Formative Assessment and Learning: Science Teachers’ Perception at East Gojjam Preparatory Schools, Amhara Regional State, Ethiopia

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Abstract

Integrating different formative assessment strategies into daily instruction are the current assertion to improve students’ learning, particularly in science education. However, the practice of assessment for learning is not straightforward. It depends on many factors. Thus, this study was aimed at investigating science teachers’ perception on the pedagogical power of formative assessment to support students’ learning. The participants of the study were 153 science teachers in East Gojjam Preparatory schools. Questionnaire, semi-structured interview and lesson observation were used to get valid information about the issue. Percentage and mean were used to analyse the quantitative data. For the qualitative data content analysis was used. The results showed that teachers who participated in this study perceived formative assessment as variety of tools used to evaluate learning at the end of the lesson continuously. This was evident by their response inconsistency to items in the questionnaire and what they actually do in the classroom. Teachers’ lack appropriate knowledge and skill about assessment for learning strategies. Thus, it has negative implication on the integration of formative assessment strategies within their daily instruction to improve students’ learning.

Key Words: Science teachers’ perception; Formative assessment; Learning; Preparatory schools

Introduction

Current research evidences on classroom assessment have shifted our view of assessment from decontextualized to authentic; from using one single measure to using multiple assessment methods to build a student’s learning profile; from assessing simple facts and understanding to assessing high level of cognitive thinking and skills also; from assessing a few to assessing many dimensions of learning; from isolated assessment to integrating assessment within the learning and teaching practices; and from teacher directed assessment to student-centered assessment. These thinking emanates from cognitive constructivist and social constructivist learning perspectives (Suurtamm, Koch and Arden, 2010; Heritage, 2010; Willis, 2011; Cowie, 2012; Cowie, Moeland and Otre-Cass, 2013). As a result, formative assessment or assessment for learning appears as an integral part of teachers’ pedagogical practice, because it has a power to produce significant gains in students’ learning (Fisseha, 2010; Heritage, 2010; Harlen, 2010; Heritage, 2011; Swaffield, 2011; Gulikers, Biemans, Wesselink, and Wel, 2013).
According to Bruno and Santos, (2010), the power of formative assessment on students’ learning, especially, in science education is unquestionable. The study of Kingston and Nash (2011) also showed the significant effects of formative assessment on students’ achievement (cited in Herman, 2013). The main purpose of formative assessment is to identify the learning gap and provide opportunity for teachers and students to fill this gap or indicate next steps in learning (Bruno and Santos, 2010; Greenstein, 2010). In formative assessment, both teachers and students collect evidences together to advance students’ learning and achievement (Greenstein, 2010; Heritage, 2011).

Formative assessment enhances teacher-student interactions through providing opportunity to examine and reflect scientific ideas in the learning process. Formative assessment provides different opportunities for learners to reflect their ideas, to develop a sense of ownership, to evaluate their understandings and others (peers) and to understand valuable practices in the classroom community (Willis, 2011; Cowie, Moeland and Otrel-Cass, 2013). Thus, sharing of learning objectives and assessment criteria, provision of constructive feedback, active involvement of students through peer and self-assessment and effective dialogues are crucial to implement formative assessment effectively (Hodgson, 2010; Department for Children, Schools and Families (DCSF), 2010; Willis, 2011).

However, such assessment system is only effective when teachers have clear view about it. According to Gardner and Harlen (2010), teachers were considered as good agents of assessment changes. Teachers’ view and belief about the subject matter, teaching, learning, assessment, and students greatly affect instructional change, particularly their formative assessment practice (Baird, 2010; Cowie, 2012; Gulikers, Biemans, Wesselink, and Wel, 2013). Moreover, a study conducted in Ethiopia on teachers’ and students’ perception of continuous assessment showed the impact of teachers’ perception and belief on their assessment practice (Yigzaw, 2013).

Mostly, teachers viewed standardized tests as the main determinant of school effectiveness, report cards and grades as the main purpose of classroom assessment; and assessment as teachers-centered (Stiggins, 2009). Such thinking arises from the behaviuoral learning theory, which was the dominant theory in 18th and 19th century. Within the behaviourist paradigm, assessment focuses on the memorization of concepts, principles and formulas for the sake of exams (Taber, 2011), because the main purpose assessment as to this perspective is to select, rank and control students and schools based on their result. Due to this fact, teachers’ current assessment conception is detached from the current views of assessment, which focus on integrating assessment within daily instruction (Gulikers et al., 2013) to improve students’ learning.

Thus, teachers should realize assessment as an integral part of instruction, student–centered and a powerful means to improve science education (Cowie, 2012). Moreover, teachers need to provoke students’ prior knowledge or schema through effective dialogue, questioning, self-assessment, open-ended assignments, thinking and concept-mapping to support them to apply concepts and strategies in real situations (Hodgson, 2010). Thus, this study aimed at investigating science teachers’ perception on assessment for learning in the selected schools.
Research Methodology

To examine science teachers’ perception on assessment for learning at East Gojjam preparatory schools, mixed method research design was used. Mixed method research design is useful to capture the best from the quantitative and qualitative approaches to investigate the issue. There are 18 preparatory schools in Gojjam Zone, Amahara Regional State, Ethiopia. The schools were clustered into two based on their year of establishment, after that, 5 schools from each cluster were included in this study randomly. All teachers in the selected schools were subjected to fill the questionnaire but from the total of 186 teachers, 153 of them filled and returned the questionnaire. Eight purposively selected teachers were also included in the semi-structured interview and observation sessions to see their live and detailed view on assessment for learning.

The questionnaire has 34 closed-ended self-rated items. Thus, the respondents were asked to indicate their perceptions about assessment for learning using a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items in the questionnaire and interview were reviewed by peers and assessment professionals to establish the content validity of the items. Pilot testing was also employed to insure the reliability and validity of the items in the questionnaire. Accordingly, all the comments were included to improve the final questionnaire.

Finally, factor analysis was done to reduce the number of items in the questionnaire. The extraction method and the Varimax rotation of variables yielded three factor loadings namely, teachers’ perception on the: Power of formative assessment to improve learning (which accounts for, 21.33%), Involvement of students (which accounts for, 12.16%), and Provision of feedback (which accounts for, 11.22%). Totally the three factors accounts for 44.72% of the total variance in the questionnaire. Table 1.1 presents the reliability coefficient, factor loading, and percent of the variance explained by each factor.

Table 1.1 Factor structure of teachers’ perception of assessment for learning sub-scale

<table>
<thead>
<tr>
<th>No.</th>
<th>Factors</th>
<th>Reliability</th>
<th>% variance explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power of formative assessment to improve learning</td>
<td>0.877</td>
<td>21.30%</td>
</tr>
<tr>
<td>2</td>
<td>Involvement of students</td>
<td>0.708</td>
<td>12.20%</td>
</tr>
<tr>
<td>3</td>
<td>Provision of feedback</td>
<td>0.729</td>
<td>11.20%</td>
</tr>
<tr>
<td></td>
<td>% of Total variance Explained</td>
<td></td>
<td>44.70%</td>
</tr>
</tbody>
</table>

Descriptive statistics such as percentage and mean were computed for the three factor loadings and for each item in each factor to determine areas of assessment for learning that teachers positively and highly perceived. For the qualitative data, content analysis was used.

Results

Teachers’ perception on the power of formative assessment to improve learning

Most science teachers reported higher level of agreement in each item in both factors. However, items loaded on teachers’ perception of the “Power of formative assessment to improve learning” factor were
highly perceived by most science teachers in the selected schools. Particularly, most teachers (92.2%, 91.5%, and 90.2%) agreed on the idea that formative assessment is an integral part of the teaching learning process, that helps them to easily identify students’ problem in learning, and it allows students to know more about their own learning problems respectively.

Relating to its application, 80.4% of the teachers believed that formative assessment is vital to assess higher order thinking, to ensure all students to have an experience of success and it makes all of them competent learners (83%), and it improves every student’s achievement in science subjects (82.3%). Likewise, most science teachers in the selected schools agreed that formative assessment is a means to capture students’ attention and efforts (83.6% and a mean of 4.07), to start their study from day one (81% and a mean of 4.02), to develop positive self-esteem and confidence among all students (86.9%), and to make all of them independent learners (75.8%) by fostering their internal motivation to learn science subjects (79.7% and a mean of 4.03).

Similarly, reasonable numbers of teachers seem to realize the importance of integrating formative assessment with daily science lesson to improve learning, to assess the effectiveness of the teaching learning process and to decrease students’ dropout and repetition in one class (86.9%, 80.4%; and 72.5%) than summative assessment respectively. Moreover, most of the science teachers reported that sharing of learning objectives and assessment criteria are vital to motivate students to learn (83.1%), to enable them to assess their own progress (83%) so that they improve their learning (86.3%). Thus, the result of this study gives the impression that most teachers in the selected schools have positive perception about the power of formative assessment to improve students’ science learning.

On the other hand, 86.3% of the respondents negatively perceived formative assessment as a process that follows the teaching-learning process which supports the behavioural learning perspectives on assessment. This means that formative assessment is viewed as a tool that is used to evaluate students’ progress continuously in the lesson learnt rather than a means to improve their learning. Such contradictory responses of teachers on the same table indicate their misconception about formative assessment. The lesson observation and interview result also validated it. Even if, most teachers seem to have positive perception on the power of formative assessment on learning, the qualitative data revealed that many of these teachers did not effectively integrated formative assessment into their daily instruction.

**Teachers’ perception on the active involvement of students**

From the three factor loadings, the second ranked factor was teachers’ perception on the “Involvement of students” in the lesson. Most teachers (90.8% and mean of 4.28) reported high level of agreement (perception) on the importance of active involvement of students in the assessment process to improve their learning. Along with, most teachers’ responded that the implementation of formative assessment allows such active engagement of students (90.2% of respondents with a mean of 4.22) in the teaching learning process.

In addition, teachers agreed on the significant role of formative assessment strategies such as the provision of constructive feedback (89.6%), self-assessment (86.3%), peer assessment (77.7%), and
questioning (84.3%) for active engagement of every student in the lesson to improve science learning. Reasonable number of teachers also highly perceived the advantage of giving long thinking time during questioning to engage every student throughout the lesson (77.1% with a mean of 3.81). Thus, science teachers have high level of positive perception about students’ active engagement in the lesson to improve their learning in the selected schools. And they perceived formative assessment strategies as a means for such active engagement. However, what was evident from the actual practices was that those teachers participated in this study did not actively involve their students in the lesson through student-centered formative assessment strategies. The result indicates a mismatch between what teachers perceived and what they actually practiced in the classroom. This happened because of skill gap among science teachers in the selected schools.

**Teachers’ perception on the provision of formative feedback**

Teachers’ level of agreement on the items that are related to the “Provision of feedback” factor was also high. Particularly, 95.5% of the respondents agreed on the purpose of using variety of assessment methods to get useful insights about students’ progress. And they viewed formative assessment as the solitary means that used various assessment methods to gather relevant learning evidences (90.1%) and to inspire students’ deep thinking in science subjects (87.6%). Moreover, they positively perceived the provision of formative feedback as one of the key component in formative assessment (87.6%), to identify gaps and to fill such gaps in students’ understanding (86.3%), and to support or inhibit students’ motivation to learn (54.9%).

In contrast, sensible number of teachers in the selected school believed on the provision of detailed correction of students’ work (74.5%) and marks (64%) as effective way of feedback to improve science learning and to provide directions for students about their progress against the learning objectives. The qualitative data also showed that the majority of science teachers mostly provide mark for any of the assessment tasks, grant with correct and wrong answers, allow students to see the results, and finally record it. However, this kind of feedback did not give direction for students to know where they are in relation to the learning objectives and success criteria to identify the gaps in their learning. It looks like that those teacher in the selected schools are dominantly challenged by the traditional way of judgmental feedback. Thus, in this study teachers were not accustomed to deliver feedback in a constructive manner to identify students’ learning gaps and to decide next steps for future learning.

The following points extracted from the interview transcript which provides insights about science teachers’ perception on formative assessment. “Teacher A” considered formative assessment as a tool used to evaluate students’ understanding in the teaching learning process to know how much they understand the day to day learning concepts. For example:

> Formative assessment is an assessment that is used to evaluate students’ day to day lesson understanding and it includes, class work, homework, oral questions, assignments, tests... that are frequently given at the end of the lesson, whereas, summative assessment is used to evaluate their understanding at the end of the semester or course (Teacher A, Nov 20, 2014).

Other teacher perceived formative assessment as a good tool to capture students’ attention and effort throughout the lesson, because as to him, it is a continuous and unexpected process. One example:
... Formative assessment is a day to day activity to know students’ understanding about the lesson. It also helps students to be ready in each day; to be active participant in the lesson, and to be conscious in their learning, because they assumed that the teacher may give surprising assessment tasks that have mark or ask them randomly (Teacher C, Nov 18, 2014).

“Teacher B” perceived formative assessment as a more frequent assessment method that empowers students but he considered it as a good murder for himself. He stated as:

Formative assessment is a continuous process that helps students to know their level of understanding in the lesson and to have good understanding about the content. It also helps teachers to make healthy teaching-learning process and to categorize students into different groups based on their ability (i.e. to make 1to 5 grouping). However, it is a very tiresome and difficult task for teachers (Teacher B, Nov 19, 2014).

“Teacher H” has a good understanding about the concept of formative assessment, but he interprets and uses it wrongly.

...Particularly, formative assessment is a process that starts at the beginning of the lesson to assess students’ day to day performance and to identify students’ needs and to assist them accordingly. Thus, it is used to evaluate students’ ability in a certain activity, to classify students into different groups, and to give tutorial according to their group and to give feedback for students to know themselves where they are (Teacher H, Nov 18, 2014).

One teacher was in doubt about the power of formative assessment to improve students’ learning; she considered it as a day to day /continuous/ collection of marks. She stated that:

... If we did not assess students’ understanding continuously, we did not know students’ daily progress in a subject. ... However, if we implement formative assessment continuously, we are not teaching students to make them competent and to achieve the required competencies (skills, knowledge and attitude) in the subject. Our work becomes continuous assessment, which does not help students to be competent in a subject. Formative assessment by itself is not an active teaching method, but it helps us to modify our teaching methods, because when students results become low the teacher asks him/herself to change his/her methodology to make all students high achiever or to modify their results (Teacher E, Nov 14, 2014).

“Teacher G” also expressed his lack of awareness about formative assessment strategies. And he feels that he need appropriate continuous professional trainings to implement formative assessment strategies in his lesson. By saying:

... I used formative assessment tools once a week to make all students competent to pass into the next grade and to make all of them good citizens. In addition to this, I used oral questions, group discussion, class activity etc. but I am not aware whether such activities are formative assessment methods or not. I simply implement it (Teacher G, Nov 18, 2014).

From their expression, all of the interviewed teachers connect feedback with the provision of correct answers, marks and detail answers for difficult questions. It was validated through lesson observation. For example:
Discussion

**Teachers’ perception on assessment for learning**

As mentioned in the introduction, the perceptions that every teacher holds are a result of their personal experiences and assumptions. Therefore, probing teachers’ perception about assessment for learning is important in the sense that it provides an indication of how different assessment for learning strategies are being used or misused because teachers’ perception on assessment affected their assessment practices (Baird, 2010; Cowie, 2012; Gulikers, Biemans, Wesselink, and Wel, 2013). The results of this study showed that science teachers in the selected school held misconception about assessment for learning. This was evident by their response inconsistency to items related to the power of formative assessment on learning and the provision of constructive feedback to students and what they actually do in the class. The details were presented below.

**Teachers’ perceptions on the power of formative assessment to improve learning**

The majority of science teachers’ reported as they have high level of positive perceptions on the power of formative assessment to improve students’ learning. Large number of teachers agreed on that formative assessment was an integral part of the teaching learning process. Moreover, they agreed on the power of formative assessment to identify students’ problem in learning, to improve every students science achievement, to empower students to study from day one, to capture students attention and effort, to develop students positive self-esteem and confidence, to motivate students to learn, to ensure all students to have an experience of success and to make all of them competent learners, and to reduce the rate of repetition and dropout than summative assessment.

On the other hand, most teachers perceived that “formative assessment follows the teaching learning process.” This is synonymous with the inspiration of traditional assessment theorists, who viewed assessment and instruction as two separate elements. As indicated in the introduction, teachers who strongly advocated the view of behavioral learning theories mostly developed negative perception about formative assessment. They mostly viewed formative assessment as an instrument used to evaluate students’ learning continuously and to provide judgmental feedbacks accordingly. However, formative assessment is multidirectional, contextualized, and integrated with the instruction which is used to collect learning evidences and to identify the gaps in students’ understanding to decide the next steps in learning (Heritage, 2010; Bruno and Santos, 2010; Greenstein, 2010).

Most of interviewees similarly perceived formative assessment as tests, assignments, oral questions, class works, home works, mid exams… that teachers gave at the end of the lesson or a topic to evaluate students’ level of understanding continuously, to classify them accordingly and to record their marks for
final result. But, as different evidences indicated in the introduction formative assessment is far from continuous or day to day evaluation of students’ understanding. As mentioned above, what makes any particular assessment formative is not the specific assessment tool employed continuously but how the information gathered from the tool is used to improve learning and to adjust instructional strategies toward the learning goals. However, if formative assessment tools were administered at the end of a lesson, the major purpose would be to evaluate students’ understanding of subject matter and not necessarily to help students and teachers to get evidences for further learning. Such inconsistency in teachers’ perception about the power of formative assessment to improve learning indicates their lack of theoretical knowledge and consistent practice of assessment for learning in science subjects.

**Teachers’ perception on the active involvement of students**

Currently, learning is viewed as an active process in which the learner constructs and reconstructs meaning for him or herself. Due to this fact, most science teachers in this study also positively perceived the importance of active involvement of students in the lesson through self-assessment, peer assessment, questioning, and effective feedback to improve their learning. Moreover, they believed on the provision of long waiting time during questioning to engage every student in thinking and answering higher order questions. Despite this fact, most of the observed teachers did not provide such chances for their students in the actual classroom practices to engage them actively in the lesson. They mentioned shortage of time and broad content coverage as the main factors.

Active involvement of students in the learning process is the heart of formative assessment to improve their science learning, because formative assessment is a collaborative process between teachers and students and among students (Greenstein, 2010; Heritage, 2011). Formative assessment provides different opportunities for learners to reflect their ideas, to evaluate their understanding and others and to understand valuable practices in the classroom community (Willis, 2011). Also teachers who participated in this study perceived formative assessment as the means to actively engage their students in the lesson. However, in all of the observed schools, formative assessment strategies were not embedded as an integral part of the instruction (as an active teaching method) to improve students’ learning, except simple oral question. Even, the questions were also not used for learning rather for evaluation purpose. Therefore, there is disparity what teachers perceived and what they actually practiced in the classroom. It indicated that teachers had gaps in their skills as well as in their theoretical knowledge. Teachers mentioned a number of reasons that might contribute to failure to grasp the appropriate knowledge and skills about formative assessment strategies and to translate the theoretical knowledge into practice.

**Teachers’ perception on the provision of formative feedback**

Almost all of science teachers believed on the importance of using a variety of assessment method to get comprehensive evidence about students learning. And formative assessment was the one that allowed them to use such variety of assessment methods. Similarly most teachers believed feedback as a dialogue between teachers and students to identify gaps and to fill it and to improve learning. Yet, teachers in the
selected schools failed to put such variety of assessment methods into practice to improve students’ learning.

Even though they considered feedback as a key component of formative assessment to improve learning, they also negatively perceived it as detailed correction of students work. Moreover, they believed that giving scores or marks provided direct direction for students about their progress against learning objectives. Thus, feedbacks in the selected schools were considered as provision of detailed correct answers and marks. The qualitative data also confirmed it. Many writers agreed that effective feedback should initiate thinking, give them insights about their work, identify students’ learning gap, allows learners to develop self-reflection and empower learners to become self-regulated learners (Moss and Brookhart, 2009; Bruno and Santos, 2010; Hodgson, 2010; Sadler, 2010; Orsmond and Merry, 2011).

Generally, this study revealed that there was a clear gap in science teachers’ perception of assessment for learning and its strategies and how they actually put it into practice in the selected schools. Therefore, appropriate trainings and supports should be given for science teachers in the selected school to change their perception about assessment for learning and as a result to implement it effectively to improve students’ learning.

Conclusion

Regarding teachers’ perception about assessment for learning, the quantitative data revealed that most science teachers seemed to have positive perception on the instructional power of formative assessment and the active engagement of students in the assessment process to improve science learning standards. In contrast, most science teachers’ perceived:

- Formative assessment as a process that follows the teaching learning process;
- Detailed correction of students work is effective way of feedback to improve learning; and
- Scores or marks provide direction for students about their progress against learning objectives.

Such kind of responses demonstrated an influential sense of perception in the behavioural view of assessment. Moreover, most of the interviewed teachers perceived formative assessment as variety of tools that continuously used at the end of the lesson to evaluate students’ understanding and to collect marks. The lesson observation also confirmed that. Most teachers practiced formative assessment accordingly. Thus, we can conclude that even if it seems that most teachers have positive perception on assessment for learning; their response instability on the items and the qualitative data disclosed their negative perception and as a result the impoverishment of the implementation of assessment for learning to improve students’ science learning in the selected schools. This clear discrepancy happened because of teachers’ lack of appropriate knowledge and skills about formative assessment strategies and its role in learning. Generally, teachers who participated in this study perceived formative assessment as variety of tools used to collect a piece of marks at the end of the lesson continuously. Thus, school administrators, teacher training institutions, and policy makers should evaluate the appropriateness of the assessment trainings given to implement formative assessment for the sake of learning.
References


