



Exploring the Extent at Which Mathematics Teachers Use Real-Life Examples/Aids/Situations in Their Daily Mathematics Teaching and Learning Environment

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Abstract

This study explored the extent at which mathematics teachers in ordinary level secondary schools use real-life examples/aids/situations in their daily mathematics teaching and learning environment. During inquiries 10 mathematics teachers from different schools were purposively selected and involved as key informers in FGD. In searching data, classroom observation, document review and Focus group discussion was smeared. The collected data was analysed by content analysis through coding major themes, quoting different narrations as fetched from informers as well as indenting key points testified by research defendants. The discoveries indicated that in most cases mathematics teachers in ordinary level secondary schools in Tanzania do not use real life examples/aids/situations in their daily mathematics teaching and learning environment rather they are just using simple tools for drawing and writing such as graph papers, coloured chalks and plain papers. These tools do not signify the authentic content learned in mathematics in their complexity as it relate to students actual living experiences. The study recommended that, mathematics teachers in ordinary level secondary schools are eagerly encouraged to extemporize their teaching approach by using real life examples/aids which will enable students to see the connection/utility of what they learn in the class to their real life experiences and finally upsurge their interest and performance in mathematics.

Keywords: Ordinary level secondary schools, mathematics, teaching aids

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1. Introduction

Facilitation of Mathematics in classroom is made fascinating to students when teachers are able to connect mathematical concepts learned in classrooms to learners real life problems and experiences (Ahmed et al., 2004). Effective connection between what learned in mathematics with students actual life experiences is made when teachers use actual teaching aids and objects which mirror students real life environment (Arthur et al., 2018). Since mathematics is a groundwork of all science subjects, teachers should facilitate this subject not as intangible knowledge but as a living part and parcel of student's life (Beswick, 2005). In line with this practice Deogratias (2022) reports that most mathematics teachers sees innovating real life examples/aids as a difficult task and

time consuming exercise. However the use of teaching aids/objects in mathematics lessons is very critical in all level of education (Ahmed et al., 2004).

Using real-life examples/aids help students to understand the subject well and finally perform it brilliantly (LeMahieu et al., 2017). Mathematics should be facilitated in such a way that students are able to realise and use mathematical concepts/knowledge learned in classrooms to solve their daily life problems as indicated in the aspect of competence in teachers lesson plans (Mazana et al., 2018). Since in the aspect of competence, teachers shows how the learned content will help students to solve various problems in their life, obvious classroom learned mathematics is not expected to be abstract (Kunwar, 2020a). Speaking on the same sight LeMahieu et al. (2017) contend that mathematics as a science should be taught in the way that reflect students actual living experiences. When teachers do not contextualize mathematics to students actual life experiences, it creates mathematics phobia among students and this letters the reason why most people in society fear mathematics and term it as difficult subject (Kunwar, 2020b).

In most cases mathematics teachers use fruits of all kinds, pieces of bricks, pebbles, gravels, piece of papers or bottle tips in helping students to realise and custom mathematical concepts such as counting, adding and subtracting numbers or items in lower education levels and use rulers, protractors, cylindrical tubes, water pipes, mathematical sets, mathematical tables, different figures and shapes in higher education levels (secondary schools) (Ojose, 2011). However these aids represent just a little conception of mathematical skills compared to a huge package that students learn in mathematics in operating with fractions, decimals and percentages in there multiplicity of meanings (Arthur et al., 2018). According to Deogratias (2022) mathematics teachers should dedicate quality time in designing and preparing contextual teaching aids which reflect students actual life experiences of the classroom learned contents. There should be improvised teaching aids that connect classroom learned contents to student's actual living environment.

The skills of attaching classroom learned mathematical knowledge to student's actual living experiences by using authentic teaching aids/objects has been a global agenda (Do et al., 2021). Most of the countries performing better in mathematics such as Netherlands, Singapore, Vietnam, America and India have adopted what is called Realistic of Mathematics Education (Do et al., 2021). Realistic of Mathematics Education theorises that mathematics should be taught based on the glitches present in real life situation (Altay et al., 2017). In another view, for mathematics teaching and learning to be operative, students should be able to recognize mathematical concepts in their tangible living environment (Altay et al., 2017). Adjoining hands to these argumentations, Dao et al. (2022) argue that application of RME has helped these countries to increase mathematics performance since teachers are encouraged to update their teaching methods by using authentic teaching aids/objects/situations and students are interested with the subject as it mirror their daily life experiences.

In Africa countries such as Ghana, Egypt, Tunisia, Morocco and Rwanda are performing better in mathematics since they have updated their education system to incorporate RME (Esra, 2018). Mathematics teachers in these countries are cheered to use real life objects/situations in mathematics teaching and learning environment which

are meaningful to students life (Altay et al., 2017). This means that, teachers contextualize mathematics to student's tangible life experiences. Mathematics is made simple and exciting to students since teachers consent them to mathematise mathematical concepts learned in classroom to their actual living experiences (Intarakamhang et al., 2023). This process make students to realise the efficacy and value of mathematics in their life (Mazana et al., 2018). When students are able to bond classroom learned mathematics to their actual living experiences, they eventually love the subject, confiscate fear and probably perform it better (Kunwar, 2020b).

In Tanzania different studies have been done pertaining to mathematics teaching and learning. Example, Micheal (2015) did the study on factors leading to poor mathematics performance where he found that among the factors for poor mathematics performance are poor teaching and learning environment and poor students background on mathematics. Again Mazana et al. (2018) assessed students altitude towards mathematics where he found that as students move from lower to high education levels, they exhibit negative attitude towards mathematics. Latest studies by Deogratias (2022) found that there is a need for mathematics Pre- Service Teachers to learn how to design and use real life aids/objects in mathematics teaching and learning environment. Taking into consideration that mathematics performance in secondary schools in Tanzania is very low as the results in NECTA examinations indicate, this study is significant as it shows the authenticity of what actually happens in classrooms (abilities of mathematics teachers to use real life examples in their daily mathematics teaching and learning environment).

2. Method

Ten teachers selected purposively from different secondary schools amalgamated with the researcher in FGD to explore the research problem. These teachers operated as key informers of the subject and discussed with the researcher on how they use real life examples/aids in their daily mathematics teaching and learning environment as per directives of the prepared discussion protocols while recording the feedbacks. The discussions based on the established criteria/themes connecting mathematics to student's real life experiences. Having thoroughly discussions, the feedbacks collected well and then transcribed into different themes connecting mathematics to student's real life experiences. Furthermore the researcher reviewed teachers prepared lesson plans to see the indicated teaching materials/aids/tools and its reflection to student's real life experiences. Lastly the researcher did classrooms observations during mathematics lessons to see the authentic teaching aids/objects/situations used by mathematics teachers if they relate to students actual living environment. While observing the teaching aids the researcher took some pictures of the items/tools used in mathematics lessons. During classroom observation, the prepared observation protocols aided the process to ensure accuracy of the collected information.

After all the process of data gathering, the collected information was analysed through content analysis. Before the operation, the researcher reviewed the specific objective and the research question of the study. Having clear re-familiarization with the research objective and research question, it followed by establishment of some

categories/themes/codes connecting classroom learned mathematics to student's actual living experiences as directed in pragmatism theory of knowledge generation where students are supposed to be taught things which are practical and relate to their actual life. Then the collected data systematically applied to the established themes/coding frames. To ensure validity and reliability of the transcribed data, member checking was done by two key informers who requested to read the transcribed information to see if they match with the intentions of the participants as well as the purpose of the study. Lastly, the resulted data/themes analysed through quotations, textual, pictorial and tabulations showing different identified variables.

3. Results

This study explored the extent at which mathematics teachers in ordinary level secondary schools use real life examples/aids/objects in their daily mathematics teaching and learning environment. It entailed in exploring different ways through which mathematics teachers in ordinary level secondary schools use real life examples which reflect student's actual living environment in mathematics lessons. During considerations, different facets regarding the use of real life examples/aids/objects/situations in daily mathematics teaching and learning environment was witnessed. The study data was collected through direct observation during mathematics lessons, Focus Group Discussion with respective mathematics teachers as well as document review by gauging mathematics teacher's lesson plans to observe the indicated teaching aids. The study specifically entailed to explore the extent at which mathematics teachers use actual teaching aids/objects/situations in their daily teaching and learning environment and its relationship to students actual living experiences.

3.1 Teaching aids/objects/situations used by mathematics teachers in their daily mathematics teaching and learning environment

During explorations, the researcher amalgamated in Focus group discussion with ten mathematics teachers purposively selected from different secondary schools to sightsee how they use real life examples/aids/objects in their daily mathematics teaching and learning environment. The Focus group discussion was steered by prepared discussion guidelines demarcating different aspects on the use of real life examples/aids and its relation to student's tangible living atmosphere. Through FGD key informants recited different areas and the real life situations/objects they utilize in mathematics lessons to conceptualize the subject to student's real life familiarities. The table below summarizes different objects/aids, situations where they are used and the subject content (topics) facilitated.

Table 1. Teaching aids/objects used in mathematics teaching

Name of the teaching aid/object	Situation where they are used	Subject content/topic facilitated
Displayed charts showing laws of logarithms	Determination of soil PH and in Carbon dating	Used in facilitating the concept of logarithms

Fruits	Showing fractions/portions	Used in facilitating the concept of Fraction
Coloured chalks	Used in indicating different coefficients of letters	Facilitating the concept/topic of quadratic expressions
Coins and dies	Tossing coins and dies	Facilitating the concept of probability
Bricks	Explaining construction activities	Used in facilitating the topic of sequence and series
Chalk box, Eggs in a tray, crate of soft drinks	Arrangement of different things or entities	Use to facilitate the concept of matrix
Plane mirrors	Displaying images of objects	Facilitating the concept of transformation
None	Bargaining prices of commodities	Facilitating the concept of linear programming
None	Showing relationship between different items	Facilitating the concept of function
Rulers/mathematical tables	Locating different angles	Facilitating the concept of trigonometric ratio

From the table above, it shows that in most cases mathematics teachers in ordinary level secondary schools provides wide-ranging application of various mathematical topics in life but occasionally the stated situations tie with student’s actual living experiences. For instance, in the concept of logarithms, informants delineated that acquired skills are used in determination of soil PH and in Carbon dating without any practices executed, and just displaying charts showing laws of logarithms, here it can be seen that students will acquire insincere knowledge of the subject matter which will not be useful and practicable to their tangible living environment. Furthermore, displayed charts/mathematical sets are not the actual teaching aids signifying logarithms or other mathematical concepts in their multiplicity of meaning, rather are just objects which help students to see the picture of the formula or its image.

Most of the teaching aids and situations outlined above are insignificantly utilizable in student’s day to day activities. For the concepts to be well understood and mastered by students, teachers were supposed to use the real objects/aids delineating mathematical knowledge/skills which are familiar and operational to student’s life. According to Arthur et al. (2018) classroom learning tend to be superficial and short lived if teachers do not show the real application of what is taught to students actual living experiences. In this case, mathematics teachers were supposed to postulate precisely tools/objects of the subject concepts/topics and their application to student’s actual living environment. Further explorations navigated that to some topics informants failed to site the teaching aids/objects they use in facilitating the subject, they ended up reciting situations where the knowledge of the subject matter are used. In this particular case one of the informer reported that:

“To be honest, it is difficult to get real examples that can be used to facilitate some of mathematical topics such as logarithms, quadratic expressions or trigonometric ratios, we just solve examples of the topic matters and then ask student to perform more exercises, but to show them what they meant in life is difficult and even in the books it is not indicated, we are just insisted to be make improvisations without any guide on how can we innovate the mentioned contents”

The above annotations tie with what have been acknowledged by other scholars. For instance, speaking on the same routine Mazana et al. (2018) note that, in most cases students perform poor in mathematics in different levels of education in Tanzania since they do not see the usefulness of mathematics in their real life making them not loving the subject and unfastened interest with the subject since teachers do not use real-world examples during classroom lessons. Again Deogratias (2022) contends that in most cases mathematics teachers never use actual teaching aids since they see it as time consuming and difficult in designing the real objects. These findings goes astray with pragmatism approach of learning in education since Rai and Lama (2020) contend that students should be taught things that are practical to their life and applicable to the real world. Hence professional development should be provided to mathematics teachers to be equipped both pedagogically and materially to intellectualise the subject to students authentic living experiences.

3.2. Ways by which mathematics teachers use real life examples/ aids/objects/situations in their daily teaching and learning environment

Throughout explorations, it was found that in most cases, mathematics teachers in ordinary level secondary schools seldom use real life examples/aids in their daily mathematics teaching and learning environment. The study figured different ways by which mathematics teachers use various tools/illustrations to facilitate the subject. Most of the outfits identified during explorations are simple mathematical tools for drawing or writing. It was further discovered that most teachers use them as teaching aids although they are not and none representative of the actual subject content facilitated. Below are different ways employed by mathematics teachers with respect to the use of actual teaching aids/objects/situations in mathematics lessons as acknowledged throughout the study explorations.

The study recognised several tools employed by mathematics teachers in their daily teaching and learning environment serving for measuring purposes. The tools observed are chalkboard rulers, spirals and different components of the mathematical sets. It was further revealed that mathematics teachers use them for measuring lengths, angles and other metric units. Speaking on application of these measurement tools as teaching aids, one of the informers reported that:

“Items for measuring metric units are very important since mathematics involve determination of different angles, heights and distances. Hence these tools help both students and teachers in measuring the asked parameter and determine

accuracy lengths/angles given. But also it helps us in lining different shapes as far as mathematics concerns”

Actually these tools are not the actual teaching aids which represent different mathematical concepts such as logarithms, matrix, probability or quadratic in the complexity of their meaning. Rather they are simple tools for measuring tenets although mathematics teachers use them as teaching aids. According to Arthur et al. (2018) quality of mathematics teaching and learning is made operative when teachers use real life examples which reflect students actual living experiences. In the same line Mazana et al. (2018) argue that most students in different levels of education in Tanzania perceive mathematics as difficult subject since in most cases it is taught as intangible knowledge which have no utility in their life.

Using tools for measurements as teaching aids misalliance with pragmatism approach of learning since effective learning occurs when classroom learning contents bear practical application to students life (Axtelle, 1968). It was expected that the study would found physical tools/aids representing the facilitated mathematical concepts which relate to students actual living experiences. For students to understand and engage with the subject well, mathematics teachers were supposed to incorporate real life examples or mathematical projects relevance to student’s authentic environment rather than just using simple tools for measuring angles, lengths and other metric units (Karakoç & Alacaci, 2015).

During explorations, the study revealed the use of different tools for illustrations. This included improvised items illustrating various shapes and figures in mathematics such as pyramids, rectangles, squares, spheres and trapeziums as displayed in the attached appendices. Most of these items were just reserved in classrooms and used to demonstrate different mathematical shapes/figures. Regarding to the use of illustration and demonstration tools, one of the informer replied that:

“These tools assist us to elaborate the subject/topic to students since helps them at least to have the picture of how the shape/figure looks like. This help students to remember the formula of a particular shape when asked to calculate areas or perimeters of the given problem”

From the case above, it is important to know that these tools touch just a little conceptions compared to concrete mathematics mathematised by teachers when orientating different topics such as matrix, transformation, quadratics, logarithms or other mathematical problems in their complexity and matriculations (Karakoç & Alacaci, 2015). Speaking on the same scenario, Deogratias (2022) asserts that in most cases mathematics teachers seldom use real life objects since they believe that improvising real objects representing mathematical concepts is time wasting, hence facilitating the substance without using teaching aids. This practice eases rote learning of mathematics and insincere mastering of the subject by students which may cause massive failure in the particular subject as experiences in NECTA examinations results.

In further explorations, the researcher revealed various charts showing different mathematical formulas and shapes. These charts were boarded on classroom walls displaying laws of logarithms, Pythagoras theories, quadratic expressions, mathematical figures, exponents, sets and trigonometric ratios. During classroom lessons, mathematics teachers ask students to observe them as reference sites regarding the presented concepts. In sincere exploration one of the teachers connoted that:

“The displayed charts on walls help students to memorise the represented formulas easy or to refer when solving mathematical problems on the respective topic. This simplify our work when solving various problems since students will refer to the displayed formulas and apply it solving the given problems”

From the above narrations, it shows that mathematics teachers just attach formulas or figures on classroom walls for students to memorise it and then apply them in solving various mathematical problems. Certainly this is rote learning since students absorbs formulas or shapes and determine areas or other mathematical expressions even without knowing their actually meaning in the real life. When speaking on using real life examples does not mean application of simple mathematical tools by displaying on classroom walls or other area around the school compound rather it refers to application of actual tools/objects/situations representing the actual facilitated subject matter (Vos, 2018). Mathematics should be taught as real knowledge which are applicable student’s daily living experiences.

In the three identified methods above, using simple mathematical tools for measurements, illustrations and displayed charts present superficial concepts compared to huge packages swallowed by students when learning mathematics. These items does not represent authentic knowledge teachers impact to students regarding three dimensions figures, trigonometric ratios, linear programming, matrix or other mathematical problems in their actual meaning. This elaborations mismatch with pragmatism approach in education since Rai and Lama (2020) contend that in education students should be taught things which are practical and applicable in the real world. Professional development skills should be communicated to mathematics teachers on the how to design/improvise actual teaching aids/situations/projects representing structured subject contents.

3.3. Exploring the actual teaching aids/objects/situations in mathematics lesson plans

During inquiries, teacher’s lesson plans were reviewed to see what has been indicated in the document and its implementation in the classroom. The findings showed that, teaching aids indicated in the aspect of teaching and learning materials of the lesson plans are superficial items for drawing or writing such as graph papers, plain papers, coloured chalks, pencils and rulers as compared to the actual meaning of the content represented in the lesson plan. The table below show some mathematics topics and the teaching aids indicated in the lesson plans as witnessed through explorations.

Table 2. Teaching aids indicated in the mathematics lesson plans

Name of the topic	Indicated teaching aids in the lesson plan
Coordinate geometry	Graph papers, ruler, paper, chalks
Area and perimeter	Graph paper, pencil, ruler
Three dimension figures	Ruler, pencil, graph paper
Functions	Coloured chalks, graph papers
Linear programming	Coloured chalks, graph papers
Probability	Graph papers, ruler, paper, chalks
Matrix	Graph paper, pencil, ruler

From the table above, it can be seen that in most of the topics, the indicated teaching aids are just items which support teachers to draw or write description of the topics but are not actual tools or situations representing the real subject insides. These items does not endorse students to acquire the real competencies as indicated in the lesson plan. For instance in the topic of Coordinate geometry, the competence indicated was:

“Students should have abilities to apply the knowledge of coordinate geometry in solving their daily life problems”

Looking at the indicated lesson competencies, it means students should be able to apply coordinate geometry skills in solving various problems in their daily life, however the teaching aids signposted in teachers lesson plans was, coloured chalks, Graph papers, rulers and white papers. Taking into consideration that coordinate geometry skills are applied in engineering and designs, cartography, computer graphics and navigations, it is uncertainly to use the indicated teaching aids in navigating vehicles, smartphones or other science and engineering fields. For students to acquire the outlined competencies, practical projects like GPS and GIS orientation was supposed to be held. According to Gainsburg (2008) true education comes when students are taught practical skills which are useful in their actual living experiences. Learning becomes superficial and short lived when the subject contents are not practical to students real life (Garii & Okumu, 2008). These explanations concurs with what is stipulated in pragmatism theory in education that students should be taught things that are practical for their life and applicable to the real world (Rai & Lama, 2020).\

4. Discussion

Specifically this study entailed to explore the extent at which mathematics teachers use real life examples/aids/objects/situations in daily mathematics teaching and learning environment. In this particular study, the findings of the study revealed that in most cases mathematics teachers in ordinary level secondary schools in Tanzania are not using real life examples/aids in their daily teaching and learning environment. This revelation was manifested through direct classroom observations, reviewing mathematics lesson plans as well as conducting focus group discussion with selected mathematics teachers where the study found the usage of only simple mathematical tools for drawing, writing, measurements, illustrations and displayed charts showing various formulas and figures.

This observation implies that majority of mathematics teachers orientate the subject as intangible knowledge to students actual living experiences. Absence of real life examples/aids means that mathematics is taught as abstract knowledge which have no direct application and utility to student's real world. Again this observation signifies that mathematics teachers lack skills of innovating/improvising real life examples/situations/projects which relate to students actual living environment. This results align with what have been reported by various scholars since Deogratias (2022) reports that in most cases mathematics teachers are not using real life examples/aids as they see it as time consuming in preparing and designing real objects which reflects students actual living experiences. This means that majority of mathematics teachers do facilitate the subject just by solving mathematical problems without telling students the practical applications of the learned contents in their day to day activities.

5. Conclusions

In summary the study revealed that in most cases mathematics teachers in ordinary level secondary schools in Tanzania are not using real life examples/aids which reflect student's actual living experiences in their daily teaching and learning environment. The findings showed that most of the teaching aids used in mathematics lessons are simple mathematical tools for drawing and writing. Mathematics teachers use these tools measurements, illustrations/demonstrations and by displaying drawn formulas/figures/laws on classroom walls. Further explorations revealed that instead of indicated real life examples in lesson plans, teachers just signpost simple mathematical tools for drawing or writing such as graph papers, coloured chalks and rulers. Lastly most of the observed teaching aids are simple items which help teachers in demonstrating different mathematical operation such as divisions and subtractions rather than using real life examples/situations which help students to utilize the learned skills in solving various problems in their day to day activities.

The findings indicated that in most cases mathematics teachers in ordinary level secondary schools in Tanzania do not use real life examples/aids/situations in their daily mathematics teaching and learning environment. It was further noted that even the teaching aids used or indicated in the lesson plans are just simple tools for drawing and writing such as graph papers, coloured chalks and plain papers. These tools do not represent the actual content learned in mathematics in their complexity as it relate to students actual living experiences. The study recommends that, mathematics teachers in ordinary level secondary schools are eagerly encouraged to improvise their teaching approach by using real life examples/aids which will enable students to see the connection/utility of what they learn/solve in the class to their real life experiences and finally increase their interest in the subject and this eventually may help to rise mathematics performance in ordinary level secondary schools in Tanzania.

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