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# The Association between Teachers' Use of Demonstration Approach and PP2 Learner's Attainment of Selected Core Competencies during Science Activities

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**Abstract**

Research demonstrates that utilising a demonstrated learner-centred methodology can improve pre-primary students' mastery of fundamental scientific abilities and concepts, essential for their future science education. Nevertheless, global academic performance in science inside educational institutions remains disturbingly inadequate, a phenomenon similarly noted in Kenya, prompting apprehensions regarding pedagogical approaches. This study seeks to examine the extent to which educators employ the demonstration approach in science activities and its relationship with Pre-Primary Two (PP2) students' attainment of

specific core competencies outlined in the Competence-Based Curriculum. Informed by Vygotsky's socio-cultural cognitive theory, the descriptive study examined 16 public preschools and their educators in Taveta Sub County, Taita-Taveta County, Kenya. The data gathering utilised questionnaires and instructional observations, with validity guaranteed by standardised items and expert evaluations. The reliability was evaluated by the split-half approach, resulting in a Spearman's Rank Order Correlation coefficient of 0.7. Quantitative and qualitative analyses were performed to improve result credibility, and Pearson's Correlation Coefficient was employed for hypothesis testing. The findings indicated a substantial correlation between the application of the demonstration technique and students' achievement of essential competencies. Recommendations encompass training educators in demonstration methodologies and incorporating ICT resources into scientific activities inside preschools in Taita-Taveta County.

**Keywords:** Learner-centred methodology, Pre-primary students, Demonstration approach, Science activities competences

## 1. Introduction

The study underscores the significance of science education in preschool environments, emphasising the need for learner-centred strategies, especially demonstration techniques, to improve young children's foundational learning (Munna & Kalam., 2021). Prior studies across multiple nations revealed considerable disparities in science performance among older students, frequently ascribed to antiquated pedagogical approaches (O'Connor & Rosicka, 2020). The Kenyan government has transitioned from the 8-4-4 system to a Competence-Based Curriculum (CBC) to enhance early educational outcomes. Many pre-primary educators, however, are inadequately trained for the implementation of the Competency-Based Curriculum (CBC), which raises concerns regarding their instructional methodologies and the efficacy of science lessons in cultivating essential competencies such as critical thinking, problem-solving, digital literacy, and self-efficacy in young learners (KICD, 2017). This study examines the correlation between teachers' implementation of learner-centred methodologies and the development of competences in pre-primary school students in Taveta Sub-County, Kenya.

### *1.1 Statement of the Problem*

Science education is crucial for pre-primary learners, fostering foundational skills and attitudes. However, global performance in science education is poor due to conventional methods, leading to unemployment and reduced workforce performance. Learner-centered methodologies may address these issues, but their impact on Kenyan schools remains uncertain. The Ministry of Education in Kenya conducted training programs for science teachers, but excluded pre-primary school educators. The Competence Based Curriculum (CBC) implementation in Kenya is unclear, and there is no correlation between these methodologies and specific competencies (Jouppila, 2021). Moreover, the degree to which these techniques impact the cultivation of essential competencies such as critical thinking, problem-solving, digital literacy, and self-efficacy among Pre-primary students Two (PP2) learners have not been sufficiently established (Erwin & Mohammed, 2022).

*1.2 Purpose of the Study*

The purpose of this study was to examine the association between teachers' use of demonstration approach and PP2 learner's attainment of selected core competencies during science activities. The study sought to determine if pre-primary 2 educators employed learner-centred methodologies, such as demonstrations, question-and-answer sessions, and group learning, to enhance science activities in pre-primary education. The study primarily aimed to determine whether the aforementioned learner-centred approaches were correlated with PP2 children's achievement of specific core competencies, namely critical thinking and problem-solving, digital literacy, and self-efficacy during science activities in Taveta Sub-county, Taita-Taveta County, Kenya.

## 2. Review of Related Literature

Kola's (2017) study underscored the significance of the demonstrative method in imparting scientific knowledge. This approach allows educators to exemplify anticipated learning behaviours via observation, so augmenting learners' competency and fostering critical thinking abilities as they engage with challenges in their interactions. It consequently enhances learners' self-efficacy as they acquire diverse competencies (KICD, 2017). An action research study by Bahfen et al. (2019) in Indonesia showed a beneficial impact of this method on the mathematical skills of preschool children. The results demonstrated a notable enhancement in the children's numerical recognition due to the demonstration method. Similarly, Hussain (2020) did a study in Pakistan demonstrating that the presentation approach favourably influenced learners' emotional understanding, particularly regarding abstract subjects, hence augmenting their confidence and receptiveness.

Valverde-Berrocoso et al. (2021) emphasised the effectiveness of employing demonstrative tactics in conjunction with ICT to improve classroom learning experiences. This methodology assists pre-primary educators in incorporating digital literacy into scientific activities, despite the investigations being conducted outside the Kenyan environment. Bahfen et al. concentrated on mathematical skills, Hussain's study investigated mixed-age youngsters, and Valverde-Berrocoso emphasised teacher education courses.

In a quasi-experimental framework, Onyekwelu et al. (2019) examined the effects of demonstration and play methods on the academic achievement of Nigerian primary pupils. While no substantial difference was detected across the experimental groups, a significant difference was seen in comparison to the control groups. Likewise, Lupupa and Aubriel (2020) identified substantial enhancements in students' comprehension of chemistry ideas via the presentation approach; however, their investigations pertained to older students, unlike the present research centred on pre-school education in Kenya.

Agommuoh et al. (2023) conducted a related experiment revealing that learner-centred teaching approaches improved student attitudes towards physics in Nigeria, supporting Onyekwelu's findings on demonstrative methods. Nevertheless, these prior studies did not concentrate on pre-primary education or the augmentation of competences using demonstrative strategies.

In the Kenyan context, Ogango (2014) employed an ex-post facto design to evaluate the efficacy of interactive teaching strategies, including demonstrations, in impacting mathematics achievement among preschool children. Notwithstanding the favourable results, this prior research was relatively antiquated and limited in scope. This study investigates the influence of demonstration methods on the acquisition of essential competencies critical thinking, problem-solving, digital literacy, and self-efficacy among PP2 students in the science environment of Taita Taveta County, Kenya.

Furthermore, Atandi et al. (2019) evaluated the performance of secondary pupils in Kiswahili, observing a preference for conventional teaching methods over demonstration, which was utilised less frequently. Their research yielded ambiguous findings concerning the impact of teaching strategies on student performance, whereas the present study systematically examined the correlation between demonstration techniques and skill acquisition in pre-primary students during scientific activities.

Aurah et al. (2022) examined the impact of novel instructional strategies on chemistry achievement in Vihiga County, revealing a substantial association between self-efficacy and teaching methods, including instructor demonstration. This research seeks to identify the specific effects of the demonstration approach on the skills of pre-primary students, so providing significant insights into the effectiveness of instructional strategies for young learners within the science curriculum.

## 3. Research Design and Methodology

### *3.1 Research Design*

The study employed a descriptive research design to elucidate the relationship between the independent and dependent variables, specifically the implementation of learner-centred approaches in facilitating science activities and the pre-primary pupils' levels of attainment in the selected CBC core competencies: critical thinking and problem-solving, digital literacy, and self-efficacy, as well as the degree of utilisation of these approaches. The design was suitable for this study as it facilitated the exploration of conditions or interactions among the study variables without manipulation (Orodho, 2012).

### *3.2 Research Methodology*

The study employed a descriptive technique, detailing events as they occurred, and specifically utilised survey methodology, as asserted by Kothari and Garg (2019), due to its efficiency in gathering data from a broadly dispersed participant group, as seen in the current study. Additionally, both open and closed-ended questionnaire items utilising ordinal measurements were employed to categorise and rank comments noted during data collection, as recommended by Orodho (2012). Furthermore, observations were performed during PP2 scientific activities to verify the information obtained from the questionnaires.

### *3.3 Location of the Study*

The research was conducted in public pre-primary schools, specifically in PP2 classrooms, within Taveta Sub-County of Taita-Taveta County, Kenya. The Sub-County is segmented into

two educational zones: Challa and Kimorigo. Taveta Sub-County was deliberately selected due to a persistent decline in science performance during the KCPE national examinations from 2017 to 2019, with average scores of 45.23, 44.57, and 44.44, respectively, as reported by the Taita-Taveta County Director of Education in 2020.

### *3.4 Target Population*

The research population consisted of 78 public pre-primary 2 (PP2) schools and their instructors, divided into two zones within Taveta Sub-County: Kimorigo zone (44 teachers) and Challa zone (34 teachers).

### *3.5 Sampling Techniques and Sample Size*

The study focused on public pre-primary schools in Taveta Sub-County, Taita-Taveta County, Kenya, specifically the PP2 classrooms. We used a purposive sample method, where 20% of the 78 classrooms were chosen using a mix of stratified and random sampling methods. To make sure that each school had an equal chance of being chosen, the names of the 44 classrooms from the Kimorigo educational zone and the 34 classrooms from the Challa zone were written on pieces of paper. Then, 16 pieces (9 and 7, respectively) were randomly pulled while blindfolded. When there were more than one teacher, a random sample was used to pick one. The final sample was 20% of the original population, which is in line with Mugenda and Mugenda's (2013) rule that a sample size of 10% to 30% is statistically enough to be representative.

### *3.6 Research Instruments*

The study utilised a questionnaire directed at PP2 educators and incorporated live lesson observations to examine the impact of a demonstrated learner-centred strategy on the development of essential competences in pupils during science activities. The questionnaire successfully engaged participants in the rural regions of Taveta Sub-County, employing a 1-4-point Likert scale for responses: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Furthermore, a lesson observation schedule was employed during live science lessons in PP2 classrooms to evaluate the efficacy of the demonstration learner-centred approach and its influence on students' acquisition of essential skills, including critical thinking, problem-solving, digital literacy, and self-efficacy. To reduce a possible Hawthorne effect, which could change how participants act because they know what the study is about Mugenda and Mugenda (2013), observations were done before the interviews.

### *3.7 Findings and Discussion*

The study sought to investigate the correlation between the use of demonstration methods and the degree of preschool learners' achievement in specific core competencies: critical thinking and problem-solving, digital literacy, and self-efficacy during science activities. Table 1 displays the findings of the descriptive statistics on the use of demonstration tactics.

Table 1. Demonstration approaches and PP2 pupil's attainment of core learning competencies

| **Statements on teachers' use of demonstration learner centred approaches** | **SA (%)** | **A (%)** | **D (%)** | **SD (%)** |
|---|---|---|---|---|
| i. Regular use of demonstrations make pre-school pupils think critically during science classes | 68.8 | 31.3 | 0.0 | 0.0 |
| ii. Demonstrations during science lessons help children to figure out how to solve their simple problems | 50.0 | 50.0 | 0.0 | 0.0 |
| iii. Use of ICT related demonstrations during science lessons help to enhance children's digital literacy | 37.5 | 56.3 | 6.3 | 0.0 |
| iv. Demonstration of learning procedures promotes acquisition of children's self-efficacy when they successfully perform given science tasks | 87.5 | 12.5 | 0.0 | 0.0 |
| v. Use of demonstrations help to enhance pre-school children's learning performance in science activities | 68.8 | 25.0 | 6.3 | 0.0 |

The findings presented in Table 1 reveal significant insights about the use of demonstrations in science education for preschool pupils as established in the findings by (Martin & Faisal, 2019). A substantial majority (68.8%) of teacher respondents affirmed that demonstrations enhanced critical thinking among students. Furthermore, a large portion recognized the effectiveness of these demonstrations in helping children solve simple problems during science activities. Only a small minority (6.3%) disagreed with the notion that ICT-related demonstrations improved digital literacy. There was universal agreement among the respondents on the positive impact of demonstration methods on children's self-efficacy and learning performance in science. These observations align with previous studies, including those by Onyekwelu et al. (2019) and Ogango (2014), which highlighted the efficacy of demonstration techniques in facilitating academic achievement in science and mathematics. Respondents articulated a clear connection between the demonstration approach and the development of critical thinking, problem-solving skills, digital literacy, and self-efficacy. They emphasized that through observation during demonstrations, students not only gain practical know-how but also build confidence in their abilities. Despite these benefits, a noted gap exists regarding the integration of ICT in demonstrations, indicating challenges preschool teachers face with ICT incorporation, which reflects broader concerns about their digital competencies. The sentiments echoed findings from various studies, stressing the importance of addressing these challenges within the Taveta Sub-County pre-school teaching landscape.

An analysis was conducted to ascertain the significant correlation between the independent variable teachers' implementation of a demonstration learner-centred approach and the dependent variable pre-school pupils' achievement of specific core learning competencies, such as critical thinking, problem-solving, digital literacy, and self-efficacy during science activities. The hypothesis HO1 was tested. To measure this association, the Pearson

correlation coefficient was computed at a 95% confidence level, and the findings are presented in Table 2.

Table 2. Correlation analysis (demonstration approach)

| | | | Core Competency |
|---|---|---|---|
| Demonstration | Pearson Correlation | .641 | |
| | Sig. (2-tailed) | .002 | |
| | N | 16 | |
| Core competency | Pearson Correlation | .641 | 1 |
| | Sig. (2-tailed) | .002 | |
| | N | 16 | 16 |

The results in Table 2 show a strong positive relationship between the demonstration learner-centred approach and preschool children's core competencies, with a Pearson r value of 0.641 and a significance level of 0.002, which is below the threshold of 0.05. The statistical significance resulted in the rejection of the null hypothesis, which asserted that no significant relationship existed between teachers' application of the demonstration learner-centred approach and the achievement of specific core learning competencies among PP2 learners during science activities. Instead, the data confirmed the alternative hypothesis, confirming that a substantial correlation existed between the implementation of this instructional technique and the performance of PP2 learners in attaining specified core skills during science activities. As a result, it can be inferred that the demonstration of a learner-centred approach positively correlates with the improvement of overall achievement in chosen core learning abilities among PP2 learners during science activities.

The extent of teachers' implementation of a demonstration learner-centred approach on preschool children's acquisition of core competencies (critical thinking and problem-solving, digital literacy, and self-efficacy) was determined through regression analysis, as illustrated in Table 3.

Table 3. Regression coefficient analysis (demonstration approach)

| Model | | Coefficients[a] | | | | |
|---|---|---|---|---|---|---|
| | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.045 | .023 | | 47.184 | .005 |
| | Demonstration | .294 | .015 | .364 | .238 | .021 |

Table 3 displays a regression analysis designed to assess the influence of the demonstration learner-centred approach on core skills. The unstandardized coefficient for the demonstration approach is 0.294, accompanied by a standard error of 0.015. This indicates that for every unit increase in the demonstration method, the core competency rises by 0.294 units, provided all other elements are held constant. This coefficient is statistically significant, exhibiting a t-value of 0.238 and a significance level of 0.021, which indicates that the implementation of a learner-centred strategy has a substantial positive impact on the identified core competencies as observed in the findings by (Ochieng, 2020).

## 4. Conclusion

The research determined that public preschool educators in Taita-Taveta Sub-County, Taita-Taveta County, Kenya, employed a demonstration learner-centred strategy to facilitate science activities for PP2 children. Moreover, a statistically significant correlation existed between the implementation of a demonstration learner-centred approach during science activities and the attainment of critical thinking, problem-solving, digital literacy, and self-efficacy among pre-primary school 2 pupils, which are selected key competencies. Although the study identified a correlation between the implementation of a demonstrative learner-centred strategy and the acquisition of chosen core skills by PP2 pupils, the application level by preschool instructors during scientific instruction was inadequate.

## 5. Recommendation

### *5.1 Recommendation for This Study*

(i) Taita-Taveta County Government's Education Department with the support of KICD should organize professional training courses on use of learner-centred approaches for pre-primary school teachers for effective facilitation and enhancement of acquisition of science competencies among pre-primary school learners, for quality transition to primary school grades.

(ii) Special attention should be given to provision of ICT resources to all public pre-schools by the County government of Taita-Taveta, including re-training of teachers on the use of the above resources in order to facilitate ICT integration during use of demonstration learner centered approach in day to day science facilitation processes among the pre-primary learners in the county.

(ii) Zonal Inspectors and related offices should carry out regular supervision of the pre-primary school teachers including regular open dialogue with them for early detection of gaps related to use of demonstration learner centered and attainment of CBC core competencies during science and other curriculum activities.

(iv) Taita-Taveta pre-primary school teachers should actively engage in open classroom dialogue with learners during science learning activities. This should involve open question and answers since every classroom social encounter provides pre-school children with a window of opportunity to practice language use, acquire and develop critical thinking/problem solving, self-efficacy and digitally related competences among other competencies.

*5.2 Recommendation for Further Research*

The study advocates for further studies to be done on use of demonstration learner centred approach with regard to the attainment of other CBC core-competencies apart from; Critical thinking and Problem solving, Digital literacy and Self-efficacy during science activities.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

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No additional data are available.