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Original Article

Assessing the Implementation of Competency-Based Education and Training in Kenya: A Case Study of the Nyeri National Polytechnic, Kenya

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ABSTRACT

Competency-based education and training (CBET) focuses on developing practical skills, knowledge, and attributes in trainees rather than just theoretical knowledge. Launched by the Ministry of Education in Kenya in 2018, CBET aims to prepare trainees for real-world employment, making them professionals. However, traditional knowledge-based technical training methods have not been fully phased out in technical training institutions. This study aimed to assess the implementation of CBET in Kenya using The Nyeri National Polytechnic (NNP) in Nyeri, Kenya, as the case study. The research focused on the following objectives: to determine the level of pedagogical knowledge of the CBET approach among CBET trainers at NNP, to explore instructional processes CBET trainers use in content delivery at NNP, and to find out the assessment methods CBET trainers use to evaluate the competence levels developed by CBET trainees at NNP. Vygotsky's constructivist theory of learning guided this study, emphasising that learners actively construct knowledge. A descriptive case study design was used, targeting a population of 3,887, including 265 CBET trainers and 3,622 trainees at NNP. The sample comprised 363 respondents: 25 trainers and 338 trainees, selected through purposive and stratified purposeful sampling. Data were collected via questionnaires, coded in SPSS, and analysed using descriptive statistics like frequency, percentage, and mean, presented through narratives and tables. The study found that CBET trainers demonstrated, on average, an Advanced Level (74%) of pedagogical knowledge in the CBET approach, indicating a solid understanding but with 26% room for improvement to reach Expert Level (90% - 100%). Trainers utilised Universal Design for Learning (UDL), active learning, learner-centred methods, practical sessions, and dual training at an average of 68.8%, while traditional methods comprised 31.2%. Reliance on traditional written assessments was 38.9%, with evaluations occurring only once during trainees' four-month industry attachments, supplemented by written assessments (CATs and end-of-term exams) to assess competence. Recommendations highlight opportunities for professional development to elevate trainers to an Expert Level. Key interventions include refining instructional methods, enhancing resource availability, and strengthening partnerships for dual training. It is also vital for CBET trainers to adopt innovative assessment tools to effectively evaluate trainees' competencies in line with industry standards. This research offers valuable insights for education stakeholders, providing a basis for assessing CBET implementation in technical institutions. It aids policymakers in refining strategies to enhance CBET initiatives and contributes to the knowledge base for future research in this area.

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INTRODUCTION

Competency-Based Education and Training (CBET) is a skills-focused modern technical training approach that centres on trainees' development of competencies (Dambudzo, 2018). Competencies comprise trainees' practical skills, knowledge, and attitudes or worker behaviours. Competence is the ability to perform tasks or work to specified occupation standards. CBET produces graduates with quality practical skills who can meet real-world employment demands without additional training. According to Dambudzo (2018), CBET imparts practical skills to trainees for self and industry employment. This enables them to become highly competent professionals, unlike traditional technical training methods that primarily focus on theoretical or abstract knowledge.

The United States of America (USA) began implementing CBET in technical training between the 1950s and 1970s (Hodge, 2007). This implementation significantly enhanced the advancement of science and technology in the USA by producing graduates who are better aligned with the needs of employers, thus increasing the employability and self-employment opportunities for Technical and Vocational Education and Training (TVET) graduates, who, in turn, contribute to social and economic development (Rutayuga, 2014). Since 1968, the United Kingdom (UK), Australia, Netherlands, and Germany have also embraced and successfully implemented CBET, producing highly skilled and competent graduates. This success story of CBET in these developed countries instilled confidence in its potential for African countries.

South Africa was the first in Africa to introduce CBET during the late 1990s to tackle the severe shortage of skilled workers (Jwan, 2022). Subsequently, other African nations, including Malawi, Ghana, and Ethiopia, adopted this approach. Tanzania, a country belonging to the East African Community (EAC), started the implementation of CBET in the early 2000s (Rutayuga, 2014). African countries view CBET as emphasising the development of practical skills that trainees can apply rather than solely focusing on theoretical knowledge (Jwan, 2022). The CBET approach meets the evolving needs of trainees and society, allowing them to gain practical skills, knowledge, attitudes, and values that enable effective problem-solving in real-life situations. However, the urgent need for effective implementation is evident in African countries, including Kenya, which has not yet implemented it effectively.

In 2018, through the Ministry of Education (MOE), the Kenyan government took the initiative by introducing CBET in technical institutions. This move was in response to concerns that traditional knowledge-based technical training focused too much on theory and not enough on assessing competencies (The Republic of Kenya, 2008). The

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industry also influenced the government's decision, as employers stressed the need for graduates to be better prepared for employment. The introduction of CBET also aimed to enhance education in sciences, technology, engineering, and mathematics, aligning with Kenya's Vision 2030 and the BIG 4 agenda. These initiatives seek to elevate Kenya to a newly industrialising, middle-income country with high living standards for all citizens by 2030 in a clean and secure environment (The Republic of Kenya, 2008).

Kenyan government acknowledges the importance of cultivating a well-educated population with high skills to effectively participate in the ever-expanding global market (The World Bank, 2007). According to the World Bank (2007), technical training is instrumental in enhancing the productivity of skilled labour, which is a crucial factor in economic productivity and competitiveness. This underscores the significance of investing in training to bolster the country's economic performance and nurture skilled human capital. The persistently elevated level of youth unemployment in Kenya presents a significant challenge. This issue results from traditional knowledge-based technical training, which has consistently generated inadequately skilled graduates who struggle to meet industry standards (Bhurtel, 2015). In contrast, CBET offers a promising solution to this pressing problem. CBET produces high-performing graduates capable of meeting industry requirements by focusing on developing relevant skills. This unique aspect of CBET reduces the need for costly retraining of employees, fulfilling the demand for skilled and competent graduates who are well-prepared for success in their respective industries without additional training.

The rapid evolution of technology innovations worldwide has increased the demand for CBET in technical training since it equips graduates with the skills necessary to adapt to changing job market requirements (KEPSA, 2024). To speed up the implementation of CBET in Kenya, the MOE, through the State Department for Technical Education, directed all TVET institutions to ensure they only admit all trainees into CBET courses during the September 2023 intake. Technical training institutions in Kenya continue to admit trainees into traditional knowledge-based technical training courses. They have yet to embrace CBET and fully transition from conventional training approaches. According to Osawa *et al*. (2023), TVET institutions in Kenya—including 12 National Polytechnics, 311 public Technical and Vocational Colleges (TVCs), 855 private TVCs, and 991 Vocational Training Centres (VTCs)—are still struggling to prepare for the implementation of Competency-Based Education and Training (CBET). This challenge stems from the adequacy of theory rooms, insufficient workshops and laboratories, inadequate technological equipment for training, and an overall deficiency in infrastructure.

The Nyeri National Polytechnic (NNP) in Nyeri, Kenya, introduced the CBET approach in 2019, according to the Office of the Deputy Principal (Academics). By April 2024, NNP had developed over 92 CBET programs, and over 250 trainers had undergone in-service training on instructional training and assessment methodologies in CBET. 3622 (51%) trainees were enrolled in these CBET courses, according to the Office of the Registrar (Administration), while 3499 (49%) trainees were enrolled in more than 100 traditional knowledge-based programs, as shown in Figure 1.

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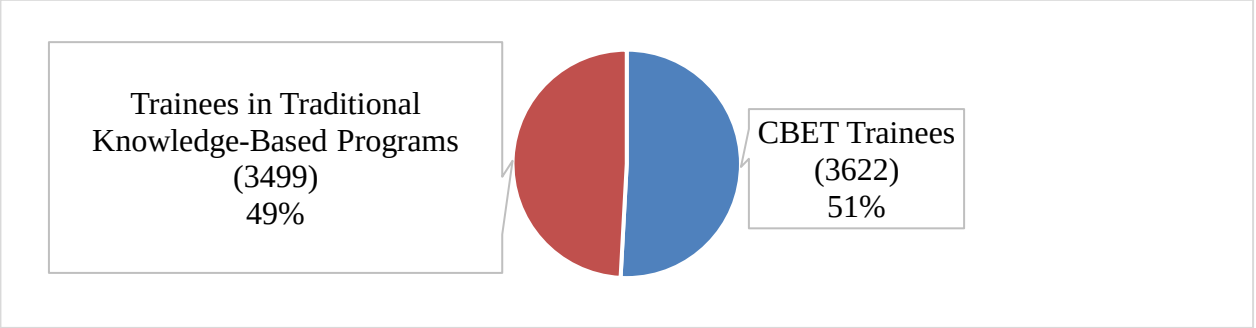
Figure 1: Total Number of Trainees at NNP



Note. This figure shows the number of NNP trainees enrolled in traditional knowledge-based and CBET programs during the term ending April 2024. The figure indicates that 3622 trainees in NNP were enrolled in these CBET courses, making up 51% of the total trainees. In comparison, 3499 trainees in NNP were enrolled in more than 100 traditional knowledge-based programs, making up 49% of the total trainees. These statistics showed the need to assess how technical institutions in Kenya implement CBET. This study aimed to assess the implementation of competency-based education and training (CBET) in Kenya, using the Nyeri National Polytechnic in Kenya as the case study. The research focused on the following objectives: to determine the level of pedagogical knowledge of the CBET approach among CBET trainers at NNP, to explore instructional processes CBET trainers use in content delivery at NNP, and to find out the assessment methods CBET trainers use to evaluate the competence levels developed by CBET trainees at NNP.

Theoretical Framework

Implementing new training modes in the TVET sector aims to increase the relevance of training to trainees. Employers demand highly skilled employees who are well-updated with the industry's current and future technologies, as well as trainees' competence in practising skills and applying knowledge when employed. Training must be in tandem with a country's dynamic social, economic, and technological needs (Labani et al., 2019). To successfully implement CBET in TVET institutions in Kenya, trainers and administrators must believe in learning theories that guide the training and learning process. Thus, in assessing the implementation of CBET in Kenya, the researcher used Vygotsky's constructivist theory of learning (1970s to 1980s).

Vygotsky's constructivist learning theory states that trainees construct skills and knowledge rather than passively absorb information (Lane, 2022). As they experience and reflect on the world, they build their representations and incorporate the latest information into their preexisting knowledge. In his article on professional learning communities, Hord (2009) identified six fundamental principles important to Vygotsky's constructivist theory of learning. The first principle emphasises that learners bring unique prior knowledge, experience, and beliefs to a learning situation. The researcher used this principle to explore instructional processes CBET trainers use in content delivery at NNP. The discussion method is one learner-centred approach that trainers use during the lesson's bridge-in session. Bridge-in aims to introduce the topic to learners, grab their attention, engage them, motivate them, and establish relevance by assessing their prior knowledge.

The second principle states that trainees uniquely and individually construct knowledge through various authentic tools, resources, experiences, and contexts. The researcher used this tenet to determine the level of pedagogical knowledge of the CBET approach among CBET trainers at NNP. To improve and optimise teaching and learning for all learners based on their understanding of how they learn, trainers must employ a Universal Design for Learning (UDL) in the classroom. To cater to all learners, trainers must use visual, auditory, action, and reading methods when delivering content.

The third principle emphasises that learning is an interactive and reflective process. CBET philosophy suggests that individuals acquire new skills and

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knowledge by reflecting on their experiences rather than memorising information through conventional teaching methods such as lecturing. This principle significantly reveals the assessment methods CBET trainers use to evaluate the competence levels developed by CBET trainees at NNP. Trainers should ensure that the methods used to assess trainees do not encourage memorisation but show the application of the acquired competencies. For trainers to declare trainees competent, trainees should be able to apply the skills and knowledge acquired during training and perform all the tasks according to occupational standards (OS). They must also reflect on and consider this during the assessments.

The fourth principle states that learning is a developmental process in which trainees construct new conceptual structures, meaningful representations, or mental models through accommodation, assimilation, or rejection. CBET is a training approach that emphasises practical and experiential learning. It encourages trainees to actively engage with the material and apply it in real-world contexts. The researcher used this principle to explore instructional processes CBET trainers use in content delivery at NNP.

According to the fifth principle, social interaction can be vital in developing and acquiring knowledge. This principle implies that when learners engage in social interaction, they can obtain multiple perspectives on a particular topic or concept through reflection, collaboration, negotiation, and shared meaning. This tenet holds specific significance in the context of CBET trainers at NNP. This principle helped the researcher determine the level of pedagogical knowledge of the CBET approach among CBET trainers at NNP by emphasising the importance of social interaction in learning. It can facilitate a collaborative and reflective approach to education, enhancing their ability to impart knowledge and skills effectively. By applying this principle in their training programs, CBET trainers can create a conducive learning environment that fosters multiple perspectives and enhances their trainees' learning outcomes.

The sixth principle states that the learner controls and mediates learning internally. This tenet helped the researcher fulfil the following objectives of the study: to explore instructional processes CBET trainers use in content delivery at NNP and to find out the assessment methods CBET trainers use to evaluate the competence levels developed by CBET trainees at NNP. This principle helps to promote a sense of independence and empowerment in CBET trainees, which can be invaluable for achieving successful outcomes. Trainees can achieve this using technology-personalised learning methods such as a learning management system (LMS). Trainees can also use ICT tools like quizzes to personalise learning and assessment.

RESEARCH METHODOLOGY

Research Design

To assess the implementation of CBET in Kenya, the researcher used a descriptive study design using the case study method. The researcher chose this design for its ability to provide a comprehensive understanding of the social system, such as a TVET institution (Siedlecki, 2020) and will be instrumental in this research. The case study research method comprehensively examines one or more units, individuals, organisations, groups, entire communities, or regions to analyse the phenomenon's context and process (Coombs, 2022). Coombs (2022) further affirmed that this approach involves thorough investigations of these units. The researcher used NNP as a case study to assess the implementation of CBET in Kenya and used the findings to generalise the implementation of CBET in other TVET institutions in Kenya.

Study Location

The researcher conducted the study at The Nyeri National Polytechnic (NNP) in Nyeri County, Kenya. NNP is located along Mumbi Road, 2.8 km from Nyeri Town Centre, at the latitude of 0.4270^{o} S and longitude of 36.9455^{o} E. According to the Office of the Deputy Principal (Administration), NNP, formerly a Technical Training Institute (TTI), is a National Polytechnic established under Legal Order No. 91 of 2016. The legal order mandates NNP to independently design, develop, train, and implement curricula and award certificates. To assess the implementation of CBET

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in Kenya, the researcher selected NNP as the case study for five reasons.

First, NNP was a trailblazer among the first public TVET institutions in Kenya to embrace CBET, introducing it in 2019, a year after the MOE's mandate for technical institutions in 2018. This pioneering spirit has matured into five years of experience in CBET training and assessment at NNP. However, it is worth noting that 3499 (49%) of NNP trainees are still engaged in theoretical knowledge-based technical training that does not assess trainee competencies. This unique blend of history and current practice made NNP a compelling subject for this study.

Second, by 2023, NNP had not just developed but also accredited an impressive ninety-two CBET programs, the highest number by any TVET institution in Kenya, as confirmed by the Office of the Deputy Principal (Academics). By the end of April 2024, 3622 (51%) of NNP trainees were in these CBET programs. This percentage underscored the significant role NNP plays in technical education, making it a compelling case study.

Thirdly, NNP boasts the largest pool of CBET trainees for this study. As of the term ending in April 2024, 3622 CBET trainees were in 92 CBET programs, as reported by the Office of the Registrar (Administration). This substantial sample size ensured that the study's results were dependable and valid.

Moreover, NNP has conducted in-service training sessions on instructional training and assessment methodologies in CBET for over 250 trainers. However, NNP continues to offer traditional knowledge-based technical training programs. To put it succinctly, NNP also boasted the largest pool of CBET trainers for the study.

Additionally, in November and December 2023, NNP held its national summative exams, in which more than 661 CBET program trainees participated. This information was crucial in achieving the third objective of this study, which is to find out the various assessment methods CBET trainers use to evaluate the competence levels developed by CBET trainees at NNP.

Study Population

Mugenda, & Mugenda (1999) define a population as a complete set of individual cases or objects with common observable characteristics. The study's target population was 3887, including 265 CBET trainers and 3622 CBET trainees at NNP, as shown in Table 1. Trainers are pivotal in implementing the curriculum as they receive, interpret, and execute it. Furthermore, they consider the diverse needs of the trainees they engage with. This study gathered insights from CBET Trainers at NNP regarding their pedagogical understanding of the CBET approach, the various instructional processes they employ for content delivery, and the assessment methods they use to evaluate the competence levels developed by CBET trainees. The contribution of CBET trainees is also crucial, as they possess extensive knowledge about CBET implementation, including the instructional strategies CBET trainers use in content delivery and the assessment methods CBET Trainers use to evaluate the competence levels they develop during their training.

Table 1: Study Population

Groups	Population	Percentage of the Total Population
CBET Trainers	265	6.82 %
CBET Trainees	3622	93.18 %
Total	**3887**	**100 %**

Note. This table shows the study's population of CBET trainers and trainees at NNP. The target population was 3887, including 265 CBET trainers and 3622 CBET trainees at NNP.

Sampling Size

The researcher used the Taro Yamane formula to select a sample of 363 as shown in Equation (2), including 25 CBET trainers and 338 CBET trainees at NNP, as shown in Table 2. The Taro Yamane formula enhances accuracy by determining a

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representative sample size with a reasonable margin of error (Baridam, 2001). As shown in the following equation (1), Baridam (2001) stated the Taro Yamane formula as follows:

$$\boldsymbol{n = \frac{N}{1 + N(e^2)}} \qquad (1)$$

Here, $\boldsymbol{n}$ is the sample size, $\boldsymbol{N}$ is the target population, and $\boldsymbol{e}$ is the margin of error. For this study, there is a 95% confidence level (or 0.05 error margin) in the sample the researcher selected from the population. For this study, the researcher calculated the sample size as follows:

$$\boldsymbol{n = \frac{N}{1+N(e^2)} = \frac{3887}{1+3887(0.05^2)} = 363} \qquad (2)$$

Table 2: Study Sample Size

Groups	Sample	Percentage of the Total Sample
CBET Trainers	25	6.82 %
CBET Trainees	338	93.18 %
Total	**363**	**100 %**

Note. This table shows the study's selected sample of CBET trainers and trainees at NNP. The researcher selected a sample of 363, including 25 CBET trainers and 338 CBET trainees at NNP.

Sampling Techniques

The researcher employed purposive sampling to select all 25 CBET trainers for the study. To achieve this, the researcher chose at least two CBET trainers from the ten academic departments at NNP. These selected trainers had at least three years of experience training and assessing CBET trainees at NNP. The selected CBET trainers per department comprised at least one male and one female. As Cresswell, & Plano (2011) noted, purposive sampling entails identifying and selecting individuals or groups with extensive knowledge or experience of the phenomenon of interest. Gathering data solely from CBET trainers of this type is crucial to achieve the best results. These trainers are responsible for implementing the curriculum, addressing trainees' needs, and employing diverse instructional and assessment techniques.

The researcher used stratified purposeful sampling to select all 338 CBET trainees for the study. The strata comprised the training levels (Levels 5 and 6), the year of training (years 1 and 2), the ten academic departments at NNP, and the trainees' gender (Male—M and Female—F). Fifty percent (50%) of the sampled CBET trainees were level 5, while the remainder were level 6. Fifty percent (50%) of the sampled CBET trainees were in year 2 of their training, while the remainder were in year 3. The proportion of male and female CBET trainees selected for the study depended on their ratios in each department, as shown in Table 3. Departments offering engineering courses had more male trainees than female trainees, while the rest had more female trainees than male. Researchers use stratified sampling for a heterogeneous population, resulting in more reliable and detailed information (Kothari, 2004). In educational and social sciences research, it is crucial for researchers to purposefully select a sample that effectively represents subgroups (or strata) in proportion to the population (Adam, & Kamuzora, 2008).

Table 3: CBET Trainees Population and Sample Size

Departments at NNP	Population				Sample		
	M	F	Total	%	M	F	Total
Applied Sciences	38	139	177	4.9	4	12	16
Building & Civil Engineering	612	170	783	21.6	57	17	74
Business Studies	24	66	90	2.5	2	6	8
Computing & Informatics	202	171	373	10.3	19	16	35
Electrical & Electronics Eng.	477	103	580	16.0	44	10	54
Fashion Design & Cosmetology	40	460	500	13.8	4	43	47
Health Sciences	2	8	10	0.3	0	1	1

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Departments at NNP	Population				Sample		
	M	F	Total	%	M	F	Total
Hospitality & Tourism	104	274	378	10.4	9	26	35
Liberal Studies	18	90	108	3.0	2	8	10
Mechanical & Automotive Eng.	560	64	624	17.2	51	7	58
Total	**2077**	**1545**	**3622**	**100**	**192**	**146**	**338**

Note. This table illustrates the population of CBET trainees by department at NNP and the corresponding sample size for each department. It also details the population and sample of CBET trainers, categorised by gender. The CBET trainees hold significant knowledge regarding implementing CBET, instructional strategies, and the assessments they partake in, rendering them crucial sources of information for this study.

Data Collection Techniques

In this study, the researcher used a primary data collection approach that involves direct interaction with CBET trainers and trainees. This firsthand approach allowed the researcher to record first-hand information tailored to the study's objectives.

Data Collection Tools

The primary data collection tools the researcher used to collect the data were questionnaires. The researcher collected the data from 25 CBET trainers and 338 CBET trainees using questionnaires. Questionnaires are low-cost, and researchers can collect the data quickly (Omari, 2011). The questionnaires for CBET trainers included structured closed-ended and unstructured open-ended questions, whereas those for CBET trainees contained only structured closed-ended questions. In the case of structured closed-ended questions, respondents are presented with a list of answers and select the ones that best reflect their opinions. The researcher employed unstructured, open-ended questions to gain deeper insights into the study and to gather recommendations on how technical institutions in Kenya can improve the implementation of CBET.

Ethical Considerations

The researcher first obtained a letter of introduction from the School of Graduate Studies at KCA University and then sought permission from the National Commission for Science, Technology, and Innovation (NACOSTI) before collecting data. Additionally, the researcher requested authorisation from the Chief Principal of NNP to engage its CBET trainers and trainees in the study. Before data collection, the researcher obtained consent from these respondents, established a good rapport with them, and assured them that the researcher would keep any information collected confidential and use it only for the study's purposes.

Pilot Study

Roland, & Vanora (2002) highlighted the importance of piloting in identifying misunderstandings, ambiguities, and inadequacies in research items. The researcher conducted a comprehensive piloting process to ensure the highest validity and reliability of the research instruments. Two CBET trainers—one male and one female—and two CBET trainees, one male and one female, were selected from The Eldoret National Polytechnic to complete the questionnaires. The trainers chosen possessed three or more years of professional experience in CBET. One trainee was from level 5, and the other from level 6, both second-year students. After a two-day interval, the researcher administered the same questionnaires to these respondents to assess the reliability of the research instruments.

The Eldoret National Polytechnic is one of the 24 national polytechnics in Kenya. Like NNP, the institution independently designs curricula, delivers training, conducts assessments, and grants qualifications. Additionally, The Eldoret National Polytechnic shares similar characteristics with NNP, such as its status, the number of CBET trainees, CBET trainers, and CBET programs, and five years of experience in CBET training and assessment. These qualities make The Eldoret National Polytechnic an outstanding choice for the pilot study. Orodho (2004) stated that both responses to

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the test questionnaires will be similar if they reflect the same content for all respondents. Therefore, the researcher expected that the scores obtained by each respondent on the first and second tests would be close. The researcher adjusted the questions after consulting with the supervisors for any ambiguities.

Validity of the Research Instruments

The concept of a test's validity pertains to its accuracy in measuring what it claims to measure (Cherry, 2010). A test must be valid to make correct interpretations of the results. In data collection, validity relates to how research findings accurately depict the phenomenon under investigation. It establishes whether the research genuinely measures its intended targets or the veracity of the research outcomes. To ensure validity, the researcher used the revised questionnaires to ensure the instruments represent what they should measure. The researchers also performed independent data checks and verified the correctness of data captured by counter-checking the findings with respondents.

Reliability of the Research Instruments

Reliability pertains to the consistency of an instrument in generating consistent results over different instances (Drost, 2011). The test-retest method will validate the extent to which a specific measurement procedure yields consistent results across multiple trials. To determine whether the research instruments consistently produce the same response each time the researcher uses the tool, the researcher compared the resulting data from the pilot study using the Pearson Product-Moment Correlation Coefficient formula. Bird (2021) defines the Pearson Product-Moment Correlation Coefficient *(r)* as shown in the following equation (3):

$$\boldsymbol{r} = \frac{\sum \boldsymbol{xy}}{\sqrt{\{(\sum \boldsymbol{x^2})(\sum \boldsymbol{y^2})\}}} \qquad (3)$$

Where $\boldsymbol{x}$ is the deviation of $\mathbf{X}$ from $\overline{\mathbf{X}}$, $\boldsymbol{y}$ is the deviation of $\mathbf{Y}$ from $\overline{\mathbf{Y}}$, $\boldsymbol{X}$ comprises the results of the first trial, $\boldsymbol{Y}$ comprises the results of the second trial, $\overline{\boldsymbol{X}}$ is the average result of the first trial and $\overline{\boldsymbol{Y}}$ is the average result of the second trial. The male CBET trainer in the pilot study had a correlation coefficient of 0.97, the female CBET trainer had a correlation coefficient of 0.87, the male CBET trainee had a correlation coefficient of 0.99, and the female CBET trainee had a correlation coefficient of 0.96. A correlation coefficient of approximately 0.8 is high enough to deem the instrument dependable (Orodho, 2008).

Data Analysis Techniques

The researcher analysed the collected data using descriptive statistical methods, including frequencies, means, and percentages. To streamline the analysis and conceptualisation process and ensure accuracy and efficiency, the researcher inputs the collected data into powerful specialised statistical computer software, the Statistical Package of Social Sciences (SPSS) (Rahman, & Muktadir, 2021). The researcher uses SPSS Version 27 to organise the data and compute frequencies, means, and percentages to extract significant insights and inform subsequent decisions on CBET implementation in Kenya.

The researcher presented the results in descriptive narratives and tables. To communicate the analysis's findings clearly and quickly, researchers thoughtfully design these visual aids (Shabiralyani *et al*., 2015). The researcher took great care to ensure the visual aids were accurate and informative, highlighting the data's most essential and relevant aspects. The aim was to provide a comprehensive and insightful overview of the data that would be useful for decision-making purposes.

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

Response Rates

The researcher issued questionnaires to 25 target CBET trainers and 338 target CBET trainees at NNP. Table 4 shows the study's response rate.

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Table 4: Study's Response Rate

Respondents	Sample Size	Responses	Response rate
CBET Trainers	25	25	100%
CBET Trainees	338	307	90.8%

Note. This table shows the study's response rates. The researcher received 25 filled-out and completed questionnaires from all 25 CBET trainers, representing a 100% response rate. The researcher also received 307 filled-out and completed questionnaires from 307 CBET trainees, representing a 90.8% response rate. A 40% to 75% response rate is acceptable across various research areas (Sataloff, & Vontela, 2021).

Reliability Results

The researcher conducted a pilot study to ensure the utmost reliability of the research instruments. Two CBET trainers (Male and Female) and two CBET trainees (also Male and Female) at The Eldoret National Polytechnic filled out and completed questionnaires. After two days, the researcher issued the same questionnaires to the same respondents to measure the reliability of the research instruments. These respondents filled out and completed questionnaires again. Using the test-retest method, the data from the pilot study were compared using the Pearson Product-Moment Correlation Coefficient formula. Table 5 shows the reliability results of the pilot study.

Table 5: Study's Reliability Results

Respondents	Pearson Correlation Coefficient
Male CBET Trainer	0.97
Female CBET Trainer	0.87
Male CBET Trainee	0.99
Female CBET Trainee	0.96

Note. This table shows the study's reliability results. The male CBET trainer had a correlation coefficient of 0.97, the female CBET trainer had a correlation coefficient of 0.87, the male CBET trainee had a correlation coefficient of 0.99, and the female CBET trainee had a correlation coefficient of 0.96. A correlation coefficient of 0.8 or higher is high enough to deem the instrument dependable (Orodho, 2008).

Validity Tests

The researcher thoroughly assessed the questionnaire's validity, ensuring accuracy and reliability. University supervisors were consulted to guarantee the questionnaire's quality, and their insightful recommendations led to necessary modifications, guaranteeing that the questionnaire effectively provided the data needed to address the study's research questions. The researcher further performed independent data checks and verified the correctness of data captured by counter-checking the findings with respondents.

Respondents' Gender

The researcher engaged both male and female respondents. Table 6 shows the number of male and female CBET trainers who filled out and completed the questionnaires in the study.

Table 6: CBET Trainers Respondents' Gender

Gender	N	%
Male	14	56.0%
Female	11	44.0%

Note. This table shows the number of male and female CBET trainers who filled out and completed the questionnaires. 14 of the 25 CBET trainers were male, representing 56%, and 11 were female, representing 44%. Also, 307 CBET trainees filled out and completed the research questionnaires. The researcher also engaged male and female CBET trainees in the study, as shown in Table 7.

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Table 7: CBET Trainees Respondents' Gender

Gender	N	%
Male	177	57.7%
Female	130	42.3%

Note. This table shows the number of male and female CBET trainees who filled out and completed the questionnaires. 177 were male, representing 57.7%, and 130 were female, representing 42.3%.

Respondents' Academic Departments

The CBET trainers who filled out and completed the study questionnaires were purposively selected from the 10 academic departments at NNP, as shown in Table 8.

Table 8: CBET Trainers Respondents' Departments

Departments	N	%
Applied Sciences	2	8.0%
Building & Civil Engineering	1	4.0%
Business Studies & Entrepreneurship	2	8.0%
Computing & Informatics	1	4.0%
Electrical & Electronics Engineering	6	24.0%
Fashion Design & Cosmetology	2	8.0%
Health Sciences	1	4.0%
Hospitality & Tourism	2	8.0%
Liberal Studies	1	4.0%
Mechanical & Automotive Engineering	7	28.0%

Note. This table shows the number of CBET Trainers per department who filled out and completed the questionnaires. 4% belong to Liberal Studies, 28% belong to Mechanical and Automotive Engineering, 8% belong to Applied Sciences, 4% belong to Building and Civil Engineering, 8% belong to the Business Studies and Entrepreneurship, 4% belong to the Computing and Informatics, 24% belong to the Electrical and Electronics Engineering, 8% belong to the Fashion Design and Cosmetology, 4% belong to the Health Science. In comparison, 8% belong to the Hospitality and Tourism. CBET trainees who filled out and completed the study questionnaires were also selected from 10 academic departments at NNP, as shown in Table 9.

Table 9: CBET Trainees Respondents' Departments

Departments	N	%
Applied Sciences	15	4.9%
Building & Civil Engineering	54	17.6%
Business Studies & Entrepreneurship	3	1.0%
Computing & Informatics	35	11.4%
Electrical & Electronics Engineering	54	17.6%
Fashion Design & Cosmetology	47	15.3%
Health Sciences	1	0.3%
Hospitality & Tourism	35	11.4%
Liberal Studies	5	1.6%
Mechanical & Automotive Engineering	58	18.9%

Note. This table shows the number of CBET Trainees per department who filled out and completed the questionnaires. 1.6% belong to Liberal Studies, 18.9% belong to Mechanical and Automotive Engineering, 4.9% belong to Applied Sciences, 17.6% belong to Building and Civil Engineering, 1.0% belong to Business Studies and Entrepreneurship, 11.4% belong to Computing and Informatics, 17.6% belong to the Electrical and Electronics Engineering, 15.3% belong to the

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Fashion Design and Cosmetology, 0.3% belong to the Health Science, and 11.4% belong to the Hospitality and Tourism.

Respondents' Professional Experience

As shown in Table 10, all CBET trainers who filled out and completed questionnaires had at least three years of professional experience.

Table 10: CBET Trainers Respondents' Professional Experience

Years	N	%
3-5 years	16	64.0%
Above five years	9	36.0%

Note. This table shows the number of CBET Trainers who filled out and completed questionnaires and their corresponding professional experience. 64% had 3 to 5 years of professional experience, and 36% had above five years of professional experience. This ensured further reliability of the results as these trainers had extensive study knowledge.

Level of Pedagogical Knowledge of the CBET Approach among CBET Trainers

The study's first objective was to determine the level of pedagogical knowledge of the CBET approach among CBET trainers at NNP. To achieve this objective, the researcher determined the average (or the mean) understanding of the meaning of the CBET approach, principles, teaching philosophies, and benefits among the CBET trainers. The researcher also determined the average (or the mean) knowledge of the meaning of OS, CBET curriculum components, characteristics and its development and the components of the quality session plan among the CBET trainers. The researcher further determined the practicality of trainers' in-service and industry training.

As shown in Table 11, the results indicate that, on average, 100% of CBET trainers understood the meaning of the CBET approach. Additionally, they were all aware of the benefits of this approach and completely understood the OS. However, a mean of 84% of trainers grasped the CBET principles, while a mean of 48% understood the teaching philosophies behind CBET. An average of 32% of trainers understood the CBET curriculum components, whereas 64% were familiar with the curriculum's characteristics. Moreover, a mean of 92% of CBET trainers understood the Backward Design Approach to Curriculum Development, and 72% comprehended the elements of a quality session plan. Regarding training experience, a mean of 76% of trainers had practical in-service training, while 48% had participated in industry training.

Table 11: Variables of CBET Trainers' Levels of Pedagogical Knowledge of the CBET Approach

Variables	% Mean
Meaning of the CBET approach	100%
Benefits of this approach	100%
Meaning of the OS	100%
CBET principles	84%
CBET philosophies	48%
CBET curriculum components	32%
CBET curriculum characteristics	64%
Backward Design Approach to Curriculum Development	92%
Elements of Quality Session Plan	72%
Practical in-service training	76%
Industry training	48%
Average	**74%**

Note. This table shows the variables of CBET Trainers' Levels of Pedagogical Knowledge of the CBET Approach and their percentage means. Results show that the average level of pedagogical knowledge of the CBET approach among CBET trainers was 74%. Table 12 shows the possible

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classification of this level of expertise among CBET trainers.

Table 12: CBET Trainers' Levels of Pedagogical Knowledge of the CBET Approach

Levels	% Range
Basic Level	0% - 40%
Intermediate Level	41% - 70%
Advanced Level	71% - 90%
Expert Level	91% - 100%

Note. This table shows the possible classification of the level of pedagogical knowledge of the CBET approach among CBET trainers. Given this classification, a 74% average would fall into the Advanced Level. This indicates that the trainers strongly understand the CBET approach, though there is room for improvement to reach the Expert Level. This presents a gap in the pedagogical knowledge of the CBET approach among CBET trainers.

Instructional Processes CBET Trainers Use in Content Delivery

The study's second objective was to explore the instructional processes employed by CBET trainers in content delivery at NNP. The researcher identified critical aspects regarding the trainers, including their familiarity with Universal Design for Learning (UDL) and their use of active learning and learner engagement strategies. Additionally, the researcher examined various aspects related to CBET trainees, such as their involvement in student-centred learning strategies, the integration of technology in CBET, their understanding of the training scope, participation in practical sessions, and their engagement in Dual TVET Training.

A notable 88% of CBET trainers are familiar with Universal Design for Learning (UDL) and employ visual, auditory, kinaesthetic, and reading techniques to accommodate all trainees, reflecting their commitment to inclusivity in training. Furthermore, an impressive 92% of trainers use active learning and learner engagement strategies, fostering an interactive environment conducive to learning. These strategies encompass mind mapping, case studies, think-pair-share, hot potato, buzz groups, group discussions, question and answer sessions, songs and role play, gallery walks, presentations, ask-it baskets, brainstorming, simulations, muddiest points, and KWL (What I Know, What I Want to Know, and What I Learned), along with exit tickets and practical activities. Time constraints and lack of resources were found to limit trainers' application of active learning strategies. However, trainee engagement in student-centred learning strategies—such as class and group discussions, fieldwork, case studies, research, brainstorming, and class presentations—stands at 74.6%, indicating room for improvement. Additionally, while 51.5% of trainees use projectors, YouTube videos, audio resources, computer simulations, and the school's website or student portals for accessing learning materials, a substantial 87% recognise that the CBET approach is rooted in practical applications, demonstrating a solid understanding of the program's objectives.

Moreover, 76.6% of trainees participate in practical sessions at the institution, whereas participation in dual TVET training is noticeably lower, at approximately 40%. The institution had yet to establish dual training for all the programs, while other programs lacked linkages and MOUs for this dual training. The findings also indicate that CBET trainees participate in traditional attachments, where they undertake industrial training for no longer than four months during their entire training period. This duration is insufficient for trainees to cover all the elements outlined in their operational standards, resulting in underprepared graduates who may struggle to meet employers' requirements. Enhancing the instructional processes CBET trainers use in content delivery requires considerable improvement. Results indicate that CBET trainers' usage of UDL, active learning strategies, learner-centred methods, practical sessions, and dual training averages 68.8%, while traditional training methods account for 31.2%. These statistics

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highlight existing gaps in the instructional approaches employed by CBET trainers.

Assessment Methods CBET Trainers Use to Evaluate the Competence Levels Developed by CBET Trainees

The final objective of the study was to find out the assessment methods employed by CBET trainers to evaluate the competence levels of trainees at NNP. The researcher identified vital elements regarding the trainees' competence assessments, including authentic assessments, dual TVET training evaluations, and various CBET assessment techniques. Additionally, the researcher explored multiple aspects of CBET trainers, such as their familiarity with checklists, rating scales, and rubrics and their application of ICT tools and E-didactics in the CBET framework. To ensure objective assessments in CBET, all TVET institutions must incorporate authentic assessment methods such as industry exposure, natural work environments, or simulations into formative and summative assessments.

The results indicate that 84% of CBET trainers employ authentic assessment methods, such as industry exposure, natural work environments, or simulations, for formative and summative assessments. However, only 28% of CBET trainers assess trainees within the framework of Dual TVET Training. Additionally, 76.6% of CBET trainees reported using written assessment methods, including written assignments, discussion problems, research questions, and project preparations. A substantial 72% of CBET trainers are familiar with tools such as checklists, rating scales, and rubrics. Furthermore, 92% of CBET trainers use platforms like Quizizz, Pallet, E-portfolio, Mentimeter, or Kahoot in their assessments, while only 67.1% of CBET trainees acknowledged using these tools.

On average, the implementation of recommended methods for evaluating trainee competence by CBET trainers stands at 61.1%, contrasted with a 38.9% reliance on traditional written methods. These conventional approaches involve written assignments, discussion problems, research questions, and project preparations, assessing trainees solely once during their four-month industry attachments and employing written CATs and end-of-term exams to gauge competence. Such assessment practices hinder the development of trainees' practical skills, creativity, and proficiency in their respective training areas, resulting in significant gaps in the assessment methods used by CBET trainers to evaluate their trainees' competence levels.

CONCLUSIONS OF THE STUDY

Determining the level of pedagogical knowledge of the CBET approach among CBET trainers reveals a commendable understanding of the CBET approach, with an average pedagogical knowledge score of 74%, categorising them within the Advanced Level. The findings indicate that while trainers are well-informed about the fundamental aspects of the CBET methodology, including its benefits and the Backward Design Approach, there remain notable gaps in their comprehension of the underlying principles and curriculum components. This suggests an opportunity for further professional development to elevate the trainers' expertise to the Expert Level. By addressing these areas of improvement, the overall effectiveness of CBET training can be significantly enhanced, benefiting both trainers and trainees alike.

Exploring the instructional processes CBET trainers use in content delivery presents a mixed yet promising landscape for CBET trainers and trainees. While there is a commendable awareness of Universal Design for Learning and a strong inclination towards active learning strategies, significant challenges persist, particularly concerning the engagement levels of trainees and the adequacy of practical training. The low participation in dual TVET training and the limited duration of industrial attachments contribute to a skills gap that may leave graduates underprepared for the workforce. To enhance the overall effectiveness of the CBET program, targeted interventions are necessary to improve instructional methods, increase resource availability, and strengthen partnerships for dual training opportunities. By addressing these gaps, the program can better fulfil its objectives and equip trainees to meet the demands of employers.

Finding out the assessment methods used by CBET trainers to evaluate the level of competence of CBET

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trainees highlights a significant disparity in the assessment methods used by CBET trainers. While a substantial majority employs authentic assessment techniques that foster practical skills and real-world applications, a notable portion still relies heavily on traditional written assessments. This reliance on conventional methods limits the opportunity for holistic evaluation and hinders trainees' development in crucial areas such as creativity and practical proficiency. To bridge this gap and enhance the quality of training outcomes, it is essential for CBET trainers to integrate innovative assessment tools and approaches further, ensuring a comprehensive evaluation of trainees' competencies that aligns with industry standards and demands. Addressing this imbalance will contribute to more effective training programs and better-prepared trainees in their respective fields.

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