et al*, 2011) outline a criteria for assessing classroom assessment practices as selection of assessment techniques (test construction), administration and scoring, interpretation of assessment and communication of assessment. Other factors to be considered are the desired outcome, methods of assessment, justification of choices made and evidence in support of decision made (Okyere *et al*, 2015). These established criteria are indications that classroom assessment cannot be done haphazardly. It needs to be done accurately in a domain of adequate possessed knowledge and following its guiding principles. Planning classroom assessment requires some level of teacher expertise and adequate possessed knowledge about principles of assessment. This requires a number of decisions to be made such as; the purpose of the assessment, specify what is to be assessed, most relevant assessment procedures for measuring what is to be assessed, contents to be included in the assessment, how to grade students response, decisions to be made from the assessment results, (Nitko, 2001; McMillan, 2008; Okyere *et al*, 2015). According to Koloi-Keaikitse (2012), teachers cannot assess their students without knowing why they are doing so. Knowing the purpose of assessment serves as bases for its use in the classroom.

With recent students' underperformance in mathematics in most parts of the world, some researchers seem to raise doubt about teachers' ability to integrate assessment into teaching and learning with the purpose of improving upon students learning. For this reason, Okyere

and Larbi (2016) probed into perception and practices of assessment among senior high school mathematics teachers. The study followed the mixed method approach. In all, 62 mathematics teachers selected from the study area participated in the study. The instrument used to collect data was a 30 item questionnaire made up of close and open-ended items. It was found among other things that in spite of the good knowledge teachers held about classroom assessment, it was not adequately practised. Thus, teachers perceived assessment as a tool to inform teaching and learning, but it was rarely used in the classroom. In a similar domain, Campbell and Evans (2000) conducted a study to evaluate the assessment practices of 309 pre-service teachers after completing a course in educational measurement. It was found that not all the criteria established in assessing students learning were utilized in their lesson notes. According to the authors, the pre-service teachers could not explicitly establish the link between curriculum goals, instruction and students achievement.

There have been many researches on teacher practices of classroom assessment. Bassey *et al* (2011) conducted a study into teacher characteristics and application of best assessment practises. Their study adopted the descriptive survey design. Simple random sampling technique was used to sample 500 basic school teachers who participated in 2009 teacher retraining and capacity building programme organised by National Teachers Institute in Nigeria. A 28 – item six-point Likert scale questionnaire was used to collect data from the respondents. The findings of the study showed that basic school teacher application of best assessment practices were not influenced by teacher gender, socio-economic status, qualification, and teaching experience.

Moved by the purpose of studying teachers' skills, and beliefs about assessment and areas practiced, Koloi-Keaikitse's (2012) study focused on primary and secondary school teachers. The study also intended to probe into teacher characteristics and assessment usage. There were 691 participants in the study and data were collected using Classroom Assessment Practices and Skill questionnaire. The findings in the study were; teachers had positive belief about their mastery and performance orientations to students' assessment; teachers with diploma and degree possessed more adequate knowledge in assessment than those with only certificate. It was also found that more experienced teachers and those who attended in-service training in assessment demonstrated mastery and performance orientation than the newly trained teachers.

METHODOLOGY

The design used for this study was a descriptive survey due to the researcher's interest in just describing the intended variables of the population without manipulating (Ary, Jacobs & Razavieh, 2002). Participants of the study comprised 88 senior high school mathematics teachers in the Sunyani west municipality in the Brong Ahafo Region. This was made up of 76 males and 12 females. The participants were selected after the researcher met with the school authorities and the teachers concerned. At the meeting, there was a discussion of the purpose of the study and the need for their participation in the study.

The instrument used in collecting data was a closed-ended questionnaire. The questionnaire was pilot tested to allow the Cronbach alpha reliability coefficient to be estimated so that the researcher could determine the extent to which all the items in the various sections of the questionnaire measure the same construct. The Cronbach alpha of the instrument was found to be 0.68. That is, the internal consistency of the instrument was good and hence suitable for the

purpose of the work (Well & Wolack, 2003). The 27 item questionnaire was modified and screened to 20 item questionnaire as a final instrument for the study. The content of the questionnaire focused on test construction, administration, grading and feedback.

On a scheduled date for the data collection, the questionnaires were administered to the participants. Teachers were given some time to respond to them and they were all collected by the end of the day. This was the procedure followed in all the participating schools. The return rate the questionnaire was 95% which was very good.

Data collected in the study were fed into SPSS version 20. The statistical tools used in the data analysis were the t-test, and one-way analysis of variance ANOVA. The independent variables were the characteristics of the teachers whilst the dependent variable was their responses about their assessment practices.

RESULTS AND DISCUSSION

This section presents the results obtained from the study, which are discussed in relation to the variables studied about the senior high school teachers.

Gender and Assessment Utilization

Table 1: Extract of t-test Analysis of Gender and Utilization of Assessment Practices

Gender	N	\bar{X}	SD	df	t	p
Male	76	35.95	3.47	86	0.187	0.852
Female	12	35.75	2.73			

Table 1 shows that there is no significant difference in the mean scores of male ($M = 35.95$, $SD = 3.47$) and female ($M = 35.75$, $SD = 2.73$) participants of the study in terms of their assessment practices. At 0.05 level of significance, the calculated t-value $t(86) = 0.187$ with a p-value greater than 0.05. Hence, we fail to reject the null hypothesis since there is no evidence that suggest differences in assessment practices according to gender. The null hypothesis which states that there is no significant difference in gender and utilization of assessment practices is therefore upheld.

Table 2: Extract of t-test Analysis of Professionalism and Utilisation of Assessment Practices

Gender	N	\bar{X}	SD	df	t	p
Trained	82	36.21	3.31	86	3.35	0.021
Untrained	6	33.00	1.67			

From Table 2, it can be seen that there is significant difference in the mean scores in the practices of trained (with education) and untrained (without education) teachers. The mean response of trained teachers ($M = 36.21$, $SD = 3.31$) and that of untrained teachers ($M = 33.00$, $SD = 1.67$) produces a calculated t-value of 3.35 which is greater than the critical t-value of 1.98 at 0.05 level of significance. Hence, the null hypothesis of no significant difference in the assessment practices between the trained and untrained teachers is rejected in favour of the alternate hypothesis.

Table 3: One-way Analysis of Variance of Teaching Experience and Utilisation of Assessment Practices Descriptive

Group	N	\bar{X}	S	
0 to 4 years	9	34.33	2.74	
5 to 8 years	21	35.20	5.06	
Above 8 years	58	36.51	2.48	

Sources of Variation	SS	df	MS	F-ratio
Between groups	53.04	2	26.52	2.49
Within groups	903.95	85	10.64	

*Not significant at 0.05; df 2 and 85; Critical F = 3.07 It is seen in Table 3 that the calculated F-ratio of 2.49 is not greater than the critical F-ratio of 3.07 given (2 and 85 degrees of freedom) at 0.05 significance level. Hence, the null hypothesis of no significant differences in utilization of assessment practices due to teaching experience is retained. This indicates that teachers' use of assessment in teaching is not influenced by their years of teaching experience.

Table 4: Extract of t-test Analysis of Exposure to INSET and Utilisation of Assessment Practices

Gender	N	\bar{X}	SD	df	t	p
Exposure	61	36.44	3.11	86	2.09	0.039
No exposure	27	34.96	2.96			

*Significant ($p < 0.05$); t-critical = 1.98

Table 4 shows a significant difference between the assessment practices of those who had participated in INSET on classroom assessment ($M = 36$ $SD = 3.11$) and those with no such exposure ($M = 34.96$, $SD = 2.96$). The calculated t-value of 2.09 is greater than the critical t-value of 1.98 at significance level of 0.05 and 86 degrees of freedom. Thus, the null hypothesis of no significant difference between teachers exposure on INSET on classroom assessment and the utilization of assessment practices is rejected in favour of the alternate or research hypothesis.

DISCUSSION

Results from the study indicate that teacher characteristics such as gender and years of teaching do not influence their use of assessment practices in teaching and learning. The teachers' decision of utilizing assessment practices does not depend on being male or female or how long the person has taught. Teaching as a profession is embraced by both sexes. There is therefore no classification of its activities to be implemented by one's state of gender or a person's teaching experience. These findings corroborate Bassey *et al*, (2011) whose study revealed that teachers' use of assessment in teaching and learning was not influenced by such characteristics as gender and teaching experience. The findings also support Osadebe (2015) who found no significant difference between males and females in their assessment practices.

On the other hand, two variables that were found to influence teacher utilization of assessment practices were teachers' professionalism and exposure to in-service education and training on classroom assessment. With teacher professionalism, the focus was on whether a teacher's background training included course in education (trained) or without such courses (untrained). Classroom assessment is a course that is studied in almost all teacher trainee programmes in the various institutions. The course seeks to equip prospective teachers with adequate knowledge and importance of assessment to enable its integration in teaching and learning. Knowledge on assessment enables teachers to determine the extent to which instructional objectives are being achieved (Nitko, 2001; Okyere, *et al*, 2015) in relation to the broad goals of teaching and learning mathematics in the country. It also serves as a tool for making majority of decisions in the classroom (McMillan, 2008). Teaching goes beyond just communication of concepts to involve assessing students learning progress, identifying students' learning difficulties and remediation, assessing the effectiveness of teaching methods, providing guidance and opportunities for students learning (Bloor, 2002; Nitko, 2001; 2005; Okyere, *et al*, 2015). A teacher who has not taken any course in assessment is likely to have negative impact on perception and belief about classroom assessment and its integration into teaching and learning (Koloji-Keaikitse, 2012).

Teacher utilization of assessment in the classroom was found to be influenced by their exposure to In-Service Education and Training (INSET). Teachers who had the opportunity to attend a retraining exercise on classroom assessment were found to integrate assessment into teaching and learning than their non-exposure counterparts. This finding supports that of Koloji-Keaikitse (2012) who found in a study that teachers who attended professional development workshop in assessment believed to be more skilled in carrying out assessment practices such as criterion referenced testing, statistical application in assessment and testing procedures. Although most teachers might have taken and passed courses in assessment, there is the need to provide continued support for learning on the job. According to Adentwi and Baafi-Frimpong (2010), preparing teachers for the job does not end after completing college or university. Learning to teach is supposed to be a life – long affair. Through in-service education and training, teachers acquire new ideas, knowledge, values, skills and attitudes necessary to enhance their competencies and productivity (Adentwi & Baafi-Frimpong 2010; Kuranchie, 2015). Adentwi and Baafi-Frimpong add that a long graduating teacher who fails to attend refresher courses is likely to fusty and perform at a sub-optimal capacity. With the foregoing views on INSET, it is therefore not surprising that teachers who were exposed to this programme frequently used assessment in their job execution.

CONCLUSION AND RECOMMENDATION

Assessment is an indispensable tool in teaching and learning. It is the only way through which teaching effectiveness as well as students' progress with instruction can be ascertained. Assessment carried out during instruction enables students' learning difficulties to be identified and remedied at the appropriate time. Based on the importance of integrating assessment into teaching and learning, with most researchers reporting teachers' low level of use of assessment, the study focused on what characteristics of teachers influence utilization of this tool in the classroom. The results of the study revealed that teacher utilization of assessment is not influenced by gender and teachers' years of teaching. However, assessment usage in the classroom is influenced by the professionalism and exposure to workshop in assessment.

The study therefore recommends that as far as teaching is concerned, considerable attention should be paid to graduates who have education background. These people are believed to have taken some critical courses necessary for teaching and learning such as psychological bases of teaching and learning, curriculum studies and most importantly classroom assessment to mention but a few. It is further recommended that retraining programmes should be organised for in-service teachers with its focus on classroom assessment.

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