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TEACHERS' PEDAGOGICAL COMPETENCE AND IMPLEMENTATION OF COMPETENCY-BASED INSTRUCTION IN MATHEMATICS IN PRIMARY SCHOOLS IN KAKAMEGA EAST SUB-COUNTY, KENYA

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ABSTRACT

Due to globalization and the demands of the 21st century, the Competency-Based Education in Kenya is being implemented in phases, where the first cohort is now in Grade ten. The curriculum is implemented with a view to meeting the new demands of the market economy in different fields. Teachers are the main implementers of any new curriculum in the classroom. Their preparedness to implement competency-based instruction in mathematics in primary schools is still not clear, yet mathematics is a catalyst for industrialization and many professions rely on it. This study was guided by one specific objective, which was to investigate the relationship between teachers' pedagogical competence and implementation of competency-based instruction in mathematics. The study was guided by Vygotsky's scaffolding theory and adopted a Correlational research design. Simple random sampling was utilized to select 15 (12%) schools to participate from a target population of 124 schools. From these schools, purposive random sampling was used to select 15 mathematics teachers and 660 (12%) grade six pupils to participate from a target population of 5456 pupils. All these translated to 675 participants drawn from a target population of 5,576. Instruments for data collection were questionnaires and observation schedules. A pilot study was conducted before the actual study in three schools within the research area. Validity of the instruments was verified by curriculum instruction experts from the university, while reliability of the instruments was assessed using the test-retest method. Quantitative data were analysed using descriptive statistics (frequency counts, percentages, means, and standard deviations), while inferential statistics were used to test the null hypothesis via Pearson's Correlation Coefficient at the .05 significance level. Results revealed that there is a significant weak positive relationship between teachers' pedagogical competence and their implementation of CBI in mathematics $r(13) = .338, p = .03$ at $\alpha = .05$, implying that teachers' level of implementation of CBI does not heavily rely on their pedagogical competence.

KEYWORDS: Competency-Based Instruction, Mathematics. Pedagogical Competence, Secondary schools

INTRODUCTION

Mathematics is the queen of sciences that explains concepts that naturally occur and is also a subject that many professions rely on (Sa'ad, Adam & Sadiq, 2014). In many countries, United Kingdom, Ghana, Senegal, Tanzania, South Africa, Zambia, and Kenya, mathematics is a mandatory subject in secondary and primary schools.

According to the United States of America (USA) National Assessment Education Progress (NAEP) (2022), the report indicated that a large number of students scored below average in mathematics from 2019 to 2022. If this trend in mathematics continues, the nation is likely to lack persons with knowledge and skills in literacy, information reading, creativity and innovation, and problem-solving (Mapaire, 2016). Mathematics performance has been poorly performed across the world, and this has led to unskilled personnel who cannot fit in the competitive world (Enu, Agyman & Nkum, 2015). Therefore, the NAEP (2022) reported working closely to fill the gaps to accelerate students' learning and their achievements in mathematics performance.

Globally the competency-based approaches in mathematics instruction has not been successfully implemented because of the many challenges affecting the design of the mathematics curriculum and how to implement it. Competency-based instruction lays more emphasis on competencies where learners learn by acquiring knowledge and applying in the real world (Mc Gehee, 2021). Learning mathematics is moving from rote memorization and drill to competency-based instruction. Methods of instruction in mathematics being used in many countries have also been listed as one of the hindrances in implementing effective competency-based instruction (Abdoulaye & Hiroki, 2019).

Competency-Based Education (CBE) is a bridge to the demands of the 21st century (UNESCO, 2017). The curriculum is implemented to enable learners to acquire knowledge, skills, and core competencies required in their real-life situations. However, UNESCO (2017) reported many gaps in teachers' implementation of competency-based instruction. Teachers had inadequate knowledge and skills in implementing CBE teaching approaches. Thus, lack of pedagogical competence among teachers influenced students' interest in learning. USA adopted Competency-Based Education in the 1960s; the system aimed at preparing learners for the world's demands and helping them achieve competence through prescribing competencies (Barrick, 2017).

China introduced competency-based education in 2014 following the government's published document from the MOE. The Chinese government adopted the system of education because it was considered to be essential for the developing and competitive world in terms of job markets (Zhao, 2020). The system is learner-friendly because learners learn at their own pace and the competencies

acquired benefit the individual as well as the nation. China has taken a great step in designing the subject core competencies to fill the gap between the myths, policies, and practices. The new curriculum has different designs in terms of content, assessments, and mode of teaching, despite challenges still influencing its effective implementation (Wang, 2019).

Ghana introduced and adopted the new CBE in the year 2019. Following the many challenges that the country was facing, unskilled personnel led to the adoption and introduction of the CBE. One challenge being that the country was producing graduates whose interest was to find a white-collar job but they could not fit in the 21st century and the competitive world. Secondly, the country wanted to shift from the colonial education system to the new CBE already adopted by many African countries. Despite its successful implementation, there are challenges affecting its effective implementation, namely: inadequate instructional materials, untrained teachers, and reluctant parents in supporting the curriculum (Apau, 2021). Apau (2021) recommended that the government of Ghana put in place programs to train teachers and provide the resources necessary for implementing the instruction.

Competence-based assessment in secondary schools in Tanzania is a result of the adoption of the CBE in 2005 (World Bank, 2011). The Competence-Based Curriculum was fully adopted in all primary schools in Tanzania in 2006. The Tanzanian government adopted the system after realizing a shortage of skills and knowledge amongst Tanzanian citizens. The government of Tanzania therefore introduced a new education system that will enable its learners to be sufficiently equipped with the core competencies that will fit them in the competitive job market. By the introduction of the new system, the government of Tanzania aimed at upgrading the education quality and producing qualified as well as skilled people in society.

There are a number of ways in which the challenges involved in accessing and using quality instructional materials can be minimized in Tanzania (Tety, 2016). Studies conducted in various parts of the world, including Africa, have shown that improvisation of instructional materials is one such strategy. In the words of Eshiet (1996), improvisation is an approach where relevant instructional materials are sourced, selected, and used in the teaching/learning process in the absence or lack of standard instructional materials for effective achievement of certain educational objectives.

Technology has given opportunities to share good quality educational materials and knowledge across geographical boundaries. Digital platforms and networks can make effective teaching practice, courses, and teaching expertise available to learners and teachers in other countries. Thus, the Internet and World Wide Web teaching method can be used to improve education in the field of communication and collaboration, and to have easier access to educational materials (Tety, 2016). Likewise, Tinio (2002) points out that Information and Communication Technologies (ICTs) have a large potential to enhance access to, quality of, and relevance of education, especially in developing countries. ICTs are used to acquire, disseminate, and assimilate knowledge, providing opportunities for the development of the education sector of developing countries.

The challenges faced by teachers in accessing adequate and appropriate instructional materials in community secondary schools, however, remain, especially in the rural areas. Financial limitations in acquiring teaching and learning materials are one major factor that restricts. For the most part, community secondary schools are government-dependent in terms of getting instructional materials, mainly capitation grants to pay for other educational needs. In the absence of such funding, schools can have far fewer textbooks and digital resources, less laboratory equipment and other teaching materials, and consequently less effective and learner-centred teaching.

A major challenge faced by teachers is inadequate exposure to modern teaching and learning facilities and a lack of exposure to modern teaching methods. This problem is especially severe in the rural and community secondary schools where adequate Information and Communication Technology (ICT) facilities are lacking. ICT can overcome limited resources of instructional materials by enabling teachers and learners to access a variety of information and educational materials in digital formats. With the advent of new scientific and technological methods in the world of education, it has gained greater significance in the current education system. Information and Communication Technology (ICT) is acknowledged as a key tool for accessing, processing, storing, and disseminating information (Aina, 2013).

Akala (2021) avers that CBE is a vehicle driving learners' success into the 21st century. Therefore, Kenya has commenced full implementation of the CBE that will encourage acquiring competencies and skills in mathematics necessary for the realization and industrialization of Kenya by 2030. A study by KICD (2016) indicated that the majority of the respondents (90%) supported the implementation of CBE while putting more emphasis on mathematics, languages, and science subjects. These subjects are considered a vehicle for the realization of the country's blueprint for economic development and Vision 2030.

Since independence, Kenya has gone through three important stages of the education system. The Ominde Commission report in 1964 led to the adoption of the 7-4-2-3 education system in post-independence. The 7-4-2-3 education system was to create human capital for the development of the country and foster national unity amongst Kenyans. The 8-4-4 education system was adopted following the Mackay report (1981) on the Presidential Working Party. The system of education was to produce a self-reliant graduand. KICD (2009) conducted a summative evaluation assessment in both primary and secondary schools and found out that the education system was content-based and examination-oriented. The 8-4-4 focused more on content based of on ranking and grading of students without acquiring the core competencies required in the 21st century. Therefore, this recommended a new curriculum in Kenya. A new curriculum that would allow learners to develop core competencies in the fast-growing economy (KICD, 2017).

A study by Apondi (2016) indicated that the mathematics taught at primary and secondary levels is elementary mathematics that enables the learners to get the best courses in their further studies, like medicine, engineering, accounting, among others. Mathematics is a core subject in the new CBE. It possesses very important content that is required in the 21st century. Thus, mathematics is a fundamental subject that is highly indispensable for industrialization and the realization of Vision 2030 (Ishenyi, 2015). Competency-based instruction in mathematics arouses students' reasoning, thinking, and problem-solving in their daily lives. These competencies are key to the country's development (PISA, 2021). However, inadequate teacher preparation leads to poor performance among learners (Nyongesa, 2016).

Kakamega County is one of the counties with a high population and is in a rural area. It has 12 sub-counties, and Kakamega East is one of the sub-counties. In terms of mathematics performance, Kakamega East has been performing poorly from Form 4, Class 8, and now in grade six. The sub-county has been training teachers in seminars and workshops since CBE was introduced, but still not adequate for them to implement the CBE. According to the Kenya National Examination Council (KNEC) (2022) report, the majority of grade six mathematics learners did not perform well in mathematics content areas.

Kenya's transition from the 8-4-4 education system to the Competency-Based Curriculum (CBC), introduced in 2017, marked a significant shift in teaching and learning. The competency-based approach seeks to develop holistic learners with the knowledge, skills, values, attitudes, and competencies required to function effectively in a changing society and meet the demands of the 21st century. Mathematics remains a core learning area because mathematical competencies are important for further education and the preparation of professionals required for national development. However, achieving these objectives depends largely on teachers' ability to translate competency-based principles into effective classroom practice.

The introduction of a new curriculum does not automatically guarantee effective implementation or improved learner outcomes. Teachers are the immediate implementers of competency-based instruction, making their preparedness central to the success of the reform. Teacher preparedness includes professional qualifications, pedagogical competence, teaching experience, understanding of competency-based approaches, ability to use learner-centred methods, assessment skills, and confidence in implementing the curriculum. Where teachers are inadequately prepared, they may continue relying on traditional teacher-centred approaches despite the curriculum's emphasis on learner participation, practical application, problem solving, continuous assessment, and competency development. Teacher preparedness therefore provides an important link between curriculum policy, classroom practice, and learners' achievement.

The Government of Kenya has responded by integrating competency-based education into teacher training and conducting capacity-building workshops for in-service teachers. However, challenges

may persist in public primary schools where teachers face large classes, heavy workloads, inadequate instructional resources, and varying levels of professional preparation. The high pupil-teacher ratio may further constrain the use of learner-centred and differentiated approaches. Teachers may therefore understand the curriculum requirements theoretically but experience difficulties translating them into effective classroom practice.

The concern is reflected in mathematics performance. Kenya National Examinations Council (KNEC) results for the pioneer Grade 6 cohort recorded a national mean score of 33.1% in mathematics, compared with 19.6% in Kakamega East Sub-County. Although low achievement cannot be attributed to a single factor, this substantial gap raises questions about the conditions under which mathematics is taught in the sub-county. In the researcher's view, it is therefore necessary to look beyond the performance gap and examine whether teachers are adequately prepared to implement competency-based mathematics instruction.

Experiences from Rwanda and Uganda demonstrate that competency-based curriculum reforms require teacher professional development, curriculum orientation, instructional resources, and continuous support. These experiences suggest that curriculum reform may fall short of its objectives when teachers are not adequately prepared to translate new curriculum expectations into classroom practice. Yet limited empirical attention has been given to teachers' preparedness to implement competency-based mathematics instruction in public primary schools in Kakamega East Sub-County. This creates an important contextual and empirical gap.

OBJECTIVE OF THE STUDY

The objective of the study was to investigate the relationship between teachers' pedagogical competence and the implementation of competency-based mathematics instruction.

RESEARCH HYPOTHESIS

To achieve the objective of this study, the following null research hypothesis was tested.

HO: There is no significant relationship between teachers' pedagogical competence and the implementation of competency-based mathematics instruction.

LITERATURE REVIEW

Teachers' pedagogical competence refers to the abilities, skills, and knowledge that teachers possess and use to facilitate pupil learning outcomes. Competent teachers are well prepared, capable of creating a positive learning environment that accommodates all learners' abilities (Blomoke, Gustafsson & Shavelson, 2015).

According to a study carried out by Koskei (2020) on the competency of instructors as a fundamental aspect of CBE implementation in Kenya (A case study). According to the findings, over ninety percent

of the sampled institutions contained teachers who were unprepared for the new curriculum. Furthermore, it was determined that the teachers' lack of readiness was attributable to a brief training period guided by instructors who lacked sufficient expertise in the CBE. According to the research findings of Waweru (2018), educators were employing antiquated teaching methods and lacked the necessary readiness to manage the CBE. This result is consistent with Makunja's (2016) findings regarding the obstacles educators in Tanzania face when attempting to implement CBE. Insufficient in-service teacher training impeded the effective implementation of CBE, according to the findings.

According to Uztosun (2018), mathematics teachers are expected to have the key competencies (knowledge, skills, and attitude) that arouse pupils' learning interests. Such pupils participate actively in learning mathematics, hence developing competencies in critical thinking and problem-solving. Such competencies help them to deal with actual life challenges. In a study carried out by Bates (2019), results indicated that in-service and pre-service teachers of mathematics develop competencies based on their pedagogies. This can be achieved mainly through team teaching. Ochieng, Kiplagat, and Nyongesa (2016) discovered that teacher competence plays an important role in mathematics achievement. Further, they noted that teachers with diplomas perform much better than those with bachelor's degrees. In a study carried out by Ndomondo and Mbise (2022), history teachers' perception about competency-based curriculum in transforming instructional practice in secondary lower schools in Tanzania. It showed that teachers could not impart knowledge and skills of their mathematical understanding during instruction. So, they lacked adequate competencies (knowledge, skills, and attitude) in the subject.

According to Bamira (2013), incompetency of teachers in teaching mathematics influenced performance in mathematics, leading to low achievement in mathematics skills among the pupils. Makunja (2016), in a study on CBE implementation, revealed inadequacy training for in-service teachers contributed to inadequate pedagogical knowledge, skills, and competence. According to the research findings of Serdenciuc (2013), in order to increase receptivity to the training requirements, the teaching vocation should be developed in chronological order. As the economy of the country evolves, the training prerequisites for teachers in the areas of expertise and competence necessary for the execution of CBE are established.

A study by Machani and Otieno (2022) on teachers' competencies in assessment of competency-based curriculum among Grade 1,2 and 3 in Langata Sub County, Kenya. The findings established that, the majority of the teacher's lacked knowledge in formative assessment that hindered the implementation of the curriculum ineffectively. Prior and adequate training for in-service teachers is necessary before the curriculum is implemented because they are the major implementers of the curriculum (Machani et al., 2022).

The research was conducted by Rwezaura (2016) on the implementation of the competence-based English curriculum in Kinondoni, Rwanda. In the findings of the study, it is clear that teachers have a

negative attitude towards teaching English as a subject because of their lack of knowledge and skills regarding the content of the subject. Additionally, Rwezaura (2016) noted that the implementation of competency-based instruction in the English language is hindered by the incompetence of the teacher and large class sizes. From the study by Mokoro (2020), it is evident that 66% of the teachers never undertook training on CBE, whereas 34% of the teachers were trained in CBE.

Muhwezi (2022) conducted a study on teachers' readiness for the implementation of the new Business subject's curriculum in Kabale District, Uganda's chosen secondary schools. The study revealed that Business as a subject was unsuccessfully implemented in the new curriculum due to various factors that hindered its implementation. The Business teachers lacked competence in the subject and digital literacy; there was a lack of instructional materials; and in-service teachers influenced its implementation. Teachers faced difficulties implementing the competency-based curriculum due to large class sizes (1:80). Teachers were unable to attend to individual learners; hence difficult for learners to acquire core competencies (Sitienei, 2020).

According to Momanyi and Rop (2019), they found out that teachers had inadequate skills, abilities, and knowledge in preparing professional documents and in content delivery. Kimangu (2023) asserted that any successfully implemented curriculum highly depends on the quality of the teacher. However, teachers' acquired knowledge and skills enable them to design and deliver lessons appropriately. This in turn, fosters critical thinking, problem-solving, and interpersonal communication among the learners. Teachers need competences in CBE for effective teaching and delivery of instruction to learners; thus, teachers' ability determines the quality of education they provide. Therefore, teachers training should be continuous (Ningtiyas & Jailani, 2018).

The reviewed literature on teachers' pedagogical competence and instruction has revealed gaps in the pedagogical knowledge, skills, and abilities among teachers in terms of teaching CBE curriculum. A report by KICD (2018) indicated that not all teachers have been trained countrywide. Teachers lack pedagogical competence to effectively implement CBE (Koskei, 2020). There is a need for prior and adequate preparation of teachers to implement competency-based instruction effectively (Muchiri, 2021). According to Bamira (2013), Rwezaura (2016), Mokoro (2020) and Muhwezi (2022), incompetence of teachers in teaching mathematics accounts for low academic achievement in mathematics among pupils. There is low mathematics achievement amongst pupils in primary schools in Kakamega East Sub -County. Could the teacher's pedagogical incompetence be the cause of this? It is against this doubt that the researcher seeks to investigate teachers' pedagogical competencies versus their implementation of Competency-Based Instruction in Kakamega East Sub -County, Kenya.

Vygotsky's scaffolding theory, advanced by Vygotsky (1978) and broadened by Bakker, Smit and Wegerif (2015), forms the basis of this study. This theory states that pupils can learn information with the help of a more informed individual. Bakker et al, (2015) assert that scaffolding, when used

effectively, can help the learner to understand content in mathematics that they would not process on their own.

Vygotsky's scaffolding is a method of teaching where a pupil is helped by a more informed individual to understand educational content. The more informed individual scaffolds the material in smaller chunks to help the learner to expand their understanding of the material much better than if they were left on their own. Vygotsky, in scaffolding theory, defined instructional scaffolding as the role of teachers and other individuals in helping the pupils to get to the next level or stage.

In an educational setting, according to Vygotsky's scaffolding, the teacher begins to work together with a pupil. The teacher then gradually withdraws his assistance as the pupils master their work, until they no longer need the teacher for any scaffolding. Vygotsky asserts that scaffolding helps pupils to: learn beyond their current topic with the help of peers, engage one another in groups, increase their likelihood of succeeding in meeting their instructional objectives, and finally, scaffolding provides differentiated learning where every pupil can be placed in their respective zones of proximal development (ZPD) and proceed to success at their own pace.

Vygotsky's scaffolding theory suggests that a pupil learns information with the help of a more informed individual. This study observed teachers (more informed individuals) in their classrooms as they carried out instructional scaffolding with a view to helping the pupils to successfully get to the next level or stage. This study therefore proposed to investigate how prepared mathematics teachers are towards implementing competency- based instruction in mathematics in selected primary schools in Kakamega East Sub- County, Kenya.

MATERIALS AND METHODS

The study was carried out in public primary schools in Kakamega East Sub-County, which is situated in the western part of Kenya within Kakamega County. Kakamega East Sub-County was purposively selected because of its persistently low performance in mathematics compared with other sub-counties in Kakamega County. Kakamega East recorded the lowest mean score among the 12 sub-counties in the Kenya Primary School Education Assessment (KPSEA) mathematics assessment. This made the sub-county an appropriate setting for examining factors that may be associated with the implementation of competency-based instruction in mathematics.

The choice of Kakamega East was also informed by the need to investigate whether teachers' preparedness may be contributing to the observed low mathematics achievement. Since teachers are central to the implementation of competency-based instruction, examining their pedagogical competence, access to instructional materials, and attitudes towards competency-based education may provide useful explanations for the performance patterns observed in the sub-county.

This study employed a correlational research design to examine the relationship between teachers' preparedness and the implementation of competency-based instruction in mathematics in public primary schools in Kakamega East Sub-County. A correlational design is appropriate where a researcher seeks to determine whether two or more naturally occurring variables are associated without manipulating the variables or introducing an experimental intervention (Kerlinger, 2003). The design enables the researcher to measure the variables as they exist in their natural school setting and determine the direction and strength of the relationships among them.

The choice of a correlational design was guided by the nature of the study variables and the purpose of the research. The study did not seek to introduce a new teaching method, train teachers, provide instructional materials, or otherwise manipulate the conditions under which mathematics teachers operate. Instead, it sought to establish whether differences in teachers' pedagogical competence, availability of instructional materials, and attitudes towards competency-based education were associated with differences in the implementation of competency-based instruction. These variables already existed within the schools and could therefore be observed and measured without experimental manipulation.

The design was particularly useful because the study sought to move beyond simply describing the level of teacher preparedness. It enabled the researcher to examine whether teachers who reported higher levels of pedagogical competence, better access to instructional materials, and more positive attitudes towards competency-based education also demonstrated higher levels of implementation of competency-based instruction. The design further allowed the researcher to determine the strength and direction of these relationships and establish whether the observed associations were statistically significant.

The correlational design also provided an opportunity to examine the combined contribution of the independent variables to the implementation of competency-based instruction. This was important because teacher preparedness is multidimensional and the implementation of competency-based instruction may not depend on a single factor. A teacher may possess appropriate pedagogical competence but face inadequate instructional materials, or have adequate resources but hold a negative attitude towards competency-based education. Examining the variables together therefore provided a more comprehensive understanding of the factors associated with implementation.

The design was also considered appropriate because manipulating teacher preparedness or withholding instructional materials for research purposes would raise practical and ethical concerns in an actual school environment. A correlational approach allowed the researcher to collect data from teachers in their normal working conditions while maintaining the natural characteristics of the study setting.

However, the researcher recognizes that correlation does not by itself establish a cause-and-effect relationship. Therefore, any association identified between teacher preparedness and the

implementation of competency-based instruction was interpreted as a relationship rather than proof that one variable directly caused changes in another. Overall, the correlational research design provided an appropriate framework for determining the nature, direction, and strength of the relationships between teachers' pedagogical competence, availability of instructional materials, teachers' attitudes, and the implementation of competency-based instruction in mathematics.

The target population for the study comprised 5,576 respondents, consisting of 120 Grade Six mathematics teachers and 5,456 Grade Six pupils in public primary schools in Kakamega East Sub-County. Grade Six was purposively selected as the focus of the study because it represented an important transition point in the implementation of the competency-based curriculum and provided an appropriate level at which to examine the practical implementation of competency-based instruction in mathematics.

The choice of Grade Six was also informed by the fact that learners at this level had experienced the competency-based approach for several years and were therefore in a position to provide meaningful evidence of how the curriculum was being implemented. Teachers teaching Grade Six had also accumulated practical experience in implementing competency-based mathematics instruction and were consequently better placed to report on their preparedness, the instructional materials available to them, and their attitudes towards competency-based education.

Most importantly, Grade Six provided an appropriate basis for examining the relationship between teachers' preparedness and learners' academic achievement. The Kenya Primary School Education Assessment (KPSEA) is administered at the end of Grade Six, making mathematics performance at this level an important indicator of the learning outcomes associated with the primary school phase of the competency-based curriculum. The selection of Grade Six therefore enabled the researcher to examine teacher preparedness and competency-based instructional practices alongside measurable learner outcomes.

The researcher considered Grade Six particularly suitable because the study was concerned not merely with whether teachers had been introduced to the competency-based curriculum, but whether they were sufficiently prepared to implement it effectively and whether such implementation was reflected in learners' mathematics achievement. The inclusion of both Grade Six mathematics teachers and pupils consequently provided complementary perspectives on the implementation of competency-based instruction and its outcomes.

Picking of a group of a population to research in such a manner that the results are indicative of the whole (Ogula, 2005). The sample size comprised of 675 pupils and 15 grade six mathematics teachers out of 120 targeted teachers representing 12% of the target population and 660 pupils out of the 5456 targeted pupils representing 12% of the target population. Kothari (2004) states that a minimum of

10% of the population constitutes a representative sample. Hence, the selection of 12% for the purposes of this study was deemed representative.

Data were collected using teachers' questionnaires and observation schedules for the mathematics teachers and pupils. Each of these instruments is explained below. Every instrument was used to address different issues on how preparedness of teachers is influencing the competency-based instruction in mathematics and its implementation.

The study used a teachers' questionnaire as the main instrument for collecting quantitative data on teachers' preparedness to implement competency-based instruction in Grade Six Mathematics in public primary schools in Kakamega East Sub-County. The questionnaire was selected because it enabled the researcher to collect standardized information from a relatively large number of teachers within a reasonable period and to quantify the key variables under investigation. The items were constructed to correspond with the study objectives, conceptual framework, and operational definitions of the independent and intervening variables. In particular, the questionnaire sought to obtain information on teachers' pedagogical competence, teachers' attitudes towards competency-based education, and background characteristics that could potentially influence implementation.

The questionnaire was organized into three sections. Section One collected teachers' background information. It included items on gender, age, teaching workload, and school type. These characteristics were included because the conceptual framework identified age, workload, gender, and school type as intervening variables that could influence teacher preparedness and the implementation of competency-based instruction. The information obtained from this section therefore provided a basis for describing the respondents and examining whether differences in these characteristics were associated with differences in the study variables.

Section Two focused on teachers' pedagogical competence. The researcher constructed this section to capture both formal teacher preparation and teachers' perceived competence in skills considered important for competency-based instruction. The first items established whether respondents were professionally trained and, where applicable, their level of training, including certificate, diploma, bachelor's degree, and master's degree. The questionnaire also sought information on teachers' years of experience in primary school teaching. These items were included because professional qualification and teaching experience formed part of the operationalization of pedagogical competence in the study.

The section further examined teachers' exposure to in-service training on the competency-based curriculum. Respondents were asked whether they had attended such training, the duration of the training, and how frequently the training was conducted. This was important because the implementation of a new curriculum requires teachers not only to possess initial professional

qualifications but also to receive continuing professional development that enables them to understand and respond to changing curriculum expectations.

The final item in Section Two required teachers to rate their level of competence across eight areas using a five-point scale ranging from very low to very high. The areas were communication and interpersonal skills, organization and planning, classroom management, facilitation and engagement, assessment and coaching, collaboration and teamwork, caring and inclusiveness, and flexibility and adaptability. These competencies were included because competency-based instruction requires teachers to move beyond transmission of subject content and facilitate active, inclusive, learner-centred learning. The researcher considered these areas useful indicators of whether teachers possessed the practical competencies required to implement CBE in mathematics classrooms.

Section Three measured teachers' attitudes towards competency-based education using a five-point Likert scale ranging from *strongly disagree* to *strongly agree*. The statements addressed teachers' perceptions of CBE in comparison with the former 8-4-4 system, their perceived ability to integrate CBE competencies into mathematics instruction, the anticipated effect of CBE on teacher-pupil relationships and the learning environment, and their use of CBE teaching approaches in the classroom. Both positively and negatively worded statements were included to capture different dimensions of teachers' attitudes and reduce the likelihood of respondents mechanically selecting the same response across all items. The negatively worded statement was intended to be reverse-scored during data analysis.

Prior to the main study, a pilot investigation was carried out in three randomly selected public primary schools located in the Kakamega East Sub-County of Kenya. Aside from these three public primary institutions, no other institutions were included in the study itself. The researcher administered the research instruments to the participants in the three educational institutions during the pilot study. The data obtained from the pilot study enabled the researcher to evaluate the response patterns exhibited by the participants in relation to the provided information. Modifications to the instruments as required were subsequently implemented. Therefore, conducting a pilot study allowed the researcher to assess the instruments' reliability before commencing the main study.

Validity of the instruments was checked by seeking experts' opinions. The instruments of research were evaluated using the test-retest procedure. The extent to which subsequent trials of a research instrument yield consistent result (Drost, 2011). Three days later, the identical instruments were re-administered to the same participants. The correlation between the scores obtained in the first and second administrations was assessed through the utilization of Pearson's Correlation Coefficient (r). A coefficient of $r=0.783$ was obtained for the questionnaire, which implied that it was a reliable tool since r was greater than 0.7, as stipulated by George & Mallery (2003).

The observation schedule was administered twice in the selected schools at different times. The results of test-1 were compared with the results of test-2 (Walker, 2012). The smaller the difference between the findings of the two sets of tests, demonstrate a higher the reliability of the observation schedule.

A coefficient of $r=0.802$ was obtained for the observation schedule, which implied that it was a reliable instrument, as the r value obtained was greater than 0.7 as stipulated by George & Mallery, (2003).

The raw data were tabulated, categorized, and classified after the data collection process. The analysis of the data was performed utilizing SPSS. The process of data analysis entailed the application of both descriptive and inferential statistics thus: frequencies, percentages, and Pearson's Product Moment Correlation Coefficient (PPMCC). Descriptive statistics were used to analyse data on demographic information, teachers' pedagogical competence, availability of instructional materials, and the teacher's attitude. PPMCC was used to test the null hypothesis at a 0.05 alpha level of statistical significance.

RESULTS AND DISCUSSION

The objective of this study was to examine the association between Teacher's Pedagogical Competence (TPC) and CBI in Mathematics. Information concerning the above research aim was obtained through the teachers' questionnaire and the observation schedule. The first part (Section A) of the questionnaire comprised five questions related to different dimensions of pedagogical competence of the teacher based on a 5-point Likert scale.

The first aspect of TPC assessed was teachers' communication and interpersonal skills. The sampled teachers were asked to rate themselves as very low, low, moderate, high or very high with respect to this aspect of TPC. Responses to this statement were analyzed by computing frequency counts and percentages thus:

Table 1
Level of Communication and Interpersonal Skills

Response	Frequency	Percent
Very Low	0	0.0
Low	1	6.7
Moderate	3	20.0
High	8	53.3
Very High	3	20.0
Total	15	100.0

As the table indicates, 0 (0.0%) of the respondents rated themselves very low, while 1 (6.7%) rated themselves low. Those who rated themselves moderate were 3 (20.0%), while 8 (53.3%) rated

themselves high, and 3 (20.0%) rated themselves very high. The majority of the respondents therefore had good communication and interpersonal skills.

The second feature of TPC examined in this study was the degree of organization and planning of the teachers. In the questionnaires that were administered to the selected teachers, they were required to indicate how they ranked themselves in regard to this TPC component. This was done in terms of their being:

Table 2
Level of Organization and Planning

Response	Frequency	Percent
Very Low	1	6.7
Low	2	13.3
Moderate	4	26.7
High	5	33.3
Very High	3	20.0
Total	15	100.0

As the table indicates, 1 (6.7%) of the respondents rated themselves very low, while 2 (13.3%) rated themselves low. Those who rated themselves as moderate were 4 (26.7%), while 5 (33.3%) rated themselves high, and 3 (20.0%) rated themselves very high. The majority of the respondents therefore had good organization and planning.

Classroom management is the third aspect of TPC that was considered in the study. The teachers in the sample were required to score themselves as either very low, low, moderate, high, or very high in relation to this aspect of TPC. The following analysis was done for this particular statement by:

Table 3
Level of Classroom Management

Response	Frequency	Percent
Very Low	0	0.0
Low	2	13.3
Moderate	4	26.7
High	5	33.3
Very High	4	26.7
Total	15	100.0

As the table indicates, 0 (0.0%) of the respondents rated themselves very low while 2 (13.3%) rated themselves low. Those who rated themselves moderate were 4 (26.7%) while 5 (33.3%) rated themselves high, and 4 (26.7%) rated themselves very high. The majority of the respondents therefore had good classroom management skills.

The fourth aspect of TPC assessed was teachers' level of facilitation and engagement. The sampled teachers were asked to rate themselves as very low, low, moderate, high or very high with respect to this aspect of TPC. Responses to this statement were analyzed by computing frequency counts, percentages, and weighted means, thus:

Table 4
Level of Facilitation and Engagement

Response	Frequency	Percent (%)
Very Low	3	20.0
Low	6	40.0
Moderate	4	26.7
High	1	6.7
Very High	1	6.7
Total	15	100.0

As the table indicates, 3 (20.0%) of the respondents rated themselves very low, while 6 (40.0%) rated themselves low. Those who rated themselves as moderate were 4 (26.7%), while 1 (6.7%) rated themselves high as another 1 (6.7%) rated themselves very high. A majority of the respondents (60.0%) rated themselves as either very low (20.0%) or low (40.0%). This finding indicates that most respondents need major improvement and help in facilitation and engagement skills.

The fifth aspect of TPC assessed was teachers' assessment and coaching skills. The sampled teachers were asked to rate themselves as very low, low, moderate, high, or very high with respect to this aspect of TPC. Responses to this statement were analyzed by computing frequency counts and percentages thus:

Table 5
Level of Coaching and Assessment

Response	Frequency	Percent
Very Low	0	0.0
Low	2	13.3
Moderate	3	20.0
High	7	46.7

Very High	3	20.0
Total	15	100.0

As the table indicates, 0 (0.0%) of the respondents rated themselves very low, while 2 (13.3%) rated themselves low. Those who rated themselves moderate were 3 (20.0%), while 7 (46.7%) rated themselves high, and 3 (20.0%) rated themselves very high. The majority of the respondents therefore had good coaching and assessment skills.

The sixth aspect of TPC assessed was teachers' level of collaboration and teamwork. The sampled teachers were asked to rate themselves as very low, low, moderate, high, or very high with respect to this aspect of TPC. Responses to this statement were analyzed by computing frequency counts and percentages thus:

Table 6
Level of Collaboration and Teamwork

Response	Frequency	Percent
Very Low	1	6.7
Low	3	20.0
Moderate	5	33.3
High	6	40.0
Very High	0	0.0
Total	15	100.0

As the table indicates, 1 (6.7%) of the respondents rated themselves very low, while 3 (20.0%) rated themselves low. Those who rated themselves moderate were 5 (33.3%), while 6 (40.0%) rated themselves high, as none (0.0%) rated themselves very high. The majority of the respondents therefore had good collaboration and teamwork skills.

The seventh aspect of TPC assessed was teachers' level of caring and inclusiveness. The sampled teachers were asked to rate themselves as very low, low, moderate, high, or very high with respect to this aspect of TPC. The frequency counts and percentages regarding teachers' responses in caring and inclusiveness are summarized in Table 7 below.

Table 7
Level of Caring and Inclusiveness

Response	Frequency	Percent
Very Low	0	0.0
Low	0	0.0
Moderate	5	33.3
High	5	33.3
Very High	5	33.3
Total	15	100.0

As the table indicates, none of the respondents rated themselves very low or low. Those who rated themselves moderate were 3 (33.3%), while an equal number rated themselves high and very high. The majority of the respondents therefore had good caring and inclusiveness skills.

The eighth aspect of TPC assessed was teachers' level of flexibility and adaptability. The sampled teachers were asked to rate themselves as very low, low, moderate, high, or very high with respect to this aspect of TPC. Responses to this statement were analyzed by computing frequency counts and percentages, thus:

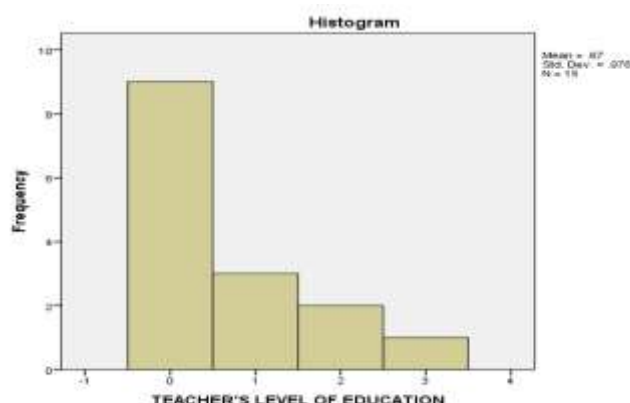
Table 8
Level of Flexibility and Adaptability

Response	Frequency	Percent
Very Low	3	20.0
Low	6	40.0
Moderate	3	20.0
High	2	13.3
Very High	1	6.7
Total	15	100.0

As the table indicates, 3 (20.0%) of the respondents rated themselves very low, while 6 (40.0%) rated themselves low. Those who rated themselves moderate were 3 (20.0%), while 2 (13.3%) rated themselves high, and 1 (6.7%) rated themselves very high. The majority of the respondents rated (60.0%), while 20.0% rated themselves very low and 40.0% rated themselves low. This finding indicated that respondents had poor flexibility and adaptability skills in the competency-based curriculum.

Another aspect of teachers' pedagogical competence that was assessed was teachers' professional qualification. This was measured in terms of the highest level of education. The results of this analysis were as displayed in Figure 1, thus:

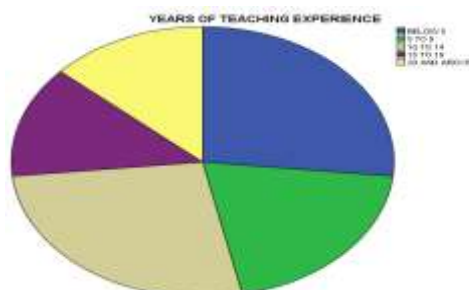
Figure 1
Respondents' Highest Level of Education



As the bar graph shows, there were 9 (60.0%) respondents whose highest level of education was certificate, 3 (20.0%) diploma, 2 (13.3%) bachelor's degree, and 1 (6.7%) masters degree. The majority of the sampled respondents were P1 certificate holders.

Another aspect of teachers' pedagogical competence that was assessed was the number of years of teaching experience among the sampled Grade 6 mathematics teachers. The results of this analysis were as displayed in Figure 2, thus:

Figure 2
Teaching Experience of Sampled Teachers in Years



As the pie chart shows, 4 (26.7%) of the respondents had teaching experience of below 5 years, while 3 (20.0%) had 5 to 9 years' experience. Moreover, 4 (26.7%) had 10 to 14 years' experience, 2 (13.3%) had 15 to 19 years' experience, while 2 (13.3%) had 20 years and above experience. The majority of

the sampled respondents therefore had sufficient experience to respond to issues relevant to this study on matters of teacher preparedness.

The null hypothesis of this study was:

HO₁: There is no significant relationship between teachers' pedagogical competence and implementation of competency-based instruction in mathematics.

This hypothesis was tested inferentially using Pearson's Product Moment Correlation Coefficient (PPMCC) with the sampled grade six Mathematics teachers' scores in the questionnaire (pedagogical competencies in mathematics) as the independent variable and their scores in the observation schedule (CBI in Mathematics) as the dependent variable. This parametric testing of H₀ was done at the 0.05 alpha level of statistical significance, thus:

Table 9
Correlation between TPC and CBI in Mathematics

Variables	Statistic	Teacher's Pedagogical Competency Score	Teachers' CBI Implementation Score
Teacher's Pedagogical Competency Score	Pearson	1	0.338
	Correlation		
	P		0.01
Teachers' CBI Implementation Score	N	15	15
	Pearson	0.338	1
	Correlation		
	P	0.01	
	N	15	15

In Table 9, it was found that a significant weak positive correlation exists between teachers' pedagogical competency score and their scores in the implementation of CBI in Mathematics $r(13) = .338, p = .01$ at $\alpha = .05$. This implies that some of the sampled mathematics teachers with high scores in pedagogical competencies also had high scores in the implementation of CBI in mathematics, and vice versa. The weak relationship is as a result of the r -value calculated lying close to zero, while the positive relationship is as a result of the positive sign of the r -value obtained from PPMCC analysis. The relationship is deemed significant because the p -value obtained is less than 0.05, the set alpha level (Masinde, 2023).

The results indicated that there was a weak positive statistically significant relationship between teachers' pedagogical skills and the extent of their implementation of competency-based instruction (CBI) in Mathematics. The relationship was significant at the 0.05 level due to the calculated correlation coefficient (r) value being less than the predetermined α level of 0.05. Thus, the null

hypothesis was rejected, and it was concluded that teachers with high pedagogical competencies had a comparatively higher level of CBI implementation in Mathematics. Therefore, it was found that teachers' pedagogical skills have been positively and significantly correlated with the implementation of CBI, but the magnitude of the relationship was weak.

The findings are in line with those obtained by Kabombwe and Mulenga (2019) in their research on the implementation of competency-based teaching methodologies by Mathematics teachers in Lusaka District in Zambia. This study used an explanatory sequential mixed methods design and included schools from ten educational zones in Lusaka. A total of 99 respondents (80 teachers) participated, and other respondents were selected purposefully for interviews. Data collection methods used were questionnaires, interview guides, classroom observation, and document analysis. The data collected were qualitative and were analyzed by thematic analysis, while the quantitative data were analyzed using SPSS. The study revealed that there were certain problems among the sampled teachers regarding the principles of competency-based or outcome-based education, affecting about 67% of them. The researchers also found that the teachers' implementation of competency-based teaching and learning was not fully adopted due to limited knowledge and competency in the implementation of competency-based approaches. According to these findings, teachers' pedagogical competencies are needed as one of the important prerequisites for the effective implementation of competency-based curricula.

The results of this study are, however, in contrast to the results obtained in a case study on the CBE implementation in the Kenyan context by Koskei (2020), which looked at teacher competency. It revealed that over 90% of the schools sampled had teachers who were poorly equipped to deal with the new curriculum. Some of the reasons given for lack of preparedness included the short duration of training and the fact that trainers involved lacked experience in the implementation of CBE. The discrepancy between the results of these two studies could be due to the different periods in which each was conducted. The study by Koskei (2020) was conducted at the very beginning of the implementation of CBE in Kenya, when the teachers were still being introduced to CBE, and there existed a lot of uncertainty about aspects of the new curriculum. Teacher capacity building and professional development for CBE have grown significantly since then, likely due to this, and may have increased teachers' familiarity with CBE and helped to positively influence their relationship, as seen in this study.

The findings also contradict those of Machani and Otieno (2022), who studied teachers' competencies in the implementation of competency-based assessment in Grade 1, 2, and 3 teachers in Lang'ata Sub-County, Kenya. They concluded that teachers' lack of knowledge about formative assessment was a significant obstacle to effectively implementing the requirements of CBE. As teachers are considered the main actors in implementing the curriculum, the researchers highlighted the need to train and develop in-service teachers before and during the implementation of the curriculum to ensure its implementation. The differences in the findings could also be explained by varying implementation

periods, levels of education, contextual factors, and levels of teacher professional development. In contrast to the older research, teachers in the current setting might have received further training in CBE and gained classroom experience since the earlier studies, which could have improved their pedagogy.

The results indicate that teacher pedagogical competency is one of the important but not sufficient elements that leads to the effective application of competency-based instruction. The low magnitude of the relationship also suggests that teachers' competence is not sufficient for explaining the variations in the implementation of the curriculum. Teacher competence may influence how far competency-based approaches are taken in classrooms and interact with other school factors such as instructional resources, practical facilities, institutional support, teacher workload, assessment practices, school leadership, and the broader implementation context. The significance of this observation is immense in the context of implementing Home Science as a STEM subject, as competent teachers, along with appropriate practical facilities, materials, assessment capacity, and institutional support, are required to effectively implement the curriculum.

CONCLUSION

Based on empirical evidence arising from data that were collected in this study, one major conclusion has been arrived at, which is that grade six mathematics teachers' level of implementation of CBI does not heavily rely on their pedagogical competence, as those who implement CBI well are not necessarily those with high pedagogical competence.

RECOMMENDATION

From the findings of this study, it is recommended that the Ministry of Education and the Kenya Institute of Curriculum Development (KICD) should strengthen continuous in-service training for Grade Six mathematics teachers. The training should go beyond general sensitization about CBE and focus on practical pedagogical skills, including learner-centred mathematics teaching, competency-based assessment, differentiation of instruction, classroom management, problem solving, and integration of competencies into mathematics lessons. The weak relationship between pedagogical competence and CBI implementation suggests that possessing professional qualifications or general teaching skills may not automatically translate into effective competency-based practice. In-service programmes should therefore emphasize practical application, classroom demonstrations, peer learning, mentoring, and follow-up support to help teachers translate pedagogical knowledge into actual CBI practices.

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