The Role of Students' Conceptions of Assessment on Secondary School Mathematics Performance in Tanzania

Florence Kyaruzi
University of Dar es Salaam, Dar es Salaam University College of Education
Department of Educational Psychology and Curriculum Studies
Dar es Salaam, Tanzania
E-mail: sakyaruzi@gmail.com

Abstract

This study investigated the role of secondary school students' conceptions of assessment in mathematics performance. Data were collected from 2767 Form Three students sampled from 48 secondary schools in Tanzania. Data collection was done through a combination of questionnaires and focus group discussions. Data were analysed by using t-test, structural equation modelling and content analyses techniques. Quantitative results showed that girls reported more positive conception that assessment improves learning and assessment is for accountability purposes than boys. Furthermore, the conception that assessment improves learning positively predicted students' mathematics performance. Qualitative results illustrated that most students valued mathematics teacher's assessment practices. Impliedly, interventions for improving students' mathematics performance could capitalise on promoting the conception that assessment improves learning.

Keywords: *Conceptions of assessment, mathematics performance, secondary school students*

Introduction

Assessment is increasingly recognised as a formal and purposive attempt to determine students' performance during or after a learning phase. Assessment can be used for improving teaching and learning processes, certifying students, placing students on track, or for improving a particular education curriculum (Pat-El, Tillema, Segers & Vedder, 2015; Pellegrino, 2014). Assessment tasks are embedded in the implemented curriculum and thus they have a power to influence curriculum

implementation practices by teachers and students. Teachers in societies with high-stakes assessment practices are likely to focus their teaching on the content which is mostly assessed than the aspects which are less likely to be assessed even if they constitute important learning outcomes. Likewise, students in such societies are likely to indulge in poor learning strategies, such as rote learning in order to pass their examinations without necessarily mastering the course objectives (Gibbs & Simpson, 2003). The potential benefits of assessment on student learning depend highly on the conceptions of assessment about its role in the teaching and learning process (MacLellan, 2001). The prerequisite condition for assessment to reach its intended role is that it should be well implemented by teachers (Kyaruzi, Strijbos, Ufer & Brown, 2018) and perceived as supportive and used by students to improve learning (Kyaruzi, Strijbos, Ufer & Brown, 2019).

Assessment has a powerful impact on students' lives because it regulates their learning processes and informs future decisions on various aspects such as employment. Given the benefits of assessment, it is expected that students adapt or modify their belief systems about assessment in response to their experienced outcomes (Brown, Peterson & Irving, 2009). Although assessment is a major factor influencing student learning, it is not necessarily well conceived by students. Brown et al. (2009) argue that assessment can trigger adaptive and maladaptive roles on students' learning. Assessment has adaptive role if students use the assessment information to identify their learning needs and take appropriate actions to remediate the weaknesses and it becomes maladaptive when students view assessments as something that can be ignored (Brown et al., 2009). In particular, self-regulated learners achieve more learning outcomes whereas students who subject responsibility to external control tend to achieve less (Reeve, 1998). Conceptions of assessment vary across context and subject domains. In particular, students' conceptions of assessment influence their behaviours in preparation for assessment, performance during assessment, and post-evaluation uses of assessment results (Peterson & Irving, 2008).

Students' conceptions of assessment

Conceptions are defined as the general mental structure, encompassing beliefs, meanings, concepts, propositions, rules, mental images and preferences (Brown & Hirschfeld, 2008; Pajares, 1992). Furthermore, conceptions represent different categories of ideas behind students' descriptions of how educational practices are experienced. In particular, Brown (2008) defined conceptions of assessment as what students consider to be the general purposes of assessment. Conceptions

of assessment express the strength and directions of agreement towards various purposes of assessment (Brown, 2008). Further, it has been shown that students' conceptions about the nature and purposes of assessment strongly influence what students can actually learn and achieve (Barnes, Fives & Dacey, 2017; Pajares, 1992). The influence of students' conceptions of assessment to performance is supported by the Theory of Planned Behaviour which postulates that conceptions influence behaviours which subsequently affect outcomes (Ajzen, 1991). Specifically, the theory claims that the more positive people's beliefs are about a specific behaviour, the more they believe they can do a specific task, and the more likely they will be able to act in accordance with their intention (Ajzen, 1991; Brown, 2008). Therefore, conceptions of assessment influence students' actions on using or not using assessment information to improve the learning outcomes.

Studies in the area of students' conceptions of assessment have consistently identified four main categories conceptions of assessment: (a) assessment improves teaching and learning, (b) assessment makes students accountable for learning, (c) assessment makes schools and teachers accountable, and (d) assessment is irrelevant to education (Brown & Hirschfeld, 2008). The conception that assessment improves teaching and learning is the central in formative assessment (Black & Wiliam, 1998) and requires teachers to use evidence about student learning to support them more (Kyaruzi et al., 2018). With the conception that assessment improves teaching and learning, teachers are expected to use various techniques to identify students' weaknesses and strengths so as to support them accordingly. The purpose of assessment within such a conception requires teachers to use students' learning evidences to provide them with feedback that moves learning forward (Michaelides & Solomonidou, 2019).

Meanwhile, the conception that assessment is for accountability purposes presumes that assessment is used to account for the use of society's resources (Brown, 2008). Accountability based conception entails utilizing assessment results to demonstrate publicly that teachers are doing a good job and it may impose consequences to schools or teachers for not reaching the required standards (Brookhart, 1994). Accountability-based conception of assessment is usually evidenced by assigning grades to students' works, and placing students into classes based on their performance (Brown, 2008). For instance, in Tanzanian context, it is a common practice that regions, districts and schools are ranked based on students' performance in national examinations for accountability purposes. Such practices seek to demonstrate publicly how the region, district or school is optimally using

the allocated educational resources. Consequently, heads of schools and other leaders in education can be promoted or demoted based on students' performance in national examinations. In particular, Brown and Hirschfeld (2008) showed that the conception that assessment is for accountability purposes predicted students' reading achievement. Generally, accountability conception is rooted in the value for investment in terms of money, time and other resources. Njabili (1999) highlights that public examinations promote accountability among educational stakeholders and could be used as a good tool for curriculum evaluation.

Apart from the perceived constructive role of assessment on student learning, assessment is sometimes conceived by students as irrelevant to education. In light of the conception that assessment is irrelevant to education, assessment is usually understood as a formal, organized process of evaluating students' performance without having a legitimate place in the teaching and learning process (Brown, 2008). Several factors may entice students to regard assessment as irrelevant. For example, Brown and Hirschfield (2008) argue that assessment is perceived as irrelevant to students when it is unfair, subjective and when teachers lack professionalism in scoring student's assignments. Generally, students conceive the purposes of assessment as being: (a) mainly for improving learning; (b) useful for improving teaching and (c) a means for making them (students) accountable.

Some studies such as Kitta (2014), Kyaruzi et al. (2018) and Ndalichako (2015) have investigated the role of teachers' conceptions of assessment and assessment perceptions on teaching and learning process in the Tanzanian context. With a national representative sample of 4160 secondary school teachers, Ndalichako (2015) showed that majority of the teachers reported that the main purpose of assessment was to improve teaching and learning. Similar results are depicted in Kyaruzi et al. (2018) that mathematics teachers reported using students' assessment information to improve the teaching and learning process. Likewise, a study with primary school English language teachers showed that teachers conceived assessment as a tool for improving teaching and learning, and an important tool for serving accountability purposes (Rugambuka, 2018). However, none of the previous studies in Tanzania has investigated what effects do students' conceptions of assessment have on mathematics performance.

It is imperative to investigate students' conceptions of assessment across cultures and groups because beliefs about the conceptions of assessment purposes are influenced by contextual demands (Fives & Buehl, 2012). Thus, students' conceptions of assessment purposes are likely to be influenced by the assessment

culture of a particular education system. In societies where assessment is mainly used to make decisions for improving student learning, students' conceptions of assessment purposes could be different from high-stakes examinations societies where assessment is for accountability. Therefore, the present study intends to assess the role of secondary school students' conceptions of assessment on mathematics performance. Much of the previous studies have either concentrated on assessing teachers' conceptions of assessment or students' conceptions of teachers' assessment without paying attention to students' conceptions of their own assessment practices, especially in Mathematics context.

Students' conceptions of assessment and mathematics performance

The education system in Tanzania is centralised and follows a '2-7-4-2-3+' schooling structure in which there are two years of pre-primary, seven years of secondary school, four years of Ordinary Level secondary school (O-Level), two years of Advanced Level secondary school (A-Level) and at least three years of higher education (Ministry of Education and Vocational Training (MoEVT, 2014a). Meanwhile, at the end of primary and secondary education levels student sit for a national examination centrally administered by the National Examinations Council of Tanzania (NECTA) for certification and placement purposes. Examinations set by NECTA are high-stakes examinations as they decide students' fate to pursue further studies or not. In order to overcome the overreliance on external high-stakes examinations, the Tanzanian government introduced the use of *Continuous Assessment* (CA) for secondary schools in 1976 to serve as a formative practice (NECTA, 2004; Njabili, 1999). Studies by Ottevanger, Akker and Feiter (2007) noted that most Sub-Saharan African countries, including Tanzania, have integrated school-based continuous assessment, although testing at the school level was mainly summative and hardly used formatively (Tilya & Mafumiko, 2010). Nevertheless, if effectively used and well perceived by students, formative assessment has the potential to improve mathematics performance in Tanzanian secondary schools. There is also the issues of gender gaps that need to be investigated particularly in Tanzania, because various studies have shown that women are still lagging behind in mathematics performance (Dickerson et al., 2015).

Despite the presence of school-based assessment in Tanzanian secondary schools, mathematics education has been suffering from low passing rates (MoEVT, 2014a). For example, data on student performance for six consecutive years (2008-2013) indicated that 83% of secondary school students failed their mathematics national

examinations (MoEVT, 2014b). Such persistent failure still happens even though mathematics teachers report practising various formative assessment practices (Kyaruzi et al., 2018). Studies have pointed out specific educational challenges in Tanzania that might explain the persistent failure. The challenges include: (a) transition from Swahili as the language of instruction in primary schools to English in secondary schools (Qorro, 2013); (b) curriculum content overload (Kitta & Tilya, 2010); and (c) lack of regular and reliable in-service teacher professional development (Kitta, 2015). Other challenges include lack of assessment skills to implement effective school-based assessment (Osaki, Hosea & Ottevanger, 2004) and relatively low-quality feedback practices by mathematics teachers (Kyaruzi, 2012). So far, there has been little discussion that focused on students' conceptions of assessment in Tanzanian context, particularly studies exploring the effects of conceptions of assessment on mathematics performance. In particular, understanding students' conceptions of mathematics assessment from students' perspective may help in developing specific interventions to overcome students' persistent poor performance in mathematics examinations. This study investigates secondary school students' conceptions of assessment and its effect on mathematics performance. Specifically, the study seeks to answer the following research questions:

1) What conceptions of assessment best describe secondary school mathematics students in Tanzania?
2) Do conceptions of assessment differ between female and male secondary school mathematics students?
3) To what extent do students' conceptions of assessment influence their mathematics performance?
4) What are the students' views for improving secondary school mathematics assessment practices?

Methodology

Participants and sampling

The study was conducted among 25 secondary schools in Dar es Salaam and 23 secondary schools in Kilimanjaro regions. According to NECTA (2014) statistics, the overall mean Grade Point Average (GPA) for schools in the sampled regions ($M = 4.63$, $SD = 0.69$) did not deviate statistically from the country schools' mean GPA ($M = 4.85$, $SD = 0.70$). In total, 48 secondary schools were sampled because it is recommended sampling at least 30 schools with at least 30 participants in each group for effective analysis of nested data (Hox, 2010). Data for this study

are considered nested because students were sampled from different schools taught by different teachers. Two further criteria were used to achieve a representative sample: school mathematics performance (high, medium, and low) according to (MoEVT, 2014b); school ranking and school-ownership (private, government). In each of the sampled school, data were collected from Form Three class because it contained more teacher-based assessment practices compared to other classes.

Multistage sampling method was used in sampling schools and participants. Schools in Dar es Salaam and Kilimanjaro regions were ranked based on their school mathematics GPA. For practicality reasons, it was decided that the study be conducted in four districts (two from each region) with high number of high performing schools. All seven and 16 schools that were categorised as high and middle performing schools respectively were sampled. The remaining 25 schools were sampled among low performing schools. In sampling classes in schools with more than one Form Three stream, the available streams were written on different pieces of paper, put together and rigorously shaken. Thereafter, one piece of paper that was picked by a mathematics teacher denoted a stream to be studied. In all the sampled classes students were requested to voluntarily participate in the study with a signed consent form. Table 1 provides a detailed description of students' demographics.

Table 1

Demographics of Participating Students and Schools Split by Regions

Demographic	Total	Dar es Salaam	Kilimanjaro
Gender	2767	1738	1031
Female	1476	988	488
Male	1277	739	538
Age			
Female	16.31(1.04)	16.23(1.02)	16.47(1.07)
Male	16.73(1.16)	16.59(1.06)	16.92(1.27)
School performance			
High	422	289	133
Middle	997	623	374
Low	1349	824	524
School ownership			
Government	1354	907	447
Private	1413	829	584

Approach and design

A mixed method research approach was applied by combining quantitative and qualitative approaches. Specifically, a concurrent embedded research design was used whereby qualitative and quantitative data were simultaneously collected and analysed to complement each other (Creswell, 2009; Dingyloudi & Strijbos, 2018). This approach was employed because it allowed using qualitative data to explain quantitative data. A mixed method was deemed suitable for this study because studying conceptions of assessment requires a multi-perspective approach.

Instruments

The study adapted the "Student Conceptions of Assessment-SCoA" questionnaire (Brown & Hirschfeld, 2008) to measure students' conceptions of mathematics assessment. Each questionnaire item was adapted to the mathematics context by inserting the word 'mathematics' to ensure that students would reflect on mathematics teachers' assessment practices. All questionnaire items were adapted to a common balanced four-point scale: fully disagree (1); somewhat disagree (2); somewhat agree (3); and fully agree (4). The study deliberately refrained from putting a middle category such as neutral, don't know and not sure due to its ambiguous perceptual meaning (Kulas & Stachowski, 2009). To measure mathematics performance, students self-reported their mathematics performance in Form Three terminal examinations. Questionnaire data were followed by focus groups discussions (FGDs) in six randomly sampled schools from the same sample. Each focus group discussion consisted of six students, resulting in a sub-sample of 36 Form Three students (Female = 20, Male = 16). The FGD questions explored students' conceptions of assessment purposes, how assessment was practised by mathematics teachers, and opportunities and barriers for using assessment information such as feedback. Table 2 summarises the scales, number of items per scale, sample items, and the Cronbach's α from the original and the present study.

Research ethics and procedure

All participating students signed an informed consent form which explained the purpose of the study and respondents right to participate or not to participate in the study. The researcher demonstrated how to use the rating scales before students filled in the questionnaires. Meanwhile, students had the opportunity to ask for clarification of any difficult questionnaire item. Questionnaires were administered during the mathematics lesson by the researcher being supported by two research assistants. For the sake of promoting student openness and honest responses, the

mathematics teacher was not present during filling the questionnaire. In average, students needed approximately 15-25 minutes to complete the questionnaire. After filling the questionnaire, six students in each of the sampled classes volunteered to participate in the follow-up focus group discussions.

Table 2: *Scales, Sample Items and Estimates of Reliability*

Scale	k	Sample item	Study Cronbach's α	
			Original	Present
Conceptions of assessment: Improves learning	5	I pay attention to my assessment results in order to focus on what I could do better next time.	.88	.66
Improves teaching	6	Assessment helps teachers track my progress.	.80	.63
Accountability	6	Assessment tells my parents how much I have learnt.	.77	.65
Irrelevant to education	8	I ignore assessment information.	.67	.66

Note. k = number of items per scale

Analysis

Prior to data analysis missing values analysis was carried out whereby 39 respondents (approximately 1%) who had more than 10% missing values were eliminated from further analysis, resulting in the final sample of 2767 students. Quantitative data were analysed using descriptive statistics, independent samples t-test and structural equation modeling. Specifically, descriptive statistics were used to summarise students' endorsement of their conceptions of assessment while t-test was used to compare female and male conceptions of assessment. Furthermore, the role of students' conceptions of assessment on mathematics performance was estimated using the structural equation modeling (SEM) technique in Analysis of Moment Structures (AMOS). Byrne (2010) explains that SEM is a method that can be used in estimating several multiple regressions and assessing the influence of each factor on the outcome variables. Generally, the evaluation of model fit was based on the multiple fit indicators as recommended by Byrne (2010) and Fan and Sivo (2007) that : (a) a good model fit was based on a combination of the Root Mean Squared Error of Approximation (RMSEA) and a Standardized Root Mean Residual (SRMR) below .05 and a Comparative Fit Index (CFI) and Gamma hat values above 0.95, (b) Meanwhile, the model had an acceptable fit when it attained RMSEA and SRMR below 0.08 and CFI scores above 0.90 (Hu & Bentler, 1999).

Content analysis was used to analyse focus group discussions. A data-derived coding scheme was developed using about ten percent of the data. Coding rules were established to assist the segmentation and coding procedures. The threshold for segmentation agreement was 80% and a Krippendorff's alpha value of 0.80 for coding reliability. In analysing the focus group discussions (FGD), two independent coders were involved in all data analysis after a specific training on the study rationale, the segmentation and coding procedures. In total, two independent coding trials were performed in analysing data for this study. The first coding trial analysed all questions from two randomly sampled focus group discussions resulted into the segmentation agreement of 89–97%. Afterwards, the coded segments from the coder with more segments were independently coded by each coder, and subsequently subjected to Krippendorff macro version 3.2 for reliability analysis which resulted into a Krippendorff's alpha of 0.87 with a lower and upper limit of 0.80 and 0.94 respectively. Even though the segmentation agreement and reliability were above the acceptable threshold, another coding trial was conducted to determine whether those standards were met by chance. The second coding trial analysed 40% of randomly sampled questions from the remaining focus group discussions. The segmentation agreement for the second coding trial was 83–92%. Likewise, segments from the coder with more segments were independently coded by each coder, and subsequently subjected to Krippendorff macro version 3.2 for reliability analysis which resulted into a Krippendorff's alpha of 0.88 with a lower and upper limit of 0.82 and 0.94, respectively. Results from the two reported coding trials consistently showed that codes had been appropriately and reliably analysed.

Results

This study investigated the role of students' conceptions of assessment on mathematics performance. The first question examined conceptions of assessment among secondary schools mathematics students. Table 3 summarises the descriptive statistics and scales inter-correlations for conceptions of assessment scales and students' mathematics performance.

Table 3: *Descriptive Statistics for Student Conceptions and their Inter-correlations*

Scales	Descriptive statistics					Scale inter-correlations				
	N	Mean	Min.	Max.	SD.	1	2	3	4	5
Conception of assessment										
1. Improves learning	2767	3.63	1.00	4.00	0.45	-				
2. Improves teaching	2767	3.54	1.00	4.00	0.48	.51**	-			

3.	Irrelevant	2767	1.94	1.00	4.00	0.57	-.22**	-.27**	-	
4.	Accountability	2767	3.52	1.00	4.00	0.50	.44**	.54**	-.12**	-
Maths performance										
5.	Maths performance	2767	43.13	0.00	100	18.58	.15**	.053**	-.13**	0.01	-

Note. ** $p < .01$, N = Total sample, SD = Standard deviation

As it can be seen from Table 3 students' rating of the conceptions that assessment: improves learning, improves teaching and assessment is for accountability purposes were above somewhat agree (3.00) indicating that students positively evaluated the three conceptions of assessment. Conversely, students' rating of the conception that assessment is irrelevant to education was slightly below somewhat disagree (2.00) indicating that students did not regard assessment as an irrelevant practice. Furthermore, students' performance in Form 3 mathematics terminal examination was below the expected mean score of 50% with large standard deviation due to the systematic collection of data from a wide range of school categories. With the exception of accountability conception, correlational analysis showed that the remaining scales were significantly related to mathematics performance. It is noted that the more students conceive assessment to be an irrelevant practice, the more they reduce the likelihood of doing well in mathematics. Therefore, for students to benefit from assessment information, they should perceive it as a relevant activity.

The second question examined the influence of gender on students' conceptions of assessment. Specifically, the study examined whether or not female and male ascertained similar conceptions of assessment purposes. The gender analysis was based on the fact that in Tanzanian context, boys outperform girls in mathematics performance as supported by findings in this study that boys performed relatively better (M = 44.93, SD =19.41) than girls (M = 41.67, SD = 17.71), t (2606) = -4.58 in examinations. Independent samples t-test analysis showed that on average, girls conceived more strongly that assessment improves learning (M = 3.66, SD = 0.44) as compared to boys (M = 3.62, SD = 0.46). This difference was statistically significant t (2647) = 3.12, p =0.00 with a small effect size, eta squared 0.004. Furthermore, girls had conceived more that assessment is for accountability purposes (M = 3.55, SD = 0.48) as compared to boys (M = 3.47, SD = 0.52). This difference was statistically significant t (2615) = 4.20, p = 0.00 with a small effect size, eta squared 0.01. Additionally, there were no statistically significant gender differences in student conceptions of assessment that assessment improves teaching and the conception that assessment is irrelevant.

The structural equation modeling (SEM) was used to estimate the effect of students' conceptions of assessment on mathematics performance. The SEM consisted of four factors: assessment improves learning and teaching, assessment is for accountability, and assessment is irrelevant to education as described in previous sections. Additionally, the model had an additional outcome variable for mathematics performance. The full structural model with all variables had good fit indices with Gamma hat = 0.949, SRMR = 0.050, and RMSEA = 0.049 with 90% CI = (0.047, 0.051), but with poor fit for CFI = 0.833. Based on the model modification indices, the model was improved by eliminating seven items with low factor loading and items that loaded on multiple factors. The remaining 19 variables model had improved fit with good fit indices for Gamma hat = 0.972, SRMR = 0.036, and RMSEA = 0.044 with 90% CI = (0.041, 0.047) and acceptable CFI = 0.901. Further analysis showed that combined the factors conceptions of assessment model accounted for 5% of the variance in student mathematics performance, with a small effect size (f^2 = 0.06). Figure 1 summarises the structural equation modeling outcomes.

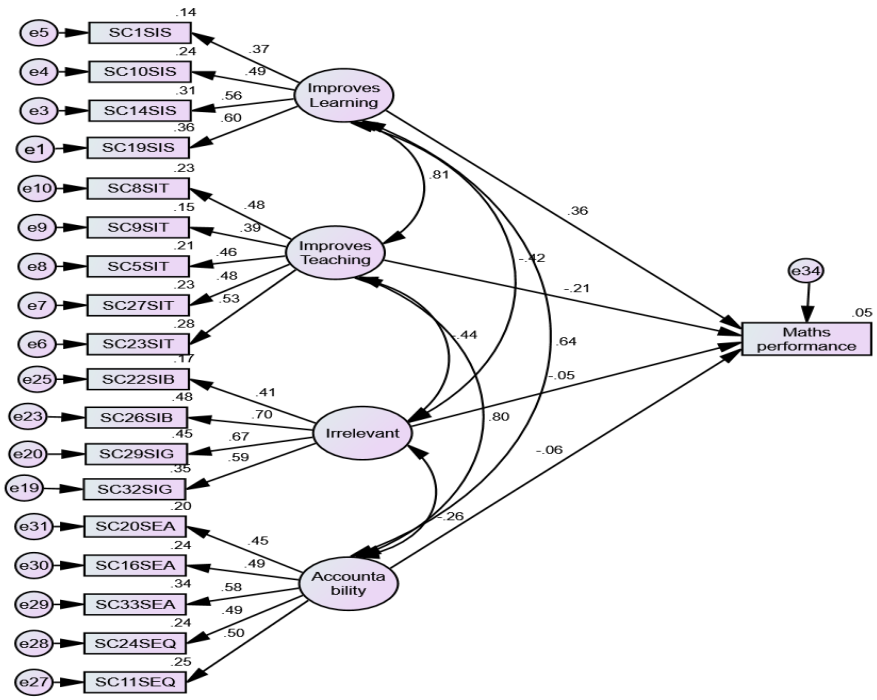

Figure 1. Structural equation model illustrating the effect of students' conceptions of assessment on mathematics performance.

Furthermore, each of the four factors in the model had different effect on students' mathematics performance. Specifically, the results indicated that only the conceptions that assessment improves student learning ($\beta = 0.36$, $p < .001$) significantly predicted students' mathematics performance. The remaining three conceptions of assessment did not significantly predict students' mathematics performance as follows: improves teaching ($\beta = -0.21$, $p = 0.05$), irrelevant ($\beta = -0.046$, $p = 0.126$) and accountability ($\beta = -0.06$, $p = 0.400$).Thus, for students to benefit from assessment information they should perceive assessment as a tool for improving their learning rather than subjecting it to external factors such as improving teaching or considering it as a tool for accountability purposes.

Five themes emerged in response to the fourth question that examined student views for improving mathematics assessment practices. Specifically, analyses of the focus group discussions (FGDs) resulted into five main themes summarising students' views on how mathematics assessment could be improved as summarised in Table 4.

Table 4: *Students' Views for Improving Mathematics Assessment Practices*

Key themes	Focus group discussion excerpts
1. Increase professional and friendly mathematics teachers (34%)	Maybe teachers forget their duty, they must cooperate with us, and must stay with us as friends to know why we fail in mathematics, and they should not leave us alone (FGD.4).
2. Provide more tests and examinations (32%)	The number of mathematics exams should be increased because mathematics needs a lot of practice (FGD.5).
3. Perceive mathematics as a simple subject (14%)	We should perceive mathematics as a simple subject, and we have to be ready to study and understand it (FGD. 2). Students should believe that mathematics is a simple subject and they should like it (FGD.6).
4. Increase peer cooperation (14%)	Students should form group discussions because in groups each student gives his/her ideas which make students to perform well (FGD.1).
5. Increase quality mathematics textbooks (6%)	The number of mathematics textbooks in our schools should be increased because you can't get a lot of questions for practice if you don't have enough textbooks (FGD.5). Mistakes in some mathematics textbooks should be avoided by publishers (FGD. 6).

Discussion

This study investigated secondary school students' conceptions of assessment and their effects on mathematics performance. The first research question examined conceptions of assessment as reported by secondary school mathematics students in Tanzania. The current study determined that out of the seven conceptions of assessment as reported in (Brown & Hirschfield, 2008), four conceptions of assessment related to: improving teaching, improving learning, accountability, and being irrelevant were evident. However, analysis did not yield substantial evidence to support other conceptions of assessment such as assessment is fun or enjoyable. What is more interesting is that students endorsed more conceptions that relate to highlighting that assessment improves learning. Furthermore, descriptive analysis indicated that students had higher orientation towards the conception that assessment improves teaching and assessment is for accountability purposes. Another important finding was that, students did not regard assessment as an irrelevant practice to education. Likewise, positive conceptions of assessment were supported by qualitative results from the focus group discussions as students had positive orientation about assessment purposes to the extent that they wished assessment practices in terms of tests and examinations would be increased. In fact, the conception that assessment improves teaching supports what is elaborated in literature that assessment is effective when perceived positively and used by students to improve their learning (Black & Wiliam, 1998).

Several explanations can be provided as regards to the study findings. First, the fact that there is a strong inclination to focusing on examinations in Tanzanian schools compels students to conceive assessment as a useful practice for their learning. Additionally, given that school-based continuous assessments are cumulative and contribute to students' final national examinations (NECTA, 2004) may facilitate the conception that assessment holds students accountable. The findings support views shared by Michaelides and Solomonidou (2019) that students report positive conceptions about assessment purposes and they regard assessment as an important activity. These results further support that assessment is likely to produce the intended outcome such as improving student performance when it is conceived positively and when students assert to it the internal locus of control.

The second research question examined gender differences in students' conceptions of assessment. In terms of gender gaps, whereas several studies have reported that girls lag behind in mathematics performance (Dickerson et al., 2015), this study sought to investigate whether those differences can be attributed to students'

conceptions of assessment. It was found out that girls' conception of assessment was that it improves learning and it is for accountability purposes. Besides, no significant gender differences were noted in students' conception that assessment improves teaching and assessment is irrelevant. Surprisingly, apart from the fact that girls reported more positive conception that assessment improves learning and assessment is for accountability, they had lower mathematics performance compared to boys. A possible explanation for such an inconsistency could be attributed to the external locus of the conception that assessment is for accountability purposes. These results call for further studies with gender lenses to uncover reasons behind the observed differences in students' conceptions of assessment.

The third research question examined the extent to which students' conceptions of assessment predicted their mathematics performance. Results from the structural equation modelling showed that, although all the four conceptions of assessment contributed towards the model fit, it is the conception that assessment improves student learning that significantly predicted mathematics performance. Thus, in order for students to benefit from assessment information in improving their performance, they should consider assessment as an important tool for their own learning. It was explicitly noted from the focus group discussions that students admire positive and constructive feedback from their mathematics teachers to show them how to improve their learning and to provide them with psychological support. In this respect, students should use assessment information such as feedback provided by teachers on their mathematics tests to improve their learning process. Findings with respect to the conception that assessment improves learning corroborate well with the empirical studies about formative assessment, that assessment is effective when perceived as supportive and used by students to improve their learning (Black & Wiliam, 1998; Ginsburg, 2009; Kyaruzi, 2012).

Likewise, when students ignore assessment information and when they consider assessment as a tool for improving teaching (for teachers), or for accountability purposes, they are less likely to use it to improve their performance. These findings may help us to appreciate that among the observed constructs, the conceptions that assessment improves learning has a key role in promoting student learning. The findings hinge on the premise that students who regulate their own learning achieve more (Reeve, 1998) whereas students who subject responsibility to external control tend to achieve less (Brown & Hirschfield, 2008).

The fourth research question sought to document students' views for improving mathematics assessment practices in Tanzanian secondary schools. It should be

noted that like in previous studies (Pat-El et al., 2015) Tanzanian students know the type of assessment they value. First, students recommended increasing the number of mathematics tests and assignments as a strategy to promote mathematics learning. Such a finding is rooted in the fact that Tanzania being a high-stakes examination country, students would like to prepare for the examinations as much as possible. Second, students proposed that improving mathematics learning requires having more professional and friendly mathematics teachers. However, this recommendation is multifaceted because students do not only propose for increased number of mathematics teachers but also, they call for friendly and professional teachers. Potential explanations for this result could be that students experience malpractices such as punishment from mathematics teachers when they make errors or mistakes in tests and examinations. These results call for specific interventions such improving the interactive competencies for teachers to improve teacher reactions to student errors (Nkuba et al., 2018).

Another important result was that students recommended changing perceptions about mathematics to regard it as a simple subject in order to improve their mathematics learning. Although students conceived mathematics to be an interesting but difficult subject, they also believed that they can do well in mathematics given supportive learning environment (Kyaruzi, 2019). The role of perceptions in performance is well articulated in the literature including the Theory of Planned Behaviour that perceptions influence actions which in turn influence performance (Ajzen, 1991; Barnes, Fives & Dacey, 2017; Pajares, 1992). Thus, it is important for students to develop positive perceptions about mathematics subject in order to benefit from assessment information. Additionally, students proposed increased peer cooperation as an important practice for their mathematics learning. The role of peers in assessment is well acknowledged in formative assessment (Kollar & Fischer, 2010) because peers can give each other feedback that can help in improving their learning.

Lastly, students recommended that there should be increased quality mathematics textbooks. It was further argued that fewer textbooks reduce the chances of doing more mathematics exercises. Students went further to identify that when mathematics textbooks contain errors, their mathematics learning is distorted. These findings support Ginsburg (2009) who argued that mathematics textbooks become the obstacle for mathematics learning when they are coupled with errors and ambiguous or confusing statements. If well prepared, mathematics textbooks provide students with the opportunity to practice and reinforce learnt materials.

Generally, like in other high-stakes examination countries (Chen & Brown, 2018) evidence from this study show that students have positive conceptions about the purposes of assessment. In particular, the conception that assessment improves learning had positive influence on students' mathematics performance. Moreover, the findings are in line with the recent studies which showed that Tanzanian students valued their mathematics teachers' assessment and feedback practices when the teacher provides them with scaffolding support to overcome learning challenges (Kyaruzi et al., 2018). Extending previous studies, this study has documented some evidence that assessment is conceived differently among boys and girls. This phenomenon calls for further studies to establish reasons for the variation. Unlike Brown and Hirschfield (2008) who found out that the conception that assessment is for accountability purposes predicted mathematics performance, this study did not find such evidence. Such inconsistencies about the effect of accountability conceptions of assessment indicate that conceptions of assessment and its effects are contextually based.

Conclusions and Recommendations

This study has established that students endorsed more the conception that assessment improves learning and teaching and it promotes accountability. It was further noted that there are gender differences in students' conception of assessment that assessment improves teaching and assessment is for accountability purposes. Additionally, it has been shown that the conception that assessment improves learning positively predicted students' mathematics performance. Qualitative results illustrated that despite the contextual challenges such as shortage of mathematics teachers and relatively low-quality mathematics textbooks, most students valued their mathematics teachers' assessment practices such as feedback. The findings suggest that, efforts to improve mathematics learning should capitalise on empowering learners to appreciate the formative role of assessment through, inter alia, using assessment information or feedback to improve learning. Evidence from this study further indicates a need to improve mathematics learning environment with respect to having enough mathematics teachers, textbooks and specific interventions that seek to improve student perceptions of mathematics. Assessment practices by mathematics teachers should capitalise on enabling students to develop positive perceptions on teacher assessment practices, realising the positive role of assessment and encouraging students to use assessment information. As discussed earlier, students will develop positive conceptions of assessment if teachers provide feedback in a professional and friendly way.

Although the study systematically drew a large representative sample, results should be interpreted in light of few limitations. Firstly, the study was mainly informed by self-reports data from questionnaires and student focus group discussions, which might be limited in their scope—although the data analysis provides evidence for their validity. Hence, future research could further substantiate these findings with other measures such as observational data. Secondly, it is not easier to draw strong causal conclusions based on cross-sectional survey design, hence, findings in this study can be substantiated by longitudinal and intervention studies. Despite the limitations, the robust nature of the analyses used and the mixed and complementary nature of analyses guarantee that the results have important theoretical and practical contributions. Given the influence of conceptions of assessment on mathematics performance, a detailed qualitative study exploring sources of students' conceptions of assessment is recommended.

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