



Enhancing Formative Assessment Strategies in Biology Education: A Case Study of Secondary School Practices and Student Achievement

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Abstract: *The present formative assessment techniques of biology instructors and their effects on student achievement were the focus of this qualitative research. One community ordinary-level secondary school in Moshi municipality was the focus of the case study methodology. Two biology professors and twenty students chosen at random from courses that do not take national exams were engaged in it on purpose. A study of students' workbooks, classroom observations, focus groups with students, and semi-structured interviews with instructors were used to gather data. Using interpretative phenomenological analysis, themes were developed from the data after their literal transcription. The results demonstrated that the majority of evaluation methods relied on teachers asking questions orally. The Biology instructors didn't appear to be acquainted with other tactics like student-student interactions, descriptive feedback, peer evaluation, or discussing learning aims with students. Researchers concluded that children would benefit from more effective use of formative assessment strategies in the classroom if instructors received in-service training on the topic.*

Keywords: *Formative assessment, feedback, peer assessment, classroom questioning, student's learning, and performance*

Introduction

The use of formative assessment has grown in popularity in the field of education in recent years, marking a paradigm change in the assessment landscape. The change is due to the fact that formative evaluation is a crucial component of effective proficient instruction and learning (Gavotto-Nogales et al., 2015). Additionally, it is an ongoing process that incorporates a number of behaviours, including communicating learning goals and assessment criteria to students, having students evaluate one another, providing feedback, engaging in collaborative learning activities, and finally, self-evaluation. Assessment for learning, also known as formative assessment, is a cycle of evaluations that

enable educators and learners to fine-tune their pedagogical practices (Heritage, 2007). The first step in formative assessment is for the instructor to determine the students' level of topic knowledge. Then, they will communicate the learning goals and evaluation criteria to the students.

The next step is to have students work together to complete learning objectives-based collaborative projects (Moss & Brookhart, 2012). Peer assessment empowers students to take ownership of their learning. It requires them to evaluate each other's work using predetermined criteria and provide detailed feedback on where they went wrong and how to fix it (Gavotto-Nogales et al., 2015; Landry et al., 2014). Students are better able to evaluate their own learning progress when evaluation criteria and learning objectives are shared (Moss & Brookhart, 2012). Evidence of students' learning is developed during classroom teaching using information acquired via classroom inquiry and collaborative learning exercises (Wiliam & Thompson, 2008). Teachers and students alike may benefit from analysing and interpreting this data (Gavotto-Nogales et al., 2015; Panayiotis & James, 2014). Thus, teachers have been using formative assessments to see whether their students have a grasp of the material and where they are struggling, and they have been working to address those students' weaknesses, while summative assessments are crucial for tracking students' progress over time. Refer to (Black & Wiliam, 1998; Guskey, 2003). The literature (Kurebwa & Nyaruwata, 2013; Salema, 2017; Tarmo, 2014b) shows that instructors are still using teacher-centered, conventional evaluation and teaching methods, which hinder students' ability to get competence. The purpose of this research was to look at the current state of formative assessment methods in the classroom and how instructors are using them to help their Biology students learn and achieve better.

Methodology

A qualitative research strategy based on a case study design was used in the study. Yin (1994) said that a case study was the best method to use since it aimed to provide a detailed and thorough explanation of a social phenomena. The research included the deliberate selection of a single community secondary school operating at the ordinary level. Form 1 and 3 classrooms that do not take national exams were the subjects of the research, which included 20 students and 2 biology professors. Teachers were surveyed via semi-structured interviews, students were surveyed through focus groups, classroom observations, and students' workbooks were reviewed. Every interview was

videotaped and lasted for forty minutes. Although the researchers did not record each FGD, they did take notes for the thirty minutes that each one lasted. Also, since every student was already fluent in Kiswahili, all FGDs were held in that language. In order to make sense of the data, interpret them, and create a narrative account of the experiences, the researchers in the study used interpretative phenomenological analysis (IPA) (Smith et al., 2009). Initial steps in the study included transcribing the audio recordings of the interviews. Subsequently, the transcript was read aloud many times to maintain the integrity of the original narrative. The data from the focus group discussions were accurately translated into English. Word per word, the transcription was done. Manual coding, sorting, and theme generation were performed on interview and FGD data using Microsoft Word. According to Igor and Smith (2014), the information was confirmed by interpreting the themes and using them to construct a narrative plot out of the transcripts. Adu (2017) and Yin (1994) highlight the use of data from observations and document analysis to validate the information gathered during interviews and focus group discussions.

Findings

Current Formative Assessment Practices

Classroom questioning and end-of-topic exercises

The current study's results demonstrated that, while covering a subject, instructors use activities such as group projects, quizzes, and exercises. In addition, the majority of these exercises were not graded, and the questions tended to be at a lower level of Bloom's taxonomy, which places an emphasis on conceptual memory. Students may not have many chances to assess their own learning progress because of this. This means that addressing problems and thinking critically are not often encouraged by the activities. Teachers rely on oral questioning to gauge students' conceptual knowledge and promote classroom interactions, according to the results. Remarks were made by one of the participating educators: *"Oral questioning is easy and I can make self-evaluation during the lesson..."* (Teacher's voice; P1).

Another teacher claimed that;

I mostly use oral questioning because it is an easy way to assess many students and it encourages them to participate during the lesson. Oral questions motivate students especially when I appreciate students' responses. (Teacher's voice; P2)

Furthermore, pupils sat quietly throughout lessons while instructors took the lead in asking questions aloud. Teachers often left questions unanswered or answered their own questions when pupils couldn't come up with replies; the questions themselves were of low level. While students were learning, instructors noticed a number of questions, including: *"Define excretion."* *"...List the five kingdoms of living thing"*

Students ask very few questions when teachers are talking, according to the results of the research. Neither the instructor nor their classmates received many inquiries from the students. Feedback from focus groups with students focuses on:

Some time you are afraid to answer a question because you can't pronounce English words properly and if pronounce badly others will laugh. (Student's 1 voice).

Another student stated that:

"Most of us do not go to the teacher for help (if you don't understand), you just disregard it." (Student's 2 voice)

The dominance of the instructor or the students' incapacity to comprehend the English language used in class are two possible explanations for why students do not ask enough questions during sessions. Thus, such an environment is not conducive to student-to-student learning via questioning and may also restrict data collection that may show learning has taken place.

Nature of Classroom Interactions

The results showed that instructors use oral inquiry as a tool to promote class participation. According to these results, the basis for teacher-student engagement in the classroom is teacher-questioning. However, it was also shown that peer-to-peer contact aided in learning and formative evaluation. The results of the focus group discussions showed that students are able to teach and learn from one another. As mentioned by one of them:

Group works help us to learn from one another so if you initially did not understand a concept, then you will understand it during the discussion... (Student's voice retrieved from FGD)

Peer Assessment

Students were able to communicate with one another in small groups, but they were unprepared to evaluate one another's progress towards learning goals. Peer evaluation, according to some, is not a reliable method of evaluation. Additionally, the results demonstrated that using peer assessment on an as-needed basis is fraught with difficulties, such as students' inherent biases both before and after the evaluation process. Students' significant agreement in focus group discussions that peer evaluation was difficult to implement confirmed this;

Peer assessment is not a good thing because when my fellow student assesses my work will do it badly maybe due to envy or jealous and when my peer knows my results, he/she will gossip about them and I will feel terrible (student's 1 voice)

Another participant stated that:

Peer assessment is a bad thing and we do not want it at all because when my peer finds out my marks, he/she will speak ill about me especially if I have failed (student's 2 voice)

Here, the author argues that one common misunderstanding of peer evaluation is that it entails students only grading one another's work without providing any kind of mutual assistance. Moreover, students' apparent ignorance of the concept of peer evaluation implies that professors seldom use it effectively in the classroom. Thus, it's safe to assume that incorporating peer feedback into the classroom is still a relatively unexplored area.

Sharing of Learning Intentions with the Students

Additionally, it was shown that instructors seldom communicated the learning outcomes to their pupils. Rather, they only tell the pupils of the subject or topics that will be discussed. One of the pupils made the following statement about it:

The teacher shares with us only the topic to be covered (Student's 1 voice).

Another student noted:

At the beginning of the lesson the teacher tells us the topic to be covered (Student's 2 voice).

Another student commented:

Sometimes the teacher just begins to teach without telling us the topic (Student's 3 voice).

During class, students probably didn't pay much attention to their own successes, failures, and opportunities for growth.

Nature of Feedback

Students' work included mistake flagging techniques like question marks, circles, and lines, and biology professors favoured grading and scoring to foster student rivalry, according to the study's results. Also shown by the results was the fact that all of the questions from the examinations and exercises were revised by the instructors on the chalkboard. The results show that teacher corrections are the most popular form of written feedback, and that instructors consider group corrections to be the most effective kind of feedback. Teachers' use of punishment as a feedback mechanism was also shown by the data. Students who received failing grades were subject to disciplinary action. Students and educators alike shared their thoughts on the topic of punishment-feedback. A instructor made a comment:

If they fail so much, I may go and give them punishment because I think they are not studying hard (Teacher's voice P1).

"If you fail and scored F, then you are caned" (Student's 1 voice from FGD), says one student. Teachers seem to use a variety of positive and negative comments depending on the scenario. However, students are seldom given detailed comments on their work that show them where they excelled and where they may need improvement.

Teachers' Knowledge on Formative Assessment Practices

Teachers' lack of understanding about formative assessment was highlighted by the study's results. Their behaviour reflects this as well, since they seldom employ formative assessment tools like descriptive feedback and peer evaluation. So, we interviewed educators to get their take on formative assessment, and here's what one of them had to say: *"I don't remember; Formative Assessment is guidance and counseling..."* (Teacher's voice p1)

Another teacher said:

Formative assessment is an assessment that is conducted to evaluate the achievement of the lesson taught based on the

lesson objectives through classroom tasks and questioning.
(Teacher's voice P2)

Teachers' existing methods, which do nothing to promote Biology learning, are influenced by a lack of awareness about formative assessment, among other variables that govern their practice.

Discussion

Finding out how instructors of biology now use formative assessment and how it affects their students' learning and performance was the driving force for this research. In order to determine whether students are learning and if they are keeping up with the learning process, assessment is an essential part of education. Andersson and Palm (2017) and Black and Wiliam (2010) found that formative evaluation significantly improved learning and performance, particularly for students who had previously performed poorly. The problem is that students' development is hindered since instructors only use a few tactics for formative evaluation. The current research found that instructors favoured a few tactics, including oral questioning and few classroom examinations. Consistent with the results of Arslan (2006), who said that instructors' questioning has a greater rate of recurrence than students' questioning throughout the class, the present research found that teachers are employing oral inquiries as part of formative evaluation.

But as pointed out by Almeida (2010) and confirmed by the present research, the questions asked by instructors place an emphasis on memorising and rote learning. The National Examination Council (NECTA) administers national examinations in Tanzania, and research by Salema(2017) and Mkumbo (2012) confirms that biology questions on these exams place a heavy emphasis on memorization and comprehension. One may argue that questions like these restrict the ability to think critically and apply principles from biology. Findings from this research are consistent with those from Tarmo (2014) and Ndalichako (2015), which found that instructors use conventional evaluation procedures that restrict inquiry learning. Teachers are more likely to answer their own questions before moving on to a new topic or altering the kind of their questions when students are unable to do so, according to a prior research (Tarmo, 2014). This result is in line with this theory. Based on these observations, it is evident that instructors either don't take the time to use formative assessment strategies to support students' learning or are in a hurry to cover all of the material in the class. Teachers place a premium on covering all of the material in the syllabus, according to research by Komba and

Mwandaji (2015), and as a result, they seldom wait for periodic assessments to reveal how their pupils are doing in class. According to Stiggins (2002), who also highlights the significance of formative assessment, students' self-esteem, motivation, and feeling of agency over their own education are all positively impacted by classroom inquiry. Furthermore, this study's results demonstrate that instructors heavily use the lecture style, which is fundamentally incompatible with competency-based learning. Such lecturing contradicts the findings of Costa et al. (2015), who found that students learn from one another via group projects and comments made by their classmates.

They go on to say that classroom relationships have an indirect impact on students' ability to learn and their grades. Wang (2017) concurs, noting that students are more engaged when they have opportunities to ask and answer questions alongside their classmates. Research by Gavotto-Nogales et al. (2015) shows that pupils retain more knowledge when teachers use their own language. Consequently, it enhances memorization and comprehension of concepts (Siddig & AlKhoudary, 2018). The majority of students in this research did not actively participate in class discussions or ask questions of either the instructor or their classmates. Furthermore, instructors never used tactics for collaborative learning to promote student-to-student communication. More than fifty pupils in a single classroom seemed to significantly reduce the likelihood of productive interactions. The current study's results on the challenges of engaging in a crowded class are consistent with those of De Paola et al. (2013) and Yelkpiery et al. (2012). The results of the current research are at odds with those of Adimonyemma et al. (2018), who found that student-to-student interactions were very effective in big courses. That is to say, there are still opportunities for students to learn from one another, even in very big courses. Teachers seldom use peer evaluation in the classroom, and pupils don't grasp its value for learning, according to the current research. Teachers do not use peer evaluation in their courses, according to Komba and Mwandaji (2015) and Salema (2017). The results of Alzaid (2017) also show that students are seldom taught the whys and hows of peer evaluation by their instructors. Students tend to either give their classmates too much or too little credit for their efforts, according to Pocock et al. (2010). On the other hand, as Double et al. (2020) point out, peer evaluation is a method that encourages students to engage with one another and the material in class. Peer evaluation also requires students to evaluate both their own and their classmates' work in relation to it (Gavotto-Nogales et al., 2015).

In spite of this, Moss and Brookhart (2012) state that students' learning and performance are significantly enhanced when they share their learning goals. Teachers seldom communicate the learning goals to their pupils, according to the current study's findings. Findings indicate that instructors do not convey the lesson's intended goals. The result is that pupils have no idea what their future holds. Similarly, Ndalichako's (2013) research shows that pupils aren't able to gauge their own progress towards objectives since professors don't lay out specific standards for success. Students are able to self-evaluate and be informed about their own learning progress when instructors verbally communicate the learning goals and use learning activities that reflect them (Stiggins, 2002). In order to properly relay learning goals to students in a simplified language, instructors should understand the learning target before the session (Leahy et al., 2005). To some extent, I feel that I see fewer examples of teachers in biology classes really communicating their goals for their students' education. Teachers indicate students' "errors" with written remarks and utilise them to check, correct, and elaborate on their responses, according to the study's results. Teachers also utilise score comments to gauge their pupils' academic standing and encourage healthy rivalry among them, according to the results of this research. There is a growing disparity in pupils' levels of achievement due to the prevalence of school-wide contests (Rahman, 2018).

When instructors provide greater attention to students who score higher, the students who score lower often fall between the cracks. However, as Black and Wiliam (1998) show, low-achieving students benefit from descriptive and personalised feedback, which leads to improved learning outcomes. Notably, Ozan and Kincal (2018) found that lesser performers were more engaged in class when feedback was based on their speed. In addition, the results show that professors seldom provide students specific comments on where they went wrong and how to fix it. This shows that pupils are missing out on crucial knowledge that may help them learn and perform better. This is due to the fact that students are better able to identify and address areas of weakness when they get detailed feedback (Hattie & Timperley, 2007; Heritage, 2007). Feedback that is both timely and constructive helps students understand their work better and provides direction for future projects in relation to learning goals (Gavotto-Nogales et al., 2015; Moss & Brookhart, 2012). That is why educators should frown upon comments that make pupils feel superior to one another. Researchers found that when pupils get failing grades, instructors often reprimand them. Teachers penalise pupils who do not

achieve the standard, according to research by Abejehu (2016), Ndalichako (2013), and Rahman (2018). According to Al-Bashir et al. (2016) and Ndalichako (2013), using punishment as a feedback method is detrimental since it discourages pupils and encourages them to have poor self-esteem. Based on this, Brinko (1993) and Heritage (2007) state that comments should inspire students to do their best and foster an encouraging classroom climate. Hence, educators should make less use of critical comments when teaching. This study adds to the growing body of research showing that educators lack the necessary expertise to implement successful formative assessment practices (Andersson & Palm, 2017; Kitta & Afeli, 2017; Kurebwa & Nyaruwata, 2013). A lack of understanding of formative assessment procedures among educators is likely to be one of the obstacles to students' ability to learn and succeed in Biology classes.

Conclusion and Recommendation

This research supports the use of non-traditional evaluation tools to collect data on student progress. The former happens when educators think critically about assessment results and incorporate them into their lesson plans. Consequently, it is essential that pre-service teachers get training in formative assessment procedures, particularly in the following areas: collaborative assessment activities, self-evaluation, descriptive feedback, and peer assessment. Reason being, students' learning and performance may be greatly enhanced by instructors' usage of formative assessment procedures in the classroom.

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