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Influence of Pre-Primary Teachers' Instructional Skills for Competency-Based Education on Learner Achievement in Mathematical Activities in Bungoma County, Kenya

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Abstract

Pre-primary teachers' instructional skills within Competency-Based Education (CBE) may predict learners' lifelong achievement in numerical development. The integration of game-based, task-based, and peer tutoring instructional skills boosts numeracy development. The use of traditional methods tends to put many learners at risk of getting stuck in the 'approaching' and 'below' expectation grade bands. This study sought to investigate the influence of pre-primary teachers' instructional skills for CBE on learners' achievement in mathematical activities in Bungoma County, Kenya. Positivism and interpretivism paradigms, entrenched in a mixed methods approach, with a Solomon Four-Group Design, across 16 purposively sampled schools (260 learners, 16 teachers). Questionnaires, observation, interview schedules, and pre/post-test tools were used to collect data that was analyzed using SPSS version 17 software. Qualitative data were analyzed thematically, anchored on three components of study, and triangulated with quantitative data to determine the influence of pre-primary teachers' instructional skills on learners' achievement in mathematical activities. Verbatim discourse was also recorded. Findings indicate that, while 93.8% teachers' self-reports show high readiness in instructional skills, only 43.75% consistently use game-based learning in the classroom. Although the experimental group, exposed to enhanced CBE training, obtained a post-test mean score of 58.82, significantly higher than the control group's 37.32 ($p = 0.001$, the utilization of traditional methods, limited space and resources, and infringements on peer-tutoring and task-based instructional skills, thereby detracting from learning gains. The results imply that structural barriers hinder the translation of skills into practice. Therefore, this study recommends ongoing, contextually relevant professional development for educators in 21st century instructional pedagogies. Policy interventions and school management support are required to provide instructional resources and reduce classroom congestion.

Keywords: *Competency; Education; Instruction; Achievement; task; learning; peer-tutoring; meeting expectations; game-based*

1.0 Introduction

Instructional skills for Competency-Based Education (CBE) manifest through game-based learning, task-based instruction, and peer tutoring, which, if well structured and efficiently coordinated, may result in successful mastery of mathematical activities and achievement of the desired numeracy goals. These instructional skills are premised on pedagogical competencies that teachers bring into pre-primary classrooms to simplify complex mathematical concepts into relatable, competency-linked activities. Nzuki, Embeywa, and Koech (2025) argue that successful implementation largely depends on teachers' readiness to move beyond theoretical dimensions into practical classroom application. Scholarly discourse suggests that motivated teachers with strong instructional skills can transform abstract numerical data into engaging lessons; for instance, Temea, Kimeu & Njoroge (2025) note that collaborative and contextually relevant professional development models in Kenya have shown promising improvements in teacher capacity and learner achievement. Instructional skills, as an ability to facilitate learning through active engagement, allow for accurate conceptualization of number sense, quantity identification, and mathematical logic. As a consequence, learners exposed to high-quality instructional pedagogy reflect higher achievement. This is supported by Bikic et al.



(2024), who argue that high-quality interactive instruction translates play into meaningful knowledge acquisition, developing critical early numeracy and spatial reasoning. Extant literature contends that teacher instructional skills are a critical part of early childhood development. Lumbantoruan and Ditasona (2024) discovered that the ways in which teachers teach significantly affect learners' processes of learning and achievement. Teachers who model and guide learners through peer-tutoring, game-based, and task-based activities effectively teach numeracy skills. This is reinforced by Tuya et al. (2025), who found that limited professional development regarding pedagogical content knowledge, specifically game-based learning, can sabotage CBE success. Therefore, utilizing CBE-aligned pedagogies allows learners to use a variety of strategies to develop vital cognitive skills such as critical thinking and problem-solving, leading to excellent comprehension of mathematical concepts.

Furthermore, Serrano (2019) posits that game-based learning, as a central dimension of tutoring skills, provides opportunities for learners to engage with mathematical content, leading directly to improved problem-solving skills among learners. Game-based teaching skills in CBE represent an active process of constructing meaning through play and interaction; they involve accessing environmental knowledge and making inferences through hands-on activities. This approach is anchored in Vygotsky's (1978) theory of social interaction, which establishes that learning is a socially mediated process, where instructors scaffold knowledge through the Zone of Proximal Development. However, Atiah, Fitria, & Destiniar (2020). warn that traditional practices inclined toward rote memorization and drill-and-practice tend to hinder the development of these higher-order skills. In the regional context, Nakawa (2020) observed that lack of skilled teachers in play-based and numeracy pedagogy remains a significant barrier to early childhood education success. This scenario calls for continuous professional development for teachers in order to deal with the limitation.

Task-based learning enhances engagement and fosters stronger connections between numbers and objects. Alotaibi (2024) found that when this approach is used, engagement, fun, and motivation are promoted, while Megagianni and Kakana (2021) established that tasks support emotional, social, and cognitive development. Similarly, Catalano (2023) contends that task-based instruction—a child-centred approach—emphasizes active physical exploration and discovery. However, according to Wanyama (2025), Kenya's CBE curriculum was hurried. Kubai (2023), purport that the CBC implementation was not appropriately planned in terms of teacher preparation and instructional methods, requiring a revisit of processes for meaningful preparation if learners' mathematical concept acquisition is to be raised to meet learning expectations.

Peer tutoring empowers learners to restate and share concepts for greater mastery. Salani and Sekgoma (2024) found a positive impact in addressing foundational mathematics; the results indicated significant improvements in learners' confidence and interest in mathematics, highlighting peer interactive teaching styles as key motivators, while Thurston et al. (2020) confirmed that peer-tutoring programs have a positive influence on mathematics achievement. Instructional skills are essential tenets, summarized in the CBE framework, requiring the sourcing of diverse resources. However, systemic challenges often limit this potential. In Tanzania, according to Likuru and Mwila (2022) research established that resource limitations and poorly ventilated, overcrowded classrooms hampered the implementation of peer-tutoring. In Kenya, Mukenya (2020) and Isaboke, Mweru, and Wambiri (2021) averred that limited teacher preparedness, alongside overcrowded classrooms and insufficient resources, compromises higher-order instructional techniques within CBE's aim of achieving problem-solving competency.

Teacher instructional skills facilitate learners' abilities and competencies to concisely process mathematical information and express numerical logic through play and tasks. These skills promote game-based learning, which tends to create deeper understanding of number sense and stronger connections between concepts, whereas learners who engage in peer tutoring capture, process, and identify key mathematical points, thereby enhancing mastery of numeracy. Instructional skills also involve task-based learning, allowing learners to better articulate and connect ideas, resulting in well-defined organization of mathematical thoughts. The utilization of these pedagogies tends to contribute to greater achievement in mathematical activities. However, while concepts of CBE are intended to be effectively taught through these approaches, discrepancies in teacher readiness and instructional strategies weaken learners' abilities to effectively conceptualize mathematics, leading to low achievement. In addition, impaired pedagogical skills and limited teacher readiness in Bungoma County tend to create inconsistencies in learners' achievement, with reports indicating that approximately 60% of Grade One learners are scoring "approaching" or "below" expectations. This inhibits the development of learners' competencies to articulate and grasp mathematical proficiency for higher achievement. Based on this realization, this study examined the influence of pre-primary



teachers' instructional skills for Competency-Based Education on learners' achievement in mathematical activities in Bungoma County, Kenya, focusing on game-based learning, task-based learning, and peer tutoring.

The objectives included:

- i. To establish the influence of game-based instructional skills for Competency-Based Education on pre-primary learners' achievement in mathematical activities in Bungoma County.
- ii. To determine the influence of task-based instructional skills for Competency-Based Education on pre-primary learners' achievement in mathematical activities in Bungoma County.
- iii. To assess the influence of peer-tutoring instructional skills for Competency-Based Education on pre-primary learners' achievement in mathematical activities in Bungoma County.

The following null hypotheses were investigated:

- i. Ho1: Pre-primary teachers' ability to use game-based instructional skills for Competency-Based Education has no significant influence on pre-primary learners' achievement in mathematical activities.
- ii. Ho2: Pre-primary teachers' ability to use task-based instructional skills for Competency-Based Education has no significant influence on pre-primary learners' achievement in mathematical activities.
- iii. Ho3: Pre-primary teachers' ability to utilize peer-tutoring instructional skills for Competency-Based Education has no significant influence on pre-primary learners' achievement in mathematical activities.

The study is anchored on a multi-theoretical framework comprising Lev Vygotsky's Social Development Theory, Jean Piaget's Developmental Stages of Play, and Albert Bandura's Social Learning Theory. These theories provide a robust conceptual foundation for understanding how instructional designs in Competency-Based Education facilitate the acquisition of numeracy competencies.

Vygotsky (1978) highlights the critical relationship between play and cognitive development, emphasizing the importance of social interaction in intellectual processes. Central to this study is the Zone of Proximal Development (ZPD), which, according to Tlou and Feza (2017), suggests that learners achieve optimal mathematical mastery when provided with experiences that push them slightly beyond their independent capabilities. In the context of CBE, this shifts the teacher's role from a traditional lecturer to a facilitator and observer during task-based learning. By utilizing the Gradual Release Model of Teaching (GRMT)- an instructional framework that shifts facilitation from tutor-directed modelling to learner- directed independent practice, it fosters learner independence and mastery. It follows 4 phases: "I Do" (focused instruction), "We Do" (guided practice)", "You Do" (collaborative work)", "You Do Alone" (independent mastery)", Salehomoum, Revelle, Duke & Pearson (2022), avers that teachers provide explicit instructions and then gradually reduce support as learners gain proficiency. This theory underscores how peer tutoring and collaborative investigation—weaving cultural elements like stories and artifacts into play—allow learners to explore and express themselves, leading to a deeper environmental and mathematical understanding.

According to Lillard (2015), Jean Piaget categorized play according to behavioural levels that reflect a child's cognitive development: sensorimotor, pre-operational, concrete operational, and formal operational. Piaget (1962) affirms that for pre-primary learners in the pre-operational stage (ages 2–7), imaginative and symbolic play are essential for building conceptual knowledge through dramatic and pretend play. Further, Piaget (1977), points out that as learners transition toward the concrete operational stage (ages 7–11), logical thinking emerges, making hands-on games with rules extremely effective instructional tools. These stages, according to Gargiulo & Kilgo (2019), play directly into mathematical activities, as play-based learning develops critical communication and problem-solving skills necessary to internalize mathematical rules and relationships.

Bandura (1977), establishes that learning occurs through observation and imitation, particularly when demonstrating behaviours as a "similar other." According to Nabavi (2012), Bandura's modelling process—consisting of attention, retention, production, and motivation—is directly applicable to CBE instructional skills. For instance, assertions by Boucherika (2025), teachers serve as successful models; through the use of multimodal resources (visual, auditory, and kinaesthetic), they capture learners' attention and facilitate retention of numerical concepts. Task-based learning, according to McLeod (2025), at Simply Psychology, provides time for "production," where learners duplicate modelled behaviours, while positive reinforcement, games, and digital devices provide "motivation" needed to build learners' efficacy and confidence in mathematical activities.



Primary criticisms of these developmental theories, as put by Tlou & Feza (2017), are that they may not fully account for individual biological differences or the impact of extreme resource scarcity on the predicted stages of development. Critics of Vygotsky argue that the ZPD can be difficult to measure precisely in overcrowded classroom settings common in developing regions, where the learner-to-teacher ratio often exceeds 50:1, making individualized scaffolding nearly impossible. Furthermore, Bandura’s theory has been critiqued for potentially downplaying the role of independent discovery compared with modelled behaviour. Despite these critiques, these theories collectively provide a comprehensive lens for examining how teacher readiness and instructional strategies “catapult” learners’ acquisition of numeracy awareness within the CBE framework.

Conceptual framework, according to Berman (2013), provides a model for the relationship between independent and dependent variables in a narrative theme for describing a phenomenon. This is demonstrated in Figure 1 below.

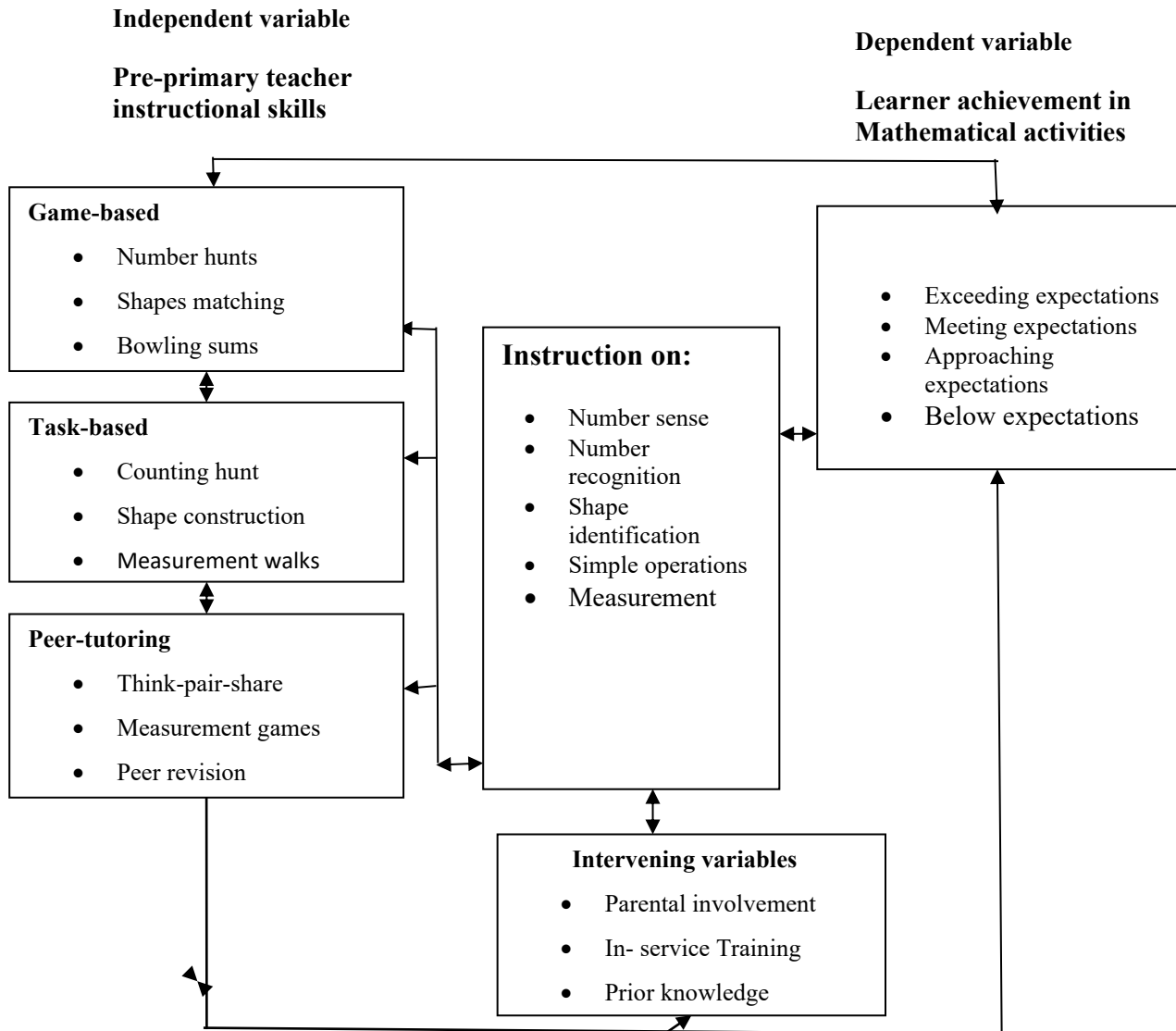


Figure 1. Conceptual Framework of the study



Figure 1 illustrates how pre-primary teachers' instructional skills influence learners' achievement in mathematical activities. If game-based teaching strategies, such as number hunts, shapes matching, and bowling sums, are implemented, learners are likely to construct meaningful mathematical knowledge. Use of effective task-based strategies, such as counting hunts, shape constructions, and measurement walks, tends to boost learners' engagement in learning opportunities for raised expected learning outcomes. Further, when teachers utilize peer-tutoring strategies, such as think-pair-share, measurement games, and peer revision, their self-efficacy and self-confidence heighten their motivation for exploring more opportunities to learn mathematics, thereby yielding either exceed, meet, approach, or fall below expectations. However, intervening factors, such as parental involvement, in-service training, and prior knowledge, may affect expected learning outcomes.

2.0 Methods

Both positivist and interpretivist paradigms embedded in a mixed-methods approach were adopted to determine the influence of pre-primary teachers' instructional skills for CBE on learners' achievement in mathematical activities in Bungoma County, Kenya. While positivism seeks to discover objective truths about reality through scientific research and empirical evidence, interpretivism seeks subjective truths by gathering the opinions, views, and feelings of individuals about phenomena. A Solomon four-group design was adopted to guide the research process. Quantitative analysis procedures using SPSS and Microsoft Excel software packages were employed to evaluate relationships between teacher readiness and mathematical outcomes. Additionally, qualitative data were collected using lesson observations, interview guides, and views from teachers in questionnaire tools; these were analyzed thematically based on components of pre-primary teacher readiness for competency-based education in mathematical activities. Bungoma County has 9 sub-counties. Public pre-primary centers in Bungoma County were targeted; all pre-primary 2 (PP2) learners, teachers, and Curriculum Support Officers (CSOs) formed the population frame of the study. Combination of stratified, simple random, and purposive sampling was applied at various levels to obtain the sample sizes, as illustrated in Table 1. This alignment was made to ensure that all aspects of Bungoma County were taken into account. In this respect, 8 sub-counties were involved by strata principles based on rural/urban inclination. In each sub-county, 2 centers were picked on a simple random sampling basis. Pre-primary teachers, CSOs, PP 2 learners, and host headteachers were picked purposively. This process yielded 16 centers; 16 PP 2 teachers, 16 host headteachers, 8 CSOs, and 260 PP2 learners to participate in the study. In this regard, 16 schools involved in the study were randomly assigned to the experimental and control groups. Whereas the experimental group consisted of 2 groups of schools code-named A, B, C, and D (experimental group 1: pretest-treatment-posttest group), E, F, G, and H (experimental group 2: treatment-only-posttest group), the control group was formed by 2 groups of schools coded I, J, K, L (control group 1: pretest-control-posttest group), M, N, O, and P (control group 2: posttest-only-control group), constituting 4 groups of Solomon Four group design. Teachers of mathematical activities in the experimental group were trained on CBE instructional strategies that included game-based, task-based, and peer-tutoring. More still, schools A, B, C, and D in the experimental group, and schools I, J, K, and L in the control group, were exposed to the pre-intervention test. After the intervention period, all sixteen schools were subjected to a post-intervention test.

Data collection instruments included a questionnaire for PP 2 teachers of mathematical activities, interview schedules for host headteachers and CSOs, an observation schedule, as well as PP2 learners' test tool. Use of these instruments is justified by the power of triangulation for in-depth acquisition of information on the study. The instruments were pilot-tested in 1 Sub-County out of 9. Necessary adjustments were affected based on the results and suggestions from respondents. Reliability analysis obtained a Cronbach's alpha ranging from 0.827 for teachers' questionnaires to 0.9 for interview schedules, which, according to Cortina (1993), were above the minimum threshold for internal consistency; therefore, good for use. Face validity was used to validate the study tools. Written instruments were assessed by the investigator's supervisors, who are experts in evaluating face validity.

Regarding ethical considerations, the investigator obtained the necessary permissions from relevant authorities, including the University of Nairobi, a permit from the National Commission for Science, Technology and Innovation (NACOSTI), letter from the County Director of Education (CDE) Bungoma County, to allow authorized contact with respondents. Further, the investigator sought consent from the school administration, parents, and guardians to engage learners in the study. Besides, learners and teachers were also taken through the ethical considerations process. Thus, all participants were assured confidentiality of their information. Limitations associated with this study's findings were mitigated through:



- i. Reorganising data collection into late-afternoon sessions outside the programmed instructional timelines, in conjunction with the schools' authorities, to reduce conflicts with normal learner programs.
- ii. Focusing strictly on Grade 1 diagnostic evaluation as a uniform measure of readiness throughout the county to curb learners' individual differences in mathematical activities.
- iii. Reassuring pre-primary teachers and CSOs' anonymity through a clear explanation of the study's objective: to provide a scholarly orientation for accelerated learning in mathematics rather than CBE Curriculum changeover performance appraisal, which could otherwise inhibit honest participation regarding their digital literacy or instructional skills.
- iv. Anchoring the study strictly within the Competent Performance Model conceptual scope (McClelland, 1973) and focusing only on the three identified dimensions of instructional skills. Other systemic factors influencing CBEC implementation, which were beyond the researcher's direct influence, such as parental involvement, teacher in-service training, and prior knowledge variables, were deliberately excluded to ensure a deep and specialized analysis of educator-related determinants.

3.0. Study Findings

Results are presented under four sub-sections, including learner achievement in mathematical activities, bivariate analysis of Solomon Four-Group post-test scores, descriptive analysis of teacher readiness in instructional skills, and multivariate linear regression analysis of the effect of teacher instructional skills on learner achievement. These findings integrate both quantitative data from the quasi-experimental assessments and qualitative insights from interviews and observations. Details are presented and discussed under the following themes.

3.1 Learner Achievement in Mathematical Activities

A sample of 260 learners in pre-primary II was selected for this study, with 123 (47.4%) included in the experimental groups and 137 (52.6%) included in the control groups. The experimental group underwent enhanced competency-based education training focused on teacher game-based, task-based, and peer-tutoring instructional skills, while the control group did not receive any additional treatment. To measure the efficacy of the intervention, referred to as "CBE adoption," which is supported by specific instructional skills, performance was assessed through a post-intervention test, hereinafter referred to as the "post-test," which measured participants' mathematical activities.

Table 1: Variation in post-test scores between learners in the experimental and control groups

Class		N	Mean	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper
Post-test	Experimental	123	58.82	15.55	1.40	56.08	61.56
	Control	137	37.32	12.76	1.09	35.18	39.46
	Levene's Test		t-test for Equality of Means				
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Diff.	95% CI (L/U)
Post-test	8.342	0.004	12.11	236.8	<0.001	21.50	18.02 / 24.98

Results presented in Table 1 show that learners in the experimental group obtained a post-test mean score of 58.82 (SD=15.55), while those in the control group obtained a mean score of 37.32 (SD=12.76). This indicates that the experimental group managed to score significantly higher on post-tests than the control group, which was not exposed to enhanced CBE adoption training. The analysis also obtained a t-statistic of 3.24 (df=238, p=0.001), which suggested up to 99% certainty that the mean scores obtained by learners in the experimental and control groups were significantly different. Given that the mean score obtained by learners in the experimental group (58.82) was substantially higher than that of learners in the control group (37.32), the results imply that training teachers on how to correctly use competency-based education methodologies was effective and expanded learners' achievement in mathematical activities.



3.2. Pre-Primary Teacher Utilization of CBE Instructional Skills and Learner Achievement

Table 2 presents responses from pre-primary teachers in Bungoma County regarding their ability to use various aspects of CBE instructional skills and the effect on learner achievement in mathematical activities. Data were collected through a questionnaire, with responses categorized on a five-point Likert scale. Table 2 presents results.

Table 2: Frequency Distribution of Teacher Utilization of CBE Instructional Skills

Statement	Strongly Agree (SA)	Agree (A)	Neither Agree nor Disagree (NS)	Disagree (D)	Strongly Disagree (SD)
I. I employ number games effectively during MA	7 (43.8%)	8 (50.0%)	0 (0.0%)	0 (0.0%)	1 (6.3%)
II. When I engage learners in mathematical tasks, acquisition of computational skills is enhanced	5 (31.3%)	9 (56.3%)	1 (6.3%)	1 (6.3%)	0 (0.0%)
III. My lesson plan allows for peer tutoring during MA	7 (43.8%)	8 (50.0%)	0 (0.0%)	1 (6.3%)	0 (0.0%)

Results in Table 2 above show that, in relation to the first statement, "I employ number games effectively during mathematical activities," 7 (43.8%) of 16 teachers strongly agreed, while 8 (50.0%) agreed. Cumulatively, 15 (93.8%) teachers affirmed the effective use of number games, demonstrating high practical readiness. Additionally, the second statement, regarding the enhancement of computational skills through mathematical tasks, revealed that 14 (87.6%) teachers affirmed this relationship. The final statement regarding peer tutoring indicated that 15 (93.8%) teachers confirmed that peer tutoring is structurally integrated into their lesson planning.

This high affirmation rate indicates that pre-primary teachers in Bungoma County feel strongly prepared to implement the core pedagogical requirements of CBE. This readiness aligns with the curriculum's emphasis on active, learner-centred methods, validating the literature by Serrano (2019) on Game-Based Learning and Gardner (2022) on peer collaboration. However, qualitative data from Curriculum Support Officers (CSOs) provides crucial context, suggesting that systemic issues such as large class sizes and compressed timetables may temper this readiness. As one CSO observed:

"Management of 60 pre-primary learners, all involved in a number game, demands a high level of class control and ample space, which is often missing. It becomes chaotic and, in most cases, distracted focus. Yes, many times, we try to be hard on teachers, but in real sense it's hard. I mean it's good, but it needs a lot of input, which is far from appropriate."

Table 3: CSOs' Observation of PPTs: Use of CBE Instructional Techniques

Response	Frequency	Percentage (%)
PPTs use curriculum designs as a guide	5	62.5
They teach traditionally	3	37.5
Total	8	100

Table 3 indicates that 5 (62.5%) out of 8 CSOs responded that, as long as teachers use curriculum designs, they are likely utilizing CBE techniques. On the contrary, 3 (37.5%) CSOs revealed that traditional instruction persists due to inadequate resources. Findings from head teachers further suggested a disconnect: 8 (50%) were not observant of pre-primary operations, while others witnessed teachers struggling with "lecture method" instruction due to an overwhelming number of learners. This suggests that while teachers are technically ready, structural barriers prevent the translation of this readiness into sustained practice.



3.3. Observation of Instructional Skills in Mathematical Activities

The analysis involved an observation of instructional techniques to estimate the extent to which teachers utilized competency-based methods in fostering active learning, with the outcomes presented in Figure 2.

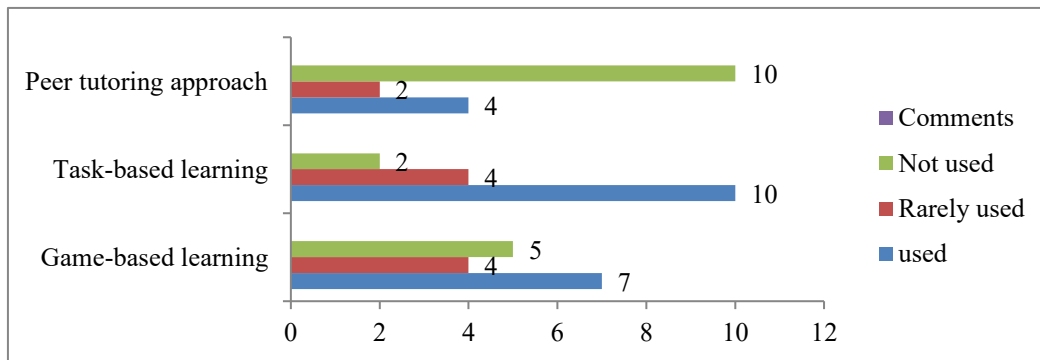


Figure 2. Observation results

Figure 2 shows that of 16 pre-primary centres observed, 7 (43.75%) teachers consistently used game-based learning during mathematical activities instruction. Conversely, 5 (31.25%) respondents did not use game-based learning at all, while 4 (25%) used it only rarely. This suggests that while a near majority of teachers are adopting the pedagogical shifts required by the Competency-Based Curriculum, a significant proportion (56.25%) still struggle with consistent implementation. These observations highlight a gap between self-reported readiness and the actual classroom environment, where the investigator noted that consistent application of these techniques was often hindered by classroom size and resource constraints.

3.4. Multivariate Analysis of Instructional Skills and Learner Achievement

The study's focus was to determine the influence of pre-primary teacher instructional skills for CBE on learners' achievement in mathematical activities. A multiple linear regression model was performed to test the influence of teacher instructional skills on learner achievement. Independent variables included pre-primary teacher Instructional Skills, while composite learner achievement in mathematical activities served as the dependent variable.

Before the variables were included, collinearity diagnostics were performed, yielding a Variance Inflation Factor (VIF) of 1.567 for instructional skills, which is well below the threshold of 10, indicating no problematic multicollinearity. The model summary revealed a moderate positive correlation ($R = 0.46$) with an R^2 of 0.347, indicating that 34.7% of the variation in learner achievement is explained by the teacher instructional skills dimensions collectively. Overall model significance was confirmed by the ANOVA table, which yielded an F-statistic of 16.991 ($p = 0.000$).

Results indicate that Instructional Skills was a variable displaying a significant and positive association with learner achievement in mathematical activities at 95% CI ($B = 0.371$, $t = 2.795$, $p = 0.019$). This B coefficient implies that a one-unit increase in the effective use of instructional methods leads to a 0.371-unit increase in learner achievement scores. The significance value of 0.019, being less than 0.05 threshold, confirms that teacher pedagogical competency is a critical predictor of learner success, effectively rejecting the null hypothesis.

4. Discussion of Findings

Descriptive findings reveal a high positive perception of teacher instructional skills, where over 90% of teachers affirmed their capability to use number games and peer tutoring. These results indicate that pre-primary teachers in Bungoma County view themselves as pedagogically functional within the Competency-Based Education framework. This alignment with Bikic et al. (2024), suggests that high-quality interactive pedagogy using playful numeracy and interactive technology is perceived as a bridge that translates play into meaningful knowledge acquisition, developing critical early numeracy and spatial reasoning. However, a critical area of non-alignment emerged during the investigator's observation, which revealed that only 43.75% of teachers consistently used game-based learning. This



highlights a gap between theoretical ability and classroom reality, echoing Ministry of Education (2025), which emphasized training initiatives to boost readiness for CBE implementation by shifting from theory to practical application.

Qualitative data from Curriculum Support Officers reinforces these “peaks” in self-reported readiness but identifies “coordination gap.” CSOs observed that, despite teachers having curriculum designs, traditional “lecture methods” often persist due to systemic vulnerabilities. This confirms concerns of Mukenya (2020) and Isaboke, et al. (2021), who identified overcrowded classrooms and a lack of resources as significant barriers that compromise CBE’s goal of problem-solving via the peer-tutoring mode of instruction.

Correlation results and the model summary provide significant insight into the hierarchy of predictors of mathematical achievement. A moderate positive relationship was established ($R=0.46$), with the teacher instructional skills dimensions explaining 34.7% of the variation in learner outcomes ($R^2=0.347$). This synergy addresses a research gap identified by studies on rote learning; it shows that when teachers shift from rote memorization to a process-oriented approach using task-based learning strategies, learner achievement rises.

Regression analysis provides the most robust empirical evidence, confirming that Instructional Skills is a significant positive predictor of achievement ($\beta=0.371$, $p=0.019$). This finding aligns with research on game-based learning, which promotes engagement, fun, and motivation necessary for skill acquisition. This validates “supportive buffer” theory: the effectiveness of the CBE curriculum is not a static property of teachers’ knowledge but a dynamic outcome “unlocked” by practical, activity-based pedagogy.

5. Conclusion

In conclusion, this study demonstrates that while pre-primary teachers in Bungoma County exhibit high self-perceived readiness in instructional skills for Competency-Based Education (CBE), significant gaps persist between perception, training, and practice, particularly in consistent game-based learning implementation, due to resource constraints and coordination challenges. Regression analysis confirms that Instructional Skills is the strongest predictor of mathematical achievement ($\beta=0.371$, $p=0.019$), underscoring the need for targeted professional development that bridges theory and classroom application, as emphasized by Kenyan training initiatives and interactive pedagogy research (Ministry of Education, 2025; Bikic et al., 2023).

Large classes and a compressed timetable are major causes of difficult use and management of task-based activities. Curriculum support officers frequently noted this discrepancy. These findings advocate for systemic interventions to enhance practical CBE delivery, ultimately fostering improved numeracy outcomes such as measurement and shape construction competencies among learners.

Peer tutoring skills are mostly hindered by limited space and resource constraints. Overcrowded classrooms and a lack of relevant resources necessitate the impossibility of “think-pair-share,” “measurement games” and “peer revision” activities enabled by peer-tutoring strategies for improved learner achievement in numerical proficiency. To address this lack, appropriate and adequate space should be provided by extending learning activities beyond classroom space to use outside space in centres with spacious playgrounds. Additionally, resource mobilization strategies, up to and including improvisation, should be engaged by all stakeholders to help curb resource scarcity if mathematical learning outcomes are to reach heights exceeding expectations.

This study generally contributes to existing knowledge by highlighting the importance of various dimensions of teacher ability to apply instructional skills vis-à-vis learner achievement. It demonstrates the dominance of qualitative tutorial factors—specifically engagement in high-order skills application of game-based, task-based, and peer-tutoring pedagogies—over the traditional delivery of learning material, to heighten learner achievement.

Limitations associated with this study’s findings were mitigated through:

- v. Reorganising data collection in late-afternoon sessions outside programmed instructional timelines, in conjunction with schools’ authorities, to abate conflicts with normal learner programs.
- vi. Focusing strictly on Grade 1 diagnostic evaluation as a uniform measure of readiness throughout the county to curb learner individual differences in mathematical activities.



- vii. Reassuring pre-primary teachers' and CSOs' anonymity through a clear explanation of the study's objective: to provide a scholarly orientation for accelerated learning in mathematics rather than CBE curriculum changeover performance appraisal, which could otherwise inhibit honest participation regarding their digital literacy or instructional skills.
- viii. Anchoring the study strictly on the Competent Performance Model conceptual scope (McClelland, 1973) and focusing only on three identified dimensions of instructional skills. Other systemic factors influencing CBEC implementation that were beyond the researcher's direct influence, such as parental involvement, teacher in-service training, and prior knowledge variables, were deliberately excluded to ensure a deep and specialized analysis of educator-related determinants.

6.0 Recommendations

To realize improved mathematical achievement in Bungoma County, this study made the following recommendations:

First, policy should stipulate that teacher training shifts its focus from simply presenting facilitation methods to learning quality and the management of differentiated instruction. Training should empower teachers to efficiently manage and sustain learner engagement, even within large classes, by focusing on the quality of implementing number games, tasks, and peer tutoring activities.

The county government must implement practical ICT and CBE training initiatives, emphasizing them, to boost the use of game-based strategies for CBE implementation by shifting from theory to practical application.

There is a need for pre-primary teachers to operate within flexible timetables to allow for effective and sustained implementation of mathematical activities, made possible by peer tutoring and task-based activities during instruction.

Financial support is required for procurement to address challenges arising from noncompliance with task-based instruction within CBE. For instance, a common theme in the interviews was pressure to complete curriculum coverage rather than ensure deep learning. In this regard, curriculum support officers noted that while teachers are enthusiastic, the successful execution of these skills often conflicts with classroom realities.

Further studies are recommended on areas of parental engagement in learner development and learning.

References

- Alotaibi, M. S. (2024). Game-based learning in early childhood education: A systematic review and meta-analysis. *Frontiers in Psychology*, 15, Article 1307881. <https://doi.org/10.3389/fpsyg.2024.1307881>
- Atiah, N., Fitria, H., & Destiniar, D. (2020). Effect of principal's coaching and supervision toward teacher's performance. *International Journal of Educational Review*, 3(1), 88-93
- Bandura, A. (1977). *Social learning theory*. Prentice Hall.
- Berman, J. (2013). Utility of a conceptual framework within doctoral study: A researcher's reflections. University of New England. *Issues in Educational Research*, 2013, vol 23(1), 1-18
- Bikic, N., Buzadija, N., & Hrnjicic, A. (2024). The impact of early childhood education and mathematical abilities on student achievement: Analysis of TIMSS 2019. *International Electronic Journal of Mathematics Education*, 19(3), emD779. <https://doi.org/10.29333/iejme/14599>.
- Boucherika, O. (2025). Teachers as Ethical Role Models: Their influence on Student Character Formation. *Intentional Journal of All Research Studies and Computer Technology (IJARSTC)*, 5(6). DOI: 10.48175/IJARSTC-26773.
- Catalano, H., Alublescu, L., Stan, C., Mestic, G., & Ani-Rus, A. (2023). Child-centered approach through slow education principles: A view of child personality development in early childhood sustainability. *Sustainability*, 15(11), 8611. <https://doi.org/10.3390/su15118611>
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1), 98.
- Gardner, J. (2022). *Exploring the benefits of peer tutoring on elementary students' academic outcomes* [Master's thesis, State University of New York College at Cortland]. <https://digitalcommons.cortland.edu/theses/155/>
- Gargiulo, R., M., & Kilgo, J. L. (2019). *An introduction to young children with special needs: Birth through age eight*. SAGE Publications.



- Isaboke, H., Mweru, M., & Wambiri, G. (2021). Teacher preparedness and implementation of the Competency Based Curriculum in public pre-primary schools in Nairobi City County, Kenya. *International Journal of Current Aspects*, 5(3), 32-53. <https://doi.org/10.35942/ijcab.v5i3.186>.
- Kubai, E. (2023). A critical review of challenges facing competency-based assessment in the competency-based curriculum in Nairobi County, Kenya. *Journal of Education and Practice*. 3(3), 1-13.
- Likuru, A., & Mwila, C. (2022). *Overcrowded classrooms: Effect on the teaching and learning process in public secondary schools in Ilemela Municipality, Tanzania*. AJESS,2022; 30(2): 75-87.
- Lillard, A. S. (2015). The development of play. In L. S. Liben, U. Miller, & R. M. Lerner (Eds.). *Handbook of Child Psychology and Developmental Science: Cognitive processes* (7th ed., pp. 425-468.) John Wiley & Sons Inc. <https://doi.org/10.1002/9781118963418>.
- Lumbantoran, J., H., & Ditasona, C. (2024). Development of a mathematics module on circle material based on the small group discussion model. *Journal of Education and Learning (EduLearn)*, 18(1), 18-25.
- Makawa (2020). Proposing and modifying guided play on shapes in mathematics teaching and learning for Zambian preschool children. *South African Journal of Childhood Education*, 10(1) (2020), Article a802.
- McClelland, D. C. (1973). Testing for competence rather than for "intelligence." *American Psychologist*. 28(1), 1-14. <https://doi.org/10.1037/h0034092>
- McLeod, S. A. (2025). *Albert Bandura's Social Learning Theory*. Simply Psychology. <https://www.simplypsychology.org/bandura.html>
- Megagianni, P., & Kakana, D. (2021). The educational value and impact of serious games in cognitive, social, and emotional development in middle childhood: Perceptions of teachers in Greece. In *Research on e-learning and ICT in education: Technological, pedagogical and instructional perspectives* (pp. 129-145). Springer International Publishing.
- Ministry of Education (2025). *National Competency-Based Education and Training (CBET) Policy (Draft)*. Government of Kenya. https://www.education.go.ke/index.php/sites/default/files/2025-12/CBET_DRAFT%20POLICY%20December%202025%20-%20.pdf
- Mukenya, R. (2020). Information communication technology integration and teacher preparedness for CBC in Bungoma County, Kenya. *Journal of Education and Technology in Africa*, 8(1), 14-28.
- Nabavi, R. T. (2012). Bandura's Social Learning Theory & social cognitive learning theory. *Journal of Personality and Social Psychology*, 1, 589-598.
- Nzuki, D. M., Embeywa, H., & Koech, P. K. (2025). Teachers of Mathematics: Induction and Its Effect on Competency-Based Curriculum Implementation and mathematics performance among 4th Grade Pupils in Machakos Sub-County, Kenya. *East African Journal of Education Studies*, 8(3), 283-292. <https://doi.org/10.37284/eajes.8.3.3518>
- Piaget, J. (1962). *Play Dreams and Imitation in Childhood*. WW Norton.
- Piaget, J. (1977). *The Development of Thought: Equilibration of Cognitive Structures*. Oxford: Basil Blackwell.
- Salani, E., & Sekgoma, A. (2024). The efficacy of peer tutoring on math achievement in supplementary examinations for first-year bachelor of primary education students. *The International Journal of Social Sciences and Humanities Invention*. 11(12):8365-8372. DOI:10.18535/ijsshi/v11i12.03
- Salehomoum, M., Revelle, K., Duke, N., & Pearson, P. D. (2022). Gradual release of responsibility instructional model. *Routledge Resources Online*. <https://doi.org/10.4324/9781138609877-REE226-1>
- Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A., & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. *European Journal of Education*, 54(2), 273-286.
- Temea, A. S., Kimeu, R., & Njoroge, K. (2025). Critical impact of professional development on teacher motivation for Competency-Based Curriculum implementation in junior secondary in Kitui West Sub County, Kitui County, Kenya. *Journal of Popular Education in Africa*, 9(8), 169-179.
- Thurston, A., Roseth, C., Chiang, T., H., Burns, V., & Topping, K. J. (2020). The influence of social relationships on outcomes in mathematics when using peer tutoring in elementary school. *International Journal of Educational Research Open*, 1, 100004. <https://doi.org/10.1016/j.ijedro.2020.100004>.
- Tlou, F. & Feza, N. (2017). Grade R educators voluntarily share their mathematics practices: Authentic realities in South Africa showcased. *South African Journal of Childhood Education*, 7(1),
- Tuya, J., Masibo, E., Nabwire, C., & Wekesa, P. (2025). Influence of teachers' pedagogical content knowledge on learners' mathematical problem-solving competence in junior schools, Bungoma County, Kenya. *International Journal of Research and Innovation in Social Science (IJRISS)*, 9(7).



- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wanyama, B. W. (2025). Competency-based Curriculum in Kenya: Taking Stock of the Implementation Process in early years education. *Culture, Education, and Future*, 3(1), 135-158. <https://doi.org/10.70116/2980274199>

