

The Use of Learner-centered Approaches in Mathematics Subject: A Case of Pugu Secondary School in Ilala District, Tanzania

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Abstract: This study sought to examine the use of learner-centered approaches in mathematics Subject at Pugu Secondary School in Ilala District, Tanzania. The study employed a qualitative approach through interviews, focus group discussions, documentary review and classroom observations. The study involved 30 students who participated in classroom observations and FGD and two teachers through interviews and the classroom observations. The study established that advanced mathematics teachers and students equally positively perceived the use of learner-centered approaches in the mathematics subject. Teachers integrated teacher-centered and learner-centered approaches but they lacked competence on how to effectively integrate different strategies when facilitating the lessons. Teachers either prepared lesson plans without following it or did not prepare the lesson plans at all. The study recommends that school administrators should make sure that teachers prepare and use lesson plans to guide the teaching and learning processes for better results. Finally, there is a need for frequent in-service training to mathematics teachers on how to effectively integrate different teaching and learning strategies in order to enhance students' achievement in mathematics.

Keywords: Learner-centered Approaches; Advanced Mathematics; Competencies; Teaching and Learning

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Introduction

The Learner-centered approaches are methods of teaching and learning that replaced the traditional "teacher-centered" method of instruction. Learner-centered approaches are instructional strategies that place the learner at the center of the learning and therefore learners are able to acquire more knowledge in their studies (Weimar, 2013). The learner centered approaches are housed in constructivists' theory, the theory that regards learning as a process shaped by eternal

forces. From this view, learning is meaningful only when individuals are actively engaged in social activities (Duffy, 2013). The constructivist philosophy conceptualizes that knowledge is constructed through interaction with the environment and through dialogue with others and reflection (Vavrus, Thomas & Bartlet, 2011). Thus, knowledge, from this perspective, is created by interacting new information with the existing one (du Plessis and Muzaffar, 2010).

Learner-centered teaching and learning approaches are underpinned by the constructivist philosophy. This philosophy conceptualizes that knowledge is constructed through interaction with the environment and through dialogue with others and reflection (Vavrus, Thomas & Bartlet, 2011). Thus, knowledge, from this perspective, is created by interacting new information with the existing one (du Plessis and Muzaffar, 2010). According to Ochieng (2020), Learner-centered Teaching and Learning Approaches (LCTLAs) are instructional strategies through which the learner is placed at the center of the teaching and learning process. According to Weimar, (2013), these strategies are multidisciplinary in that students learn through a variety of media for meaningful learning to take place. Duffy (2013) posits that learning is meaningful only when individuals are actively engaged in social activities.

In Thailand, a study done by Treesuwan and Tanitteerapan (2016) revealed that learner-centered teaching and learning approaches were perceived positively by both teachers and learners. The approach helped teachers and learners to interact well by sharing and making collaborative discussions on different subjects, thus boosting students' confidence in articulating their feelings and sentiments.

According to Wohlfarth et al. (2008), in the learner-centered approach, classes are more open for critical thinking, active learning and real-world assignments. The study found that LCTLAs increased learners' critical thinking ability and encouraged learners' self-directedness. Ochieng (2020) further argues that LCTLAs increase learners' active participation and are more effective than teacher-centered learning approaches in which students simply listen to lectures and do assignments. He also emphasized that active participation increases the quantity of information absorbed by learners in the process of learning and that enhanced interaction between students and instructors have positive impact on the quality of learning.

Lukindo (2016) found that using competence based education through the use of LCTLAs influenced positive learning outcomes. The author stressed that LCTLAs prioritize learners with teachers serving as facilitators of the teaching and learning process and that LCTLAs grants learners greater opportunity to actively reflect, evaluate,

analyze and synthesize what they have learned. The LCTLAs educate students for real-world circumstances, exposing them to critical thinking and innovation.

Kafyulilo (2014) asserted that the role of the teacher in the learner centered approach is to direct class activities and tasks where students explore and create knowledge through critical thinking. Through this approach, students actively interact not only with each other but also with the teacher in the process of teaching and learning. On the contrary, Komba and Mwandaji (2015) have it that the traditional system of learning such as the "chalk and talk" approach resulted in poor students' performance. Therefore, learner centered approaches are more ideal for enhanced learning effectiveness.

Mathematics subjects usually register a failure rate among students at all levels in Tanzania (Mazana, Montero & Casmir, 2019). This failure rate is attributed to several factors such as teachers' and students' partial use of LCTLAs, and the absence of teaching and learning resources (Mhonyiwa, 2014). A high failure rate is also associated with incompetent teachers and teachers' negative attitude towards students and mathematics (Michael, 2015).

Tanzanian secondary school students have been performing poorly in mathematics. This has also been the case at Pugu Secondary School where students' pass rates in Advanced Mathematics fluctuated from 96% in 2014 to 96% in 2015, 82% in 2016, 62% in 2017 and 64% in 2018 (NECTA, 2018). Despite the government of Tanzania's efforts to train teachers on LCTLAs and to launch a number of programs for improving teachers' pedagogical content, the challenge still persists (Lukindo, 2016). As a result, an evaluation of the usage of LCTLAs in improving mathematics performance in advanced secondary schools is inevitable.

Reviewed literature shows that studies have investigated the learner-centered teaching and learning approaches in different subject areas, apart from mathematics. The studies include Treesuwan and Tanitteerapan (2016) in Thailand, Wohlfarth et al. (2008) and Strobel and Van Barneveld, (2009) in the United States of America, Ochieng (2020) in Kenya and Lukindo (2016), Michael (2015), Mwangi (2014), Kafyulilo (2014), Mtitu (2014), Mazana, Montero & Casmir (2019),

Komba and Mwandaji (2015) as well as Mhonyiwa (2014) in Tanzania. As a result, there is a gap of research on the use of LCTLAs to improve mathematics performance in advanced secondary schools, especially in Tanzania.

The study was conducted at Pugu secondary school in Ilala District on use of the learner-centered approaches in mathematics subject. Students' performance in advanced mathematics at Pugu secondary school fluctuates yearly from 2014 to 2018 which led the researcher to find out about approaches used in teaching so as to make relevant recommendations regarding the problem. This study therefore sought to establish the use of Learner-centered Approaches on Mathematics Performance at the Secondary School.

Methodology

This study used a qualitative approach. By definition, a qualitative approach is an approach that involves a collection of non-numeric data which includes texts, pictures and video clips gathered from interviews, Focus Group Discussions and observations (Saunders, Lewis & Thornhill 2007). This study used a case study design. Robson (2011) defines case study as "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple sources of evidence."

Population and Sampling

The study used purposive sampling to select two out of five advanced mathematics teachers who could provide information through the in-depth interview and for conducting classroom observations during the teaching and learning sessions. Then, a simple random sampling was used to select 30 out of 231 advanced mathematics students who were randomly picked to form the Focus Group Discussions of ten students each.

Validity and Reliability

The instruments were subjected to two supervisors from the Open University of Tanzania who gave opinions on what had to improve it before data was collected.

Statistical Treatment of Data

Data was analyzed using the thematic content analysis technique (Creswell, 2012). This was done by arranging it in categories and themes.

Ethical Considerations

This study adhered to ethical issues. The researchers obtained a clearance letter from the University which formalized this study. Then, permission to conduct data collection in the selected area was sought from local government authorities where a letter introducing the researcher was obtained. On the other hand, consent forms were supplied to respondents which every respondent was required to sign indicating their consent to be involved in this study.

Results and Discussions

This section presents results of the study and it was guided by research questions as follows:

Research Question 1: What are teachers' and students' perception of learner-centered teaching and learning approaches in advanced mathematics?

The first research question dealt with the assessment of teachers' and students' perception toward the learner-centered teaching and learning approaches in enhancing advanced mathematics performance. Teachers' interviews, Students' focus group discussions and the observation schedule were used to collect data.

During the interview, one of the participants stated: "this approach is good because students can share and interact among themselves and with their teachers. Through interaction and sharing, mathematics knowledge and skills can be transmitted to others" (Interview, A). The second teacher lamented that "learner-centered teaching and learning approaches are good strategies as an emphasis in teaching advanced mathematics is to enhance good performance but the only challenge to me, I lack training how to integrate different strategies when facilitating the lesson" (Interview, B).

On other hand, one student said; "We perceived learner-centered teaching and learning strategies positively when our teachers facilitated lesson in the classroom but the only challenge to us, we are lacking competencies on the application of LCTLAs during classroom learning" (FGD, 2). These results show that teachers and students perceived positively that learner-centered teaching and learning approaches can enhance students' performance in advanced mathematics. The finding conforms to Treesuwan and Tanitteerapan

(2016) who revealed that the LCTLAs facilitated interaction between students and teachers and enabled them to share and discuss the concept, hence, enhancing students' achievement.

Research Question 2: How did teachers and students use Learner-centered Teaching and Learning Approaches in Advanced mathematics?

In this research question, the researchers used the observation schedule guides to observe how teachers and students practiced the LCTLAs. The researchers met with teachers before entering the classrooms and the two teachers signed the consent form before classroom observations commenced. Non -Participant observation was used by the researchers in that during a classroom observation. One of the researchers sat back in

the classroom and ticked items based on what took place in the classrooms.

In both table 1 and table 2, teachers were observed asking relevant questions and respecting students' ideas, using students' previous knowledge before guiding the learner, providing collaborative tasks for students in the classroom, encouraging the students' questions engagement in the learning process and inviting students to make a demonstration on the chalk blackboard. However, the teacher did not follow the lesson plan in the process of teaching and learning. The classroom observations revealed that two teachers somehow practiced learner-centred teaching and learning approaches.

Table 1: Teachers' and Students' Practice in the Classroom

Observed teacher Teacher A	Statement	Scale	
		Done	Not done
	The teacher asked relevant questions and respected students' ideas	√	
	The teacher used students' previous knowledge before guiding the learner	√	
	The teacher provided collaborative tasks for students in the classroom	√	
	Students talked and asked questions to the teacher	√	
	The teacher encouraged students' questions engagement in the learning process	√	
	The teacher used and followed up the lesson plan		√
	The teacher invited students to make a demonstration on the chalk blackboard	√	

Table 2: Teachers' and Students' Practice in the Classroom

Observed teacher Teacher B	Statement	Scale	
		Done	Not done
	The teacher asked relevant questions and respects students' ideas	√	
	The teacher used students' previous knowledge before guiding the learner	√	
	The teacher provided collaborative tasks for students in the classroom	√	
	Students talked and asked questions to the teacher	√	
	The teacher encouraged the students' questions engagement in the learning process	√	
	The teacher used and followed the lesson plan		√
	The teacher invited students to make a demonstration on the chalk blackboard	√	

This means that teachers were somehow able to use the learner-centered approaches. However, they disregard to prepare learner –centered lesson plans required to improve the use of the approaches. The results conform to Nzilano (2017) who revealed that tutors had partial

knowledge on the use of the learner-centered approaches. Therefore, there is a need to emphasize the use of the learner-centered approaches in secondary schools and provide teachers 'training on proper use of the learner-centered lesson plan.

During documentary review, researcher revealed that one teacher had prepared a lesson plan before going to the period but he/she did not use it in the process of teaching and learning. On other hand, the other teacher did not bring any lesson plan for review. This means that teachers had not prepared lesson plans at all or had prepared one but did not use it in the teaching and learning process. This implies that, teachers may not be able to follow stages of the lesson plan, unable to choose appropriate teaching and learning techniques, hence causing students to miss appropriate assessment activities required during the teaching and learning process. The

results conform to Nzilano (2017) who also found that teachers had not prepared lesson plans prior to classroom teaching and learning. Therefore, emphasize should be done to enhance teachers to actively observe the requirements and procedures for implementing the learner-centered approaches.

The Use of Learner-centered Approaches

The researcher conducted two classroom observations to assess the use of the learner-centered approaches in the classrooms. Results are presented in Table 3 and 4.

Table 3: Teaching and Learning Strategies (Classroom observations)

Observed Teacher	Strategies	Very often	Often	Never
Teacher A	Lecture method (LM)	√		
	Group discussion (GD)	√		
	Questions and answers (QA)	√		
	Problems solving (PS)	√		
	Inquiry-based learning (IBL)	√		
	Discovery learning (DL)		√	
	Think –pair share (TPS)	√		
Teacher B	Lecture method (LM)	√		
	Group discussion (GD)		√	
	Questions and answers (QA)	√		
	Problems solving (PS)		√	
	Inquiry-based learning (IBL)		√	
	Discovery learning (DL)		√	
	Think – pair share (TPS)	√		

Table 4: Teaching and Learning Strategies (Classroom observations)

Observed Teacher	Strategies	Very often	Often	Never
Teacher B	Lecture method (LM)	√		
	Group discussion (GD)		√	
	Questions and answers (QA)	√		
	Problems solving (PS)		√	
	Inquiry-based learning (IBL)		√	
	Discovery learning (DL)		√	
	Think – pair share (TPS)	√		

Table 4 indicates another teacher's use of the learner-centered strategies during classroom observation. The results indicate that the teacher very often used lecture method, questions and answers and think-pair share methods. The teacher often used group discussion, problem solving, inquiry-based learning and discovery learning approaches. This implies that there is mixture of methods of teaching i.e. teacher-centered methods and the learner-centered methods of learning. The results conform to Lukindo, (2016) who revealed that teachers preferred the use of question and answers and

lecturing methods. Therefore, teachers should be trained on how to use a variety of learner-centered approaches to enhance students' achievements in mathematics subject.

Conclusions and Recommendations

Conclusions

It is concluded that advanced mathematics teachers and students positively perceived the use of learner-centered approaches in the mathematics subject. The positive perception motivates and enhances students' achievement in mathematics. Teachers integrated teacher-centered and learner-centered approaches but

they lacked competence on how to effectively integrate different strategies when facilitating the lessons. They often used group discussion, problem solving, inquiry-based learning and discovery learning approaches to facilitate learning. Finally, teachers either prepared lesson plans without following it or did not prepare the lesson plans at all. The involvement of both teacher-centered and learner-centered approaches allowed the teachers and students to love the mathematics classes.

Recommendations

The study recommends that teachers' and students' positive perceptions on the use of learner-centered approaches have to be enhanced by providing training to teachers, increasing teaching and learning resources, ensuring close monitoring and inspection of schools and encouraging teachers and students to adopt the learner-centered approaches in classroom teaching and learning in order to attain better performance in the mathematics subject. Finally, there is a need for frequent in-service training to mathematics teachers on how to effectively integrate different teaching and learning strategies in order to enhance students' achievement in mathematics. The training can be done through seminars, workshops and any other means.

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