

**CRITICAL ANALYSIS ON HOW LEARNER-RELATED FACTORS AFFECT
APPLICATION OF PROGRESSIVISTS' LEARNER-CENTERED APPROACHES IN
TEACHING AND LEARNING OF MATHEMATICS: A CASE OF MERU SOUTH SUB-
COUNTY, THARAKA NITHI COUNTY, KENYA.**

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ABSTRACT

Learning mathematics` problem-solving skills using learner-centered teaching approach, as emphasized in the philosophy of progressivism, enhances creativity and problem solving skills to the learners. In contrast, learning mathematics using teacher-centered approaches have increasingly dire consequences to the pupils such as poor performance, lack of creativity, poor socialization and lack of problem-solving skills. This study critically analyzed how learner-related factors affect application of progressivists' learner-centered approaches in teaching and learning of mathematics. The study employed descriptive survey research design. The target population comprised of 5,547 subjects consisting of 5,160 pupils and 387 teachers from 129 public primary schools within Meru South Sub-County, Tharaka Nithi County, Kenya. A sample size of 378 respondents was obtained using simple random sampling and purposive sampling techniques. Questionnaires were used to collect data from pupils and mathematics teachers. The results of the data analysis were presented using bar graphs, frequency tables and charts. The research findings revealed several learner-related factors such as motivation, attitude, beliefs and myths on mathematics, which were noted to make pupils participate passively in the learning process. Pupils' negative attitude towards mathematics was also noted as a major hindrance to the application of Progressivists' learner-centered approaches in teaching and learning of mathematics in Meru South Sub-County. The researcher anticipates that the findings and recommendations of this study may provide valuable reference for teachers, curriculum developers and policy makers in education on learner-centered approaches to enhance teaching of Mathematics.

Key Words: Philosophy of Progressivism, learner-Centered, teaching, learning

1.0 Introduction

Children, because of their individual personalities, require instruction that address several learning attributes (Holt, 2004). Some characteristics of young children include shorter attention spans, less experience with social interactions and basic skills in the classroom and an inability to understand lengthy, complicated directions (Holt, 2004). Although children use a variety of skills to learn new information, younger children have a limited vocabulary; hence, it is important to teach without relying solely on verbal instructions (Elliot, 1999). Teacher-centered teaching methods such as rote learning, lecture method and memorization makes the learner to be passive in the learning process and encourages dogmatism. In learner-centered teaching approaches such as group discussion, learners are encouraged to cooperate with their classmates and with their teachers.

Progressivism is a philosophy, whose major proponents are John Dewey and William Heard Kilpatrick, relates children's growth process with the process of acquiring knowledge (Kilpatrick, 1951). According to Dewey (1944), philosophy of progressivism suggests ways of teaching and learning through basing instruction on the needs, interests and developmental stages of the child. It means teaching students the skills they need in order to learn any subject, instead of focusing on transmitting a particular subject; it means promoting discovery and self-directed learning by the student through active engagement. Kilpatrick (1951) summarizes progressivism as 'child-centered instruction', 'discovery learning' and 'learning how to learn'.

In United States of America, Radu (2011) observed that through learner-centered methods of learning, pupils work on their projects enthusiastically for learning to take place, rather than memorization. Before learner-centered approaches were introduced in the American curriculum as asserted by Radu (2011), regular classroom students just memorized what they needed to know and was soon forgotten after the test. In South Africa according to Hayes (2007), progressivism as learner-centered theory with high ideals of educational revolution that make each and every child to be a successful learner. Thus, proper implementation of the progressivism theory in some schools, led to good performance in science-related subjects especially in Mathematics (Hayes, 2007).

2.0 Statement of the Problem

Mathematics is the foundation of scientific and technological knowledge that is vital in socio-economic development of a nation. Despite government's efforts to enhance the use of learner-centered teaching and learning approaches, performance in Mathematics at the Kenya Certificate of Primary Education examination has been declining over the years. In the long run, pupils may miss out on admission to high schools and due to low achievement in mathematics. The persistent poor performance has been blamed on several factors that are teacher-related, curriculum-related and learner-related. This study therefore seeks to assess and provide a critical analysis how learner-related factors affect application of progressivists' learner-centered approaches in teaching and learning of mathematics.

3.0 Purpose of the Study

The purpose of this study was to assess and provide a critical analysis how learner-related factors affect application of progressivists' learner-centered approaches in teaching and learning of mathematics among pupils in public primary school in Meru South Sub-County.

4.0 Objectives of the Study

The study was guided by the following specific objectives.

- i. To identify learner-related factors that affect application of Progressivists' learner-centered approaches in teaching and learning of Mathematics among pupils in public primary schools of Meru South Sub-County.
- ii. To critically analyze how the identified learner-related factors affect application of Progressivists' learner-centered approaches in teaching and learning of Mathematics among pupils in public primary schools of Meru South Sub-County.

5.0 Literature review

5.1 Philosophy of Progressivism

Progressivism is a philosophy that emphasizes on teaching based on the needs, experiences, interests, and abilities of learners. Progressivists emphasis on learning based on the belief that

knowledge isn't a thing that can simply be given by the teacher at the front of the room to students in their desks. Rather, knowledge is constructed by learners through an active, mental process of development; learners are the builders and creators of meaning and knowledge (Kilpatrick, 1926). Bruffee (1984) noted that through progressivists' learner-centered teaching and learning approaches, children learn to identify obstacles that hinder their learning and then work on solutions to overcome them. It equips the children with skills not just to take on obstacles in their learning process, but also the obstacles in life. In this way, learners acquire skill sets that are necessary to handle different situations in school and life. The progressive method adopts a unique teaching philosophy centered around projects, analysis of data, understanding problems and their solutions and answering questions after careful analysis of facts at hand (Biggs, 1995). This allows children to learn concepts and content without resorting to memorization but by gaining, a deeper understanding of the content learner-centered approaches namely; Learning by doing, collaborative learning and problem-solving approach.

5.2 Learning by Doing Approach (LDA)

Learning by doing is a teaching and learning approach that has been applied for many years. It has many proponents, including Plato, Thomas Hobbes, English and Spanish epigrammatists, Karl Marx and Mao Zedong, cultural anthropologists, Montessori, John B. Watson, and B. F. Skinner. Learning by doing approach has many forms, including discovery versus instruction, practical experience versus book-learning, the practice-theory-practice dialectic, and proof upon practice. Laturner (2002) noted that very few learner-centered teaching methods are used today in public schools that include the learners being able to actually do what they are being taught. This could be because of the complexity and time it adds to lesson plans, additional materials required, time allowed for assessments, inexperienced educators or traditions in the education field. Learning by doing allows a learner to practice and become confident in their ability to perform. It not only allows the teacher to assess if they are meeting the teaching goals of the course but also allows the student to be able to do what they have spent their time and possibly money to learn; so that they can use the skills, they have learned after they have completed the course. Abercrombie (2000) noted that anyone can have students read from a book, hand out a test and give out grades, but every teacher cannot complete the tasks being doing all the activities on the chalkboard, let alone be experts in the field they are experts.

5.3 Demonstration Method

Demonstrations involve activities that occur in the classroom as a means of helping learners understand how a phenomena 'works' (Biggs, 1995). This method is more active than lecture method because pupils get involved and they see in first-hand how the construction or phenomena present itself in the real world. Kilpatrick (1951) emphasize that after demonstration, the teacher should task the pupils to review key points in the class. If a significant number of pupils missed or misunderstood any key points, the teacher may need to repeat the demonstration process. As a follow-up exercise, pupils should apply the concept to a new situation so they can generalize their learning (Dewey, 1938). For technique demonstrations, it is often helpful for pupils to watch the teacher coach a student volunteer through a technique. Then the pupils should perform the technique on their own to consolidate learning. Demonstrations are usually the teaching and learning technique that involves all of the students in the class, either working in groups or alone, to solve a problem or puzzle. The benefit of demonstrations is not only that it increases attention and students are able to see a phenomena unfold, but are also able to personally manipulate and practice using that phenomena in a first-hand environment (Phillips, 2000). This is advantageous because

students may not truly understand a concept until they have manipulated it for themselves (Whetten & Clark, 1996). Examples of in-class activities can range from playing games as exam reviews (Cook & Hazelwood, 2002; Saranson & Banbury, 2004) to in-class journaling (Bolin, Khrantsova, & Saarnio, 2005).

5.4 Collaborative Learning Approach (CTA)

Collaborative teaching approach is a term for a variety of learner-centred teaching methods involving joint intellectual effort by pupils, or pupils and teachers together. In collaborative learning, Dewey (1944) recommended for pupils to work in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product. Nurrenbern and Robinson (1997) noted the main limitation of applying collaborative learning approach and group discussions as they are normally conducted is that there is no individual accountability at all. The result is the familiar situation in which some team members do the bulk of the work, others contribute little and understand little or nothing about the project, everyone gets the same grade, and resentment abounds. Adjusting the team project grades for individual performance goes a long way toward correcting these injustices. In addition, it is good practice to include some individual testing on every aspect of the project and have the results count toward the final course grade (Giangreco, 1993). If this is done, hitchhikers who understand either nothing or only the little they did personally will be penalized and perhaps induced to play a more active role in subsequent work.

Progressivists advocates forming discussion teams heterogeneous in ability level. The unfairness of forming a group with only weak students is obvious, but groups with only strong students are equally undesirable (Golub, 1988). The members of such teams are likely to divide up the homework and communicate only cursorily with one another, avoiding the interactions that lead to most of the proven benefits of cooperative learning. In heterogeneous groups, the weaker students gain from seeing how better students approach problems, and the stronger students gain a deeper understanding of the subject by teaching it to others (Nurrenbern & Robinson, 1997). Moreover, when graduates go to work in industry or business, they will be required to work in teams and will have no voice in the team formation, and their job performance evaluation will depend as much on their ability to work with their teammates as on their technical skills (Johnson & R.T, 1989). Since that's what they'll be doing then, the job of their instructors is to prepare them for it now.

5.5 Learners' Related Factors

According to Dewey (1944) effective teaching and learning is measured by what goes on in the mind and the heart of the learner but not what the teacher does or thinks. Kilpatrick (1936) emphasized that in learner-centered approaches, learning is rooted in the questions of learners that arise through experiencing the world and therefore learners should be active, not passive. Pupils' attitude and motivation are key factors to any teaching and learning process because it inculcates enjoyment, interest and curiosity in learning (Antler, 1982). Hayes (2007) notes that learners' beliefs and myths towards a particular subject affects their attitude and achievement on that subject. In teaching and learning of mathematics, myths and beliefs such as mathematics are meant for boys not girls and the ability to solve mathematics' problems is genetically inherited from parents, affects learning process.

6.0 Theoretical Framework

This study was informed by the Progressivism theory whose major proponents are John Dewey and William Kilpatrick. The progressivism theory states that the learning process starts with self-

appropriation of knowledge, construction of problems and provision of possible solutions by the learners themselves (Kilpatrick, 1947). The theory is based on philosophical approach referred to as Pragmatism, which states that an ideology or proposition is true if it works satisfactorily. Kilpatrick (1939) noted that in order to participate successfully in a progressive environment, classrooms must shift from a passive to an active role. Progressivism theory emphasizes that learners should synthesize several sources of information and references in order to draw conclusions and then evaluate them (Dewey, 1938). The theory advocates for learner-centered teaching approach where students learn through action and by being involved in the processes that will get to the end product, rather than memorization.

Progressivism theory is relevant to this study since it emphasizes on learner-centered teaching approaches such as collaborative learning, experimentation, group discussions, demonstration and contextual learning. The theory has special focus on the learner that allows them to exercise their brain through problem solving and critical thinking to enhance effective learning. Consequently, learner's brain develops and hence preparing the learner for real world and many of the everyday setbacks. In teaching mathematics, progressivisms stress that learner should construct new ideas to help one to have a better understanding of reality.

7.0 Research Methodology

This study employed descriptive survey research design. This research design was chosen because it allows the researcher to study the phenomena without manipulation of the variables. The independent variables in this study were Progressivism's learner-centered approaches while the dependent variables were learner-related factors. Two methods of technical philosophy; critical analysis and conceptual analysis approach were used to reinforce the research design to enhance elaborate description of the phenomena under study.

7.1 Conceptual Analysis Approach

The conceptual analysis approach involves breaking down the main ideas into constituents through the process of analysis and synthesis. The main aim of conceptual analysis approach is to clarify the language used as well as analyzing the concepts expressed in it. In order to clarify the concepts such as learner-centered approaches, teaching and learning, it was necessary to use conceptual analysis approach. According to Ogola (2011) some of the philosophical problems are as a result of the complexities of the language since certain concepts may have several uses and hence it may be a fallacy to the users. Conceptual analysis was used to ensure that whatever was said about the concepts was said clearly in order to eliminate any possible fallacy.

7.2 Critical Analysis Approach

According to Njoroge and Bennaars (1986) the critical analysis approach points to positive evaluation as it seeks to evaluate and to judge things based on clear and distinct ideas. The approach is characterized by asking probing questions to establish merits and demerits of an issue, where answer to one question leads to another question. This approach was used in making rational judgments on how the philosophy of progressivism has affected mathematics teaching in Primary schools.

8.0 Research findings and discussion

8.1 Pupils' Demographic Characteristics

An item on the pupil's questionnaire inquired on their gender. Figure 1 illustrates the gender composition of the pupils' respondents.

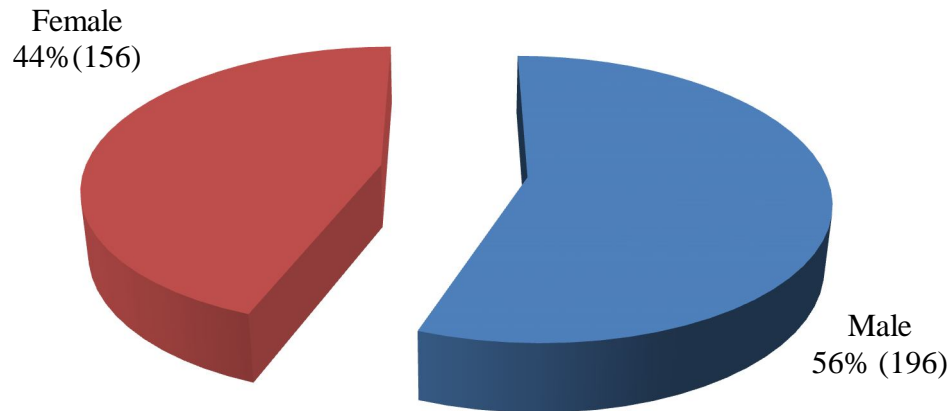


Figure 1. Distribution of Pupils by Gender

A total of 352 pupils took part in the study. According to information represented on Figure 1, majority (56%) of the pupils were males while their female counterparts formed 44% of the pupils sampled. An item in the pupils' questionnaires inquired about their age and the findings are illustrated in Table 1.

Table 1

Age Distribution of Pupils

Age (Years)	Frequency	Percentage
11- 12	86	24.4
13 – 14	229	65.1
15 – 16	33	9.4
17 – 18	3	0.9
19 – 20	1	0.3
Total	352	100.0

Based on the results in Table 1, majority of the pupils sampled were aged between 13 and 14 years and comprised 65.1% of the sample. Pupils who formed the minority were aged between 19 and 20 years and constituted 0.3% of the sample. According to progressivists, learner-centered teaching and learning approaches should be applied more to young learners aged 15 years and below as compared to their old and mature counterparts.

8.2 Learner-Related Factors

The second objective of the study was to critically analyze the learner-related factors and how they influence application of progressivists' learner-centered approaches in teaching and learning of

Mathematics among pupils in public primary schools of Meru South Sub-County, Kenya. The respondents ticked the responses that closely indicated their perception on learner-related factors that affect application progressivit's learner-centered approaches in teaching and learning of Mathematics in their class. They indicated the extent of agreement or disagreement where: Disagree (D), Agree (A), Strongly Disagree (SD), Undecided (U) and Strongly Agree (SA). The findings are indicated in Table 2.

Table 2
Pupils' Perception on Learners' Related Factors

Statement	SD(%)	D(%)	U(%)	A(%)	SA(%)
Learners choose what they want to learn not what the teacher has planned.	55.4	24.9	4.3	11.7	4.3
Ability to Solve mathematics problems is a talent that is possessed by few pupils.	22.7	30.3	6.8	34.0	6.2
The attitude towards mathematics' teacher affects ability to solve mathematics problems.	23.4	20.5	6.6	25.9	23.7
Teaching other fellow pupils how to solve mathematics problems may make them defeat me.	43.2	31.5	10.8	6.8	7.8
A discussion group should consist of members of the same gender.	47.6	36.8	6.7	5.6	3.4

From the findings in Table 2, 55.4% of the pupils sampled disagreed strongly that they were allowed to choose what they want to learn not what the teacher has planned. The study findings indicated that 34.0% pupils sampled disagreed with the statement that ability to Solve mathematics problems is a talent that is possessed by few pupils. On formation of discussion groups, 47.6% of pupils sampled disagreed strongly that they should consist of members from the same gender. The findings agreed with Salau (2000) that collaborative learning is both socially and intellectually involving since it invites learners to build closer connections to those of the opposite sex. The findings in Table 9 show pupils strong disagreement on choosing what they want to learn not what the teacher has planned. Dewey (1944) stated that learners should be engaged in making conjectures, proposing approaches and solutions to problems, and arguing about the validity of particular claims. According to the philosophy of progressivism, learners should choose what they want to learn and methods of teaching according to their individual judgements.

The teachers' questionnaire contained open-ended questions on how the given learners' related factors namely: Learners' motivation, attitude, believes and myths affected teaching and learning of mathematics. The findings are shown in Table 3.

Table 3
Teachers' Opinion on Learners' Related Factors

Learners' Related Factors	Agreed (%)	Disagreed (%)
Motivation	94.1	5.9
Attitude	88.2	11.8
Believes and Myths	58.8	41.2

Table 3 summarizes the findings of the teachers' opinion on how learners' related factors affect application of progressivists' learner-centered approaches teaching and learning of mathematics. Majority of the teachers agreed that learners' motivation, attitude, believes and myths affect teaching and learning of mathematics.

Teachers had several opinions regarding learners' motivation on teaching and learning of mathematics: some felt that when pupils are motivated, they performed well but the performance declined when the motivation was withdrawn; motivating learners with rewards made learners to do extra work and to read ahead of the teacher; intrinsic motivation made learners to participate more in class as they sought for clarifications; motivation changed pupils' attitude towards mathematics and once the reward was removed, motivation was lost. The teachers' opinions regarding learners' motivation on teaching and learning of mathematics are in line with Ormrod (2008) assertion that students typically learn more and are more productive when they are either intrinsically or extrinsically motivated.

Motivation can be long-lasting and self-sustaining which typically promote learning and focuses on the subject rather than rewards or punishments. The philosophy of progressivism recognizes and validates the pupil's point of view, so that rather than being "wrong" or "right," the pupil reevaluates and readjusts his knowledge and understanding. Such an emphasis generates confidence and self-esteem, which, in turn, motivate the pupil to tackle more complex problems and themes. Progressive education believes in working with the child rather than getting the child to do something based on rewards and punishments (Bode, 1998).

Most of the mathematics teachers agreed that learners' attitude affected application of progressivists' learner-centered approaches teaching and learning of mathematics and had several opinions: most of the pupils had negative attitude towards learning of mathematics and they just did it because it was compulsory; some pupils considered mathematics as inapplicable in life and therefore they concentrated less in learnig. Some teachers felt that boys performed well in mathematics than girls since they enjoyed doing practicals such as drawing and constructions; pupils with positive attitude towards mathematics were noted to read ahead of the teacher and were actively involved in peer teaching and learning.

A critical analysis of the findings based on progressivists' point of view, shows that there exists a positive correlation between students' attitude towards mathematics and academic achievement of learners. Giangreco (1993) noted that lack of interest, motivation and confidence makes learners view mathematics as a hard subject. In cases where learners have positive attitude towards mathematics, they spare more time to practice the subject and this leads to good performance. Progressivists' learner-centered approach requires mathematics teachers to direct their efforts towards attitude development as well as academic growth of learners.

Concerning the effect learners' beliefs and myths on application of progressivists' learner-centered approaches teaching and learning of mathematics majority of mathematics teachers had the different opinions: most pupils believed that mathematics was meant for boys and hence girls were not motivated to learn the subject; some learners believed that the ability to solve mathematics problems was genetically inherited from parents; some pupils believed that mathematics was a naturally a difficult subject and they were not motivated to learn; some felt that mathematics formulae should be memorized, the goal just being to get "right answers"; the role of the mathematics teacher is to transmit the knowledge and to ascertain that students acquired it.

According to philosophy of progressivism, such conceptions and beliefs held by primary school mathematics teachers in Meru South Sub-County may prevent pupils from inventing alternative strategies and approaches to solving mathematical problems and different ways of defining concepts. Progressivists emphasize that pupils should learn to support their conclusions with evidence and logical arguments to prove its relevance in the learning process. Pupils should not continue with such beliefs "blindly" but they should research and prove their existence.

The teachers' interview schedule sought for suggestions on any other learner-related factors that affect teaching and learning of mathematics. Indiscipline was noted to be the major factor hence pupils were said to be uncooperative in class, disobeying teacher's instructions and could not fit in any discussion group. Some teachers noted that poor economic background among some pupils affected learning and teaching of mathematics. According to mathematics teachers, most pupils had positive attitude towards mathematics but they could not afford the necessary tools and learning materials such as textbooks, geometrical sets. The conceptions, beliefs and myths of the learners regarding mathematics and mathematics teaching have been considered to be very significant factor underlying learning and teaching process. The researcher noted some learner-related factors namely negative attitude, lack of freedom to suggest what they should learn, false beliefs and myths, affects application of progressivists' learner-centered approaches teaching and learning of mathematics.

9.0 Conclusions

Several learner-related factors such as motivation, attitude, beliefs and myths on mathematics were noted to make pupils participate passively in the learning process. Pupils' negative attitude towards mathematics was noted as a major hindrance to the application of Progressivists' learner-centered approaches in teaching and learning of mathematics. Motivation changed pupils' attitude towards mathematics and once the reward was removed, motivation was lost.

10.0 Recommendations

Following the findings, the following recommendations were made:

- To eliminate negative attitudes towards mathematics among pupils, school managements should organize motivational forums by inviting male and female professionals who specialized on mathematics such as accountants and bankers. In addition, teachers should come up with ways of motivating different categories of learners such as the most creative, best discussion groups, best peer teachers and high performers in mathematics.
- To enhance collaborative learning as well as to promote learners' social skills, primary schools' mathematics teachers within Meru South Sub-County should organize regular interschool mathematics contests. Learners from different institutions but of the same level should be guided to lead mathematics contests built around small group problem-solving, with an explicit emphasis on peer teaching.

- To enrich mathematics environment both at home and in school, pupils should be provided with adequate teaching and learning aids, geometrical instruments, writing and drawing materials for personal practice, counters, computer internet and programs relevant for learners' research and revision materials.

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