INTERNATIONAL JOURNAL OF CONTEMPORARY AFRICA RESEARCH NETWORK
Publication of Contemporary Africa Research Network (CARN)
Volume 2 (1), 2024
ISSN: 1115 – 585x
Available online: https://journals.iapaar.com/index.php/ijcarn/issue
DOI: 10.5281/zenodo.10594451

Enhancing Learning and Performance in Mathematics through Effective Assessment Feedback: Insights from Third-Year Secondary School Students and Mathematics Instructors in Moshi Municipality

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Abstract: *The purpose of this qualitative research was to examine how third-year secondary school pupils in Moshi Municipality benefited from assessment comments in the area of mathematics. Math instructors' perspectives on the impact of assessment feedback on their students' learning and performance were investigated in this research. Two community secondary schools provided the twenty-four students and two mathematics instructors that made up the sample. The research collected data using a case study approach, which included classroom observation, interviews, focus groups, and document analysis. Next, the data was organised into topics, categories, and patterns using coding. Maths classrooms heavily relied on task-level evaluative input, according to the results. Verbal and written evaluation feedback at this task level does not assist students in gaining a thorough grasp of different ideas via the process of making adjustments and solving comparable mathematical problems, which might ultimately lead to improved learning and performance. Findings from the research support the idea that in-service educators would benefit from frequent professional development courses that train them to provide students constructive criticism. Students' learning and performance in mathematics at CSEE will be improved as a result of the programmes' ability to help instructors provide appropriate feedback.*

Keywords**:** *Assessment feedback, effective feedback, formative assessment, Mathematics classrooms, learning and performance*

Introduction

Many Tanzanians are worried about the students' poor scores in the Certificate of Secondary Education Examinations (CSEE) in Basic Mathematics. This topic has been declining in performance for a long time,

despite being a key subject at the ordinary level of secondary school (Mabula, 2015; Masele & Tweve, 2018; Mazana et al., 2020). For instance, according to NECTA (2020), only 20.03 percent of CSEE 2019 test takers were successful. Eighty percent of those pupils were unsuccessful. Concerns among assessment stakeholders over students' Maths performance persist, with a focus on whether or not these students will be prepared to deal with the rapid technological change that is occurring in the modern world. Math plays a significant role in inventing and improving several ideas in science and technology, and it is also an essential component of these fields (Mazana et al., 2018).

There are a number of causes for the widespread mathematical underperformance in secondary schools. According to Masele & Tweve (2018), Mazana et al. (2018), Mutodi & Ngirande (2014), and others, these factors include students' self-confidence, the availability of learning resources, their interests in Mathematics, the tactics used to teach and study the subject, and the attitudes and practices of families. A number of aspects are related to the school and even the parents, while others are related to the students and instructors. According to research (Black & Wiliam, 2010; Pokorny & Pickford, 2010), assessment feedback is one of the most important variables influencing students' learning and academic performance across a range of topics. But according to Anderson and Palm (2017), the quality of feedback students get from instructors and classmates determines how much they learn and how well they do in any given topic.

Assessment Feedback Practices in Tanzania

After realising that content-based curricula wouldn't cut it in the modern day, Tanzania adopted a competence-based curriculum in 2005 for secondary school students' education and evaluation (Komba & Kira, 2013). The quality of the feedback that students get from their instructors has a direct correlation to how well competence-based curricula work (Kumar & Rajasekhar, 2019). The nation has been employing competence-based curricula for a long time, however research shows that instructors aren't adopting feedback-centered formative assessment (Komba & Mwandaji, 2015). Maths instructors lack expertise in feedback offering, which prevents them from providing students with constructive criticism (Lema and Maro, 2018). In both the exercises and the test scripts, teachers often utilise checkmarks like crosses and ticks to indicate whether pupils have answered correctly, along with more general remarks that aren't always pertinent.

Teachers criticise low-achieving students without taking their sentiments and emotions into account while providing criticism, according to Kyaruzi et al. (2019). Because of this, these students are less likely to implement the suggestions made in their comments. Furthermore, there seem to be a number of variables that impact the kind of feedback that students get from their teachers. These include teachers' lack of feedback literacy (Lema & Maro, 2018) and classrooms with a high ratio of teachers to pupils (Ndalichako, 2017).

Feedback and Students' Learning

Feedback has the ability to significantly improve pupils' learning and academic performance, according to studies. Students may benefit from thorough comments made by instructors or classmates before going on to the next unit or evaluation (Kyaruzi et al., 2018; Owen, 2016). Yet, feedback has an impact on students' learning only when it is both high-quality and relevant, and when students themselves acknowledge its significance (Crichton and McDaid, 2016). Therefore, it is critical for students' learning how their professors perceive their evaluation comments. When students find the feedback they get from professors to be helpful, they are more likely to utilise it to improve their grades. Students are looking for and appreciate it when professors point out where they went wrong and provide suggestions for how to do better on future assessments (Kyaruzi et al., 2019). This tends to imply that students only benefit from feedback that they perceive as beneficial, rather than all input (Brown et al., 2016; Harris et al., 2014). As a result, students are more likely to actively participate in their learning when they get specific, actionable feedback that they can use to improve their performance on future assignments.

Feedback and Performance

Students' academic achievement is the primary focus of feedback (Wang & Zhang, 2020). When students find and use feedback beneficial, it has a good effect on their academic achievement, according to studies (Winstone et al., 2017). Therefore, it is easy to attain improved performance via the proper delivery of instructor feedback. The effectiveness of instructional feedback strategies, however, determines whether or not students' performance improves (Kyaruzi et al., 2019). However, according to Wang and Zhang (2020), there is no significant impact of feedback on students' performance in some subjects. Thus, there is a difference of opinion on the value of feedback

in enhancing academic achievement. But, as Zhang and Hyland (2022) point out, the establishment of a connection between feedback and performance depends on the level of learning engagement. Therefore, although feedback may not have an immediate impact on students' performance, it might have a knock-on effect by encouraging them to change their study habits, which in turn improves their learning and, ultimately, their performance.

The Current Study

Motivating factors for doing this research were the desire to improve students' mathematical performance and the widely held belief in the power of assessment feedback to raise both. As said previously, one of the things that helps children learn and do better in school is getting good feedback on assessments (Wiliam, 2011). Concerns about the effectiveness of teacher feedback on students' mathematical performance have been raised in light of their persistently low results on the Certificate of Secondary Education Examination (CSEE) (Mabula, 2015; Mazana et al., 2020). Consequently, the purpose of this research was to examine the relationship between the kind of feedback Math instructors in Tanzanian community secondary schools use and their students' mathematical performance. There were three main goals that the research set out to achieve:

1. to understand more about the types of evaluation feedback that students get when studying maths;

2. examine how students' understanding and performance on mathematics exams are affected by assessment feedback;

3. To determine the obstacles that prevent instructors from providing students with useful feedback on their mathematics learning

Methodology

The phenomena (evaluation feedback provision) was investigated in its natural contexts utilising many sources of data for triangulation in this qualitative research that used a case study methodology (Creswell et al., 2007). Two mathematics instructors from Moshi Municipality's two community secondary schools and their respective third-year pupils made up the sample. Twelve pupils from each school, for a total of twenty-four, took part in the focus group discussions (FGDs). Twelve female students and twelve male students made up the study's gender ratio. Furthermore, samples representing

the top, medium, and bottom achievers were chosen from the results of the third terminal test. This sample approach was deemed crucial due to the fact that the chosen schools include both boys and girls. Learners, depending on their gender and test results, have different experiences and perspectives when it comes to assessment feedback. The research used four different ways to gather data: classroom observation, interviews, focus group discussions, and document analysis. What and how teachers provide feedback in the classroom were the primary foci of the observation. Secondly, instructors were asked to share their thoughts on the kind of feedback they utilise via one-on-one semi-structured interviews. The usual feedback techniques that students encounter from their professors were also the focus of the focus group discussions.

Finally, documents analysis was utilised to examine the kind of written feedback that instructors used, as seen in students' workbooks and graded test papers. Thematic analysis was used to uncover emergent problems linked to the research by re-reading transcribed data from interviews and focus groups with data from classroom observation and document analysis. This was done to compile all of the data acquired from the sources. In the end, the data was classified and organised into topics according to the study's aims.

Findings

The study findings are presented along the three specific.

Nature of Assessment Feedback utilized by Mathematic Teachers

Participant and document data showed that, in mathematics classes, verification feedback—evaluative comments offered either orally or in writing—was the norm. Instructors could tell whether their students had answered correctly or incorrectly by using verification feedback. Exam graded scripts and practice books showed that written verification feedback was widespread, but vocal verification feedback was common during classes. For successful responses, teachers would use tick marks, which are represented by ticks (), and for erroneous replies, crosses (). Evaluation feedback in the form of percentages, marks, scores, and marks and grades all appeared prominently in the data derived from interviews, FGDs, and document analysis. Teachers were asked to describe their process for providing written feedback to students during one-on-one interviews.

One teacher replied that; *"In students' scripts I put scores and grades..."* (Interview T1, 8th September 2020).

When asked how their professors provide feedback on written tasks during FGD, students also mentioned the existence of evaluative comments. One of the students replied by saying; *"He just puts marks and grades."* Adding to that another student claimed that, *"the teacher uses marks, grades and comments such as good and study hard."* Document examination of student assignments and homework at both institutions revealed the usage of evaluative feedback in the form of scores, percentages, and marks. The use of evaluative feedback is prevalent even though research has shown that it promotes student competitiveness and avoidance of challenging tasks, rather than improving students' learning (Hattie and Timperley, 2007).

Characteristics of Feedback Practices

Regardless, math educators still rely on verification and evaluative feedback, despite the fact that it does nothing to improve students' mathematical understanding (Noor et al., 2010).

Delayed Feedback

Written tasks, including weekly, midterm, terminal, and yearly exams, are most affected by the poor and delayed feedback that students experience, according to the research. When asked how long it takes to provide feedback after a written assignment, instructors had the following replies during interviews.

> *For weekly test which is done every Monday, I provide feedback on Friday, but for midterm test, terminal, and annual examinations it takes one to two weeks to give feedback* (interview T1).

Another teacher responding to the same question had the following to say:

> *For exercise it takes only one day; for the test because you need to consider many things during marking you cannot mark within a single day because you can only mark ten to twenty scripts per day. Therefore, it takes three to four days to finish marking and giving feedback* (interview T2)

The lack of timely feedback on assessments seems to be a common theme in many replies. There was even some doubt about whether or not feedback could be provided after three or four days; after all, a teacher in a form three class with up to three streams would need at least seven days to mark 150 papers (the average number of students in this class). Students did

not get any feedback for the whole marking period, and the subject instructor was still grading terminal exams that were given three weeks previously, according to the researcher's observation. Students at another school complained during FGD that they did not get any feedback on their exam scores and that, even three weeks after the test, their marked scripts remained in the teacher's office. These results indicated that students not only got delayed feedback, but input that did not help them learn. Consequently, pupils are introduced to new ideas and concepts without a thorough grounding on the prior material. Because of the vertical link between subjects, wherein information gained in one area aids learners in understanding the next, students struggle to grasp new material when they do not fully grasp prior material.

Low Occurrence

Feedback was not often given in mathematics classes, according to data gathered from interviews and focus group discussions. There are instances when maths instructors either do not provide feedback at all or give feedback that is more later than expected. Feedback in mathematics classes is so inadequate, according to responses from both instructors and students in focus groups and interviews. Take this teacher's response to the question of how class size affects feedback provision as an example:

> *Sometimes it limits me to test many topics because if I will test many topics, I will not manage to mark all scripts. Moreover, it makes me unhappy to mark those exercises or tests while I face the pressure to give classroom instructions without fail.* (Interview T1)

Because assessment feedback is derived from thorough examination of students' work, the teacher's comment above shows that there are times when instructors do not mark students' work, leading to a lack of assessment feedback supply. The statement goes on to suggest that some instructors find marking assignments tiresome and don't do them often enough. In a similar vein, students learned throughout FGD how long it takes to get comments on their written work or exams. An anonymous secondary school student from Umoja said that;

> *It depends. For example, end of topic exercises takes at least one week for feedback to be received. But for the midterm and terminal or annual examinations, it may take three to four weeks to get feedback.* (FGD S7)

Their counterparts from Ushindi (pseudonym) Secondary school responding to the same question had the following to say:

> *For examinations, it takes much time, for example we did a terminal examination [three weeks back] but we are yet to receive any feedback until now*. (FGD S10)

Adding to that another student said;

> *For midterm tests, we did not receive any feedback since July and sometimes teachers burn our examination scripts without giving us any feedback.* (FGD S1)

Finally, another student brought attention to the infrequency of feedback by stating: "Sometimes our teacher brings back our scripts unmarked and he does not do any correction" (FGD S3). The study found that many of the assignments and homework handed out to maths instructors in the field were left unmarked, which is in line with the student's claims. The results imply that students seldom get feedback in mathematics classes, which leads them to make the same errors again and again and ultimately score poorly on CSEE.

Generalized Feedback

Teachers of mathematics at the schools that participated in the research also used feedback that was generalizable.The majority of mathematics educators report using generalised feedback, according to data gathered from interviews, focus group discussions, and course observation. One educator, for instance, provided the following response when questioned about his favoured methods of instruction:

> *"... because of overcrowded classes I provide general feedback to the whole class in order to save time; it is difficult to provide feedback to individual learners." (interview T1).*

In a similar vein, the researcher saw that when pupils were struggling with a mathematics issue, the professors would often solve it on the blackboard to help the rest of the class. In most cases, the results showed that generic comments were more effective than specific ones. Students' learning is hindered by generic comments since every student has unique strengths and limitations, necessitating personalised techniques for progress.

Perceived Effect of Feedback on Students' Learning and Performance

The second goal of the research was to determine how students' understanding and performance in mathematics were affected by evaluation comments. The following sections provide the results.

Influence of Assessment Feedback on Learning

The purpose of the interviews was to get the instructors' opinions on how they think feedback may help students learn better. The following were their replies: *"Feedback helps student to learn, without feedback there is no learning"*

Another teacher argued that,

> *Feedback plays a great role in improving students' performance. It helps them to know the areas which they are good at. This enables them to make revision on those areas which they are not good at in order to attain maximum marks in their examinations; it also makes them happy and motivated to learn* (interview T2).

Students throughout FGD had similar views to T2's when asked how they use comments into their daily learning. Here are the answers given by pupils at Ushindi Secondary:

> *I use the feedback to make revision because sometimes teachers repeat same questions in examinations.*

Another student responded by saying,

> *I use the given feedback to find and solve other questions with the same concepts hence helps me to have a deep understanding about that concept.*

Individuals from Umoja Secondary School (pseudonym) had similar views. When it was almost time for the test, most of them said they would use the feedback to look for additional problems like these in previous examinations and attempt to answer them using the strategies suggested in the feedback. Feedback on students' mathematical learning is crucial, as these explanations from both instructors and students demonstrate. Therefore, it is essential for professors to provide students feedback, and students should be motivated to use input from both instructors and classmates to enhance their learning and, eventually, their success in the topic.

Influence of Assessment Feedback on Performance

Teachers' and students' perspectives on how assessment feedback impacts maths achievement were also recorded in this research. The following were some of the comments that instructors had when asked how feedback affected their students' learning:

"Feedback helps to improve learning because they score better in subsequent assignment" (interview T1)

Likewise, while responding to the question on whether the feedback given to learners helps to improve performance, T2 said:

> *Yes, it helps them to improve their learning, for example, the first test I gave them, only ten students passed but after giving them feedback, fifty students passed the next test, so it is obvious that feedback also improve performance*. (interviewT2)

Teachers' justifications like these show how students improved their knowledge and performance on future assignments after receiving feedback on earlier ones. At Ushindi Secondary School, FGD also included questions on how students felt feedback affected their maths grades. The following were the notes of one of them: I feel more prepared for exams and, on occasion, I am able to recall exactly what my friends stated about an idea during our focus group discussions (FGDs), which helps me remember questions from feedback provided.

Another respondent from Umoja (pseudonym) had the following to share:

> *Sometimes the same question or questions of similar concept we did in one assignment and receive feedback appears in the next assignment, in this case it is easier to attempt such a question* (FGD)

Based on what these students have said, it seems that feedback is useful for helping students solve mathematical problems that include the same ideas or that are similar to ones they've seen before. Their overall performance in these areas is improved as a result. It is clear that feedback affects performance, but the extent to which it does so depends on how students incorporate the comments into their regular study routines. As a result, one may claim that students' performance is indirectly impacted by feedback as it improves their learning, but this improvement happens only when students put the input into practice.

Limitations to Providing Effective Feedback

The report went on to say that there are a number of things that make it hard for maths professors to provide students useful comments. Class size, workload, instructor illiteracy, curriculum overload, and high-stakes exams are some of these problems.

Teacher's Feedback Illiteracy

According to interview data, most instructors take assessment feedback to mean finding out where students are strong and weak in a certain area, and then they go on to lesson planning based on that knowledge. This shows that teachers have a very limited concept of feedback. Feedback, in their view, should educate students of their areas of strength and progress and provide

them with solutions for doing so.The instructors' failure to grasp the notion of evaluation feedback was highlighted by this question. For instance, interviewed teacher T1 said,

> *Assessment feedback is the way you examine and check how students have understood the taught concept; it helps to know whether the learners have understood the lesson (Interview).*

Moreover, when he was asked, what was he taught during pre-service training about feedback, he said,

> *At the college I was taught that whenever you teach make assessment which gives feedback" (Interview).* Responding to the same question, teacher T2 said, "*Aaah, no. We were not taught about feedback provision* (Interview).

Because assessment feedback informs both instructors and learners about their progress, it may be inferred that teachers' lack of understanding about feedback stems from teacher training institutes where they are not well prepared.

Large Class Size and Heavy Workload

According to the results, instructors also have difficulties in providing useful feedback due to factors such as class size and workload. It was observed that instructors are instructing over 150 pupils in three separate streams at the two schools that were part of the research. This indicates that there were more than 50 pupils in each class. Consequently, when asked how factors like workload and student body size impact the quality of feedback they provide, they say that it depends. Says T1, "*My teaching load, leads to delayed feedback and make marking exercise very tedious hence teachers avoid giving test and assignment to the learners"* On the side of class size, he commented that, *"Large classes make the marking of exercises tedious hence teachers opt not to provide assignments, or give just a few questions for students to work on" (Interview).* Teacher T1 was absent from the school grounds for many days owing to other administrative duties; as a result, the researcher was unable to complete the marking of terminal examination scripts on time, in addition to the teachers' replies. In addition, T2 said in response to a same inquiry,

> *Sometimes, it becomes difficult for me to test students in many topics because when you do that you will have many questions and therefore you will not manage to mark all scripts. It sometimes makes you dislike marking those exercises or test* (interview).

This research lends credence to the idea that professors are unable to provide students useful criticism when they are swamped with work and have massive class sizes. In order to ensure that students get useful feedback and ultimately succeed in mathematics, it is crucial to have an adequate teacher-student ratio.

Overloaded Curriculum Content and tension of High-stake Examinations

There are a lot of obstacles to providing feedback, including as a heavy curriculum and high-stakes exams. It was discovered that teachers are occupied with attempting to cover an overly ambitious curriculum in order to have time to administer tests to their pupils before to important exams. The mathematics teacher at Umoja Secondary School confirmed what had been suspected via an interview: all of the schools in Moshi municipality take the same final and yearly tests. Thus, rivalry across the educational institutions is palpable. In an interview with T2, we learned more about the impact of a heavily laden curriculum and high-stakes exams when she said that,

> … *sometimes even politicians need us to complete topics early, so we forget to provide feedback, we forget to provide assessment tasks because what we care about most is to complete the topics in order to please them* (Interview T2)

When he was further asked; about the effects of not giving feedback students? He said,

> *It obviously affects their learning, but sometimes in this teaching profession is not respected because even politicians interfere a lot and sometimes they come to pressurize our school management and the management cascade that pressure on us that we must cover all the topics as soon as possible. They do not understand that syllabus indicates duration of completing each topic* (Interview).

In order to have enough time to test and retest their students as they prepare for the annual examinations that are administered across the municipality, mathematics teachers are reportedly working under a great deal of pressure to finish teaching the curricula. Because of this, teachers are unable to conduct formative assessments, which would have allowed them to see where their students were struggling and where they were succeeding with each concept. This feedback would have helped students fully grasp each concept before moving on to the next one. Thus, instructor remarks

demonstrated that, in order to finish the curriculum material quicker than the specified time, formative assessment procedures are disregarded.

Discussion

Students' performance in mathematics is positively impacted by assessment feedback, according to this research. This is because students use it to revise their work, delve more deeply into the subjects, and prepare for future projects. Feedback also boosts students' self-assurance for when they tackle future projects. This agrees with what other researchers have found, such Winstone et al. (2017), who found that students' performance improves after receiving constructive criticism. Students' individual study habits are transformed as a result of feedback, rather than performance itself (Wang & Zhang, 2020). One of the important aspects of feedback, according to this study and a prior one by Yin and Wang (2016), is to motivate students to learn. When students see how far they are from meeting expectations, they are more motivated to work on closing the gap, whether that means rereading the material, making revisions to their work, or solving similar concepts' problems. Based on the research conducted by Kyaruzi et al. (2019a), it can be concluded that the quality and kind of feedback, as well as students' utilisation of it, determine whether their performance improves. Nevertheless, the majority of schools in the survey used task level feedback, which includes evaluative feedback in the form of comments, grades, and scores, and verification feedback. Hattie and Timperley (2007) also found that instructors mostly utilise task level feedback when evaluating their students.

Additionally, this research indicated that schools mostly employ written or spoken forms of evaluating feedback. Lema and Maro (2018) reported on the use of verification feedback in mathematics instruction and student learning in Tanzanian secondary schools; similarly, this study found that teachers use checkboxes for right answers and crosses for wrong answers in students' exercises and exam scripts. Teachers also mostly employed verbal and written remarks as feedback, however these comments were often imprecise and unrelated to the students' work, according to the research. This is in line with what Lema and Maro (2018) found; they found that secondary school teachers in Tanzania mostly use comments as a form of feedback, but that the comments themselves reveal a lack of expertise in this area. Poor performance on the national mathematics test may be attributable, in part, to the fact that task level feedback is supposedly inadequate for improving deep learning (Hattie and Timperley, 2007). This was also the case with the

students' mathematical achievement in Tanzanian secondary schools, and more specifically, in the community secondary schools that were the focus of the current research.

In addition, the study's results showed that, generally speaking, evaluation feedback is not specific enough. Individualised feedback was determined to be unworkable, whereas teacher feedback is often delivered in large groups (the whole class). Students relied solely on peer feedback because of the delayed and incomplete responses. The results are in line with those of other researchers who found that instructors couldn't apply efficient evaluation methods or give each student the attention they needed because of the huge class sizes (Kitta & Tilya, 2010; Marais, 2016). It follows that generalised feedback, which is both insufficient and delayed, contributes to students' poor performance in mathematics, as previously mentioned. The reason for this is because learners' requirements are unique, and generalised feedback doesn't take that into account (Wiliam, 2011). On the other hand, students do poorly because they make the same errors in future tasks when feedback is delayed or not provided adequately.

Teachers do not always provide students thorough feedback or mark their work accurately, according to the results of the present research. These results are in line with what other researchers have found: that professors seldom if ever provide feedback or corrections on student work (Kyaruzi et al., 2019a; Ndioho & Joy.C, 2017). Poor performance in mathematics at CSEE is likely due, in part, to the fact that students do not receive sufficient, timely, and task-specific evaluative feedback (either verbally or in writing), which hinders their ability to gain a thorough grasp of abstract ideas through practice with related problems.

Conclusion and Recommendations

Mathematical instructors at a subset of Tanzanian community secondary schools were the focus of this investigation on the efficacy of assessment feedback in improving students' mathematical knowledge and skills. The results demonstrated that most mathematical classes relied on task-level feedback that was mostly evaluative.

Furthermore, responses were less specific, took longer to materialise, and happened less often. Students' low maths scores at CSEE could be attributable, in part, to comments like these. One finding is that current educators would benefit from frequent professional development sessions that educate them how to give students constructive criticism. Students' learning

and performance in mathematics at CSEE will be improved as a result of instructors' ability to provide meaningful feedback. Conversely, it is important to encourage students to use feedback from both instructors and classmates to better grasp different ideas, which will ultimately lead to better success in CSEE.

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