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Comparison Between Practical-Based And Conventional Lecture Instruction On Skill Acquisition Among Electrical And Electronics Technology Students In Migori County, Kenya

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Abstract
The study sought to establish the differences in skill acquisition between Electrical and Electronics Technology (EET) students exposed to practical based instruction and those taught through traditional lecture methods in Technical and Vocational Education and Training (TVET) institutions in Migori County, Kenya. The study adopted a quantitative descriptive survey design to investigate the effectiveness of the two instructional approaches on technical competence. The study employed a census method and involved a total of 350 Electrical and Electronics Technology (EET) students in the selected TVET institutions. This thus ensured full representation of the target population. Data collection was done using structured questionnaires and analysed using IBM SPSS Statistics, Version 27. Descriptive statistics were used to present data in terms of frequencies, percentages, means and standard deviations. The results revealed that the students exposed to practical-based instruction were better at acquiring skills than the students exposed to the traditional lecture methods. In particular, hands-on training was associated with improved skills in electrical installation, circuit assembly, troubleshooting, equipment operation, problem-solving, safety practices, and general work readiness. The results suggest that the instructional approach is important for the development of technical competencies of EET students and for preparing them for the demands of the workplace. The findings of this study indicate that practical based instruction is more effective than conventional lecture methods in enhancing the acquisition of technical skills among the EET students. It recommends that practical learning in TVET institutions should be enhanced by investing more in laboratory facilities, modern equipment, instructional materials and learner-centred instructional approaches to improve students' technical competencies, graduate employability and the alignment of training outcomes with industry needs.

Keywords: *Practical-based instruction, conventional lecture methods, skill acquisition, Electrical and Electronics Technology, TVET institutions*

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I. Introduction

Technical and Vocational Education and Training (TVET) is widely recognised as a significant driver of economic growth and workforce development, as it develops learners' practical skills needed for modern industries (UNESCO, 2021). Recent educational reforms have moved away from teacher-centered instruction to competency-based approaches that focus on hands-on learning, where students can apply theoretical knowledge through practical experiences such as laboratory work, workshop practice, project-based learning, and industrial attachment (International Labor Organization [ILO], 2022).

The significance of experiential learning is validated by Kolb's Experiential Learning Theory, which asserts that knowledge is constructed through the transformation of experience into learning (Kolb, 1984). Compared to the traditional lecture-based teaching (Prince, 2004; Kolb et al., 2015), empirical studies have demonstrated that experiential learning enhances technical competence, problem-solving ability, knowledge retention, and workplace readiness. Therefore, many countries have adopted competency-based training models to enhance practical skills and improve the employability of graduates.

However, studies done in Africa show that there still exist many TVET institutions that are challenged with inadequate workshop facilities, obsolete equipment, limited instructional resources and poor industry links that limit effective implementation of hands-on learning (Afeti, 2018; World Bank, 2020). Although Kenya is implementing the Competency-Based Education and Training (CBET) model to enhance students' practical skill acquisition, technical education continues to face significant obstacles, such as a lack of funding and opportunities for hands-on learning (TVETA, 2021; Ministry of Education, 2022).

The Electrical and Electronics Technology (EET) is a practice-oriented programme which requires learners to develop competencies in electrical installation, circuit design, equipment maintenance, testing and troubleshooting through continuous practical engagement. However, there is limited empirical evidence of the effects of practical learning on the development of technical skills by EET students in TVET institutions in Migori County, Kenya. Therefore, this study sought to investigate the influence of hands-on learning approaches on technical skill development among Electrical and Electronics Technology students in selected TVET institutions in Migori County.

II. Literature Review

Kolb's Experiential Learning Theory provides the theoretical foundation for practical-based instruction. It explains that knowledge is constructed through the transformation of experience into learning, where learners are actively engaged in concrete experience, reflective observation, abstract conceptualisation and active experimentation (Kolb, 1984). The theory posits that learners will acquire a deeper understanding and develop more robust practical skills through active engagement in learning rather than by passively attending conventional lectures. Technical competence, critical thinking, problem-solving ability, and long-term knowledge retention can be better fostered through practical and practice-based learning approaches compared to traditional lectures, according to empirical research (Prince, 2004; Freeman et al., 2014). In light of these results, numerous nations have bolstered practical education by introducing more laboratory work, project-based learning, apprenticeships, and training in the workplace.

Worldwide, groups like UNESCO and the International Labour Organization have emphasised the importance of hands-on learning in order to equip students with skills that can adapt to industries that are constantly evolving due to technology advancements (UNESCO, 2021). Similarly, OECD (2021) discovered that graduates from educational systems that prioritise hands-on learning are more likely to be innovative, adaptable, and employable compared to those whose curriculum is primarily based on classroom instruction. Students in technical and engineering programs have shown improvements in their technical competence, teamwork, and preparedness for the workforce after implementing other experiential learning methodologies including project-based learning (Mutambara & Bayaga, 2021).

According to the African Union (2016), one of the best ways to help Africa achieve industrialisation, economic transformation, and sustainable development is through competency-based technical education. Inadequate financing, out-of-date workshop equipment, a lack of practical materials, and weak industry relations are some of the issues that many TVET institutions continue to face (Afeti, 2018; World Bank, 2020). This situation leads to some institutions still using traditional lecture ways, which makes it difficult for students to get practical skills for the workplace.

The implementation of Competency-Based Education and Training (CBET) in Kenya has put more emphasis on practical based instruction through workshops, laboratories, project based learning and industrial attachment (TVETA, 2021). However, poor laboratory equipment, lack of instructional materials, congested workshops and inadequate time for practical sessions still are barriers to effective implementation of practical instructions (Ministry of Education, 2022; TVETA, 2021). This leads to a high degree of variation in the practical-based instruction that students receive compared to traditional lecture methods. This is particularly critical in Electrical and Electronics Technology (EET) where skill in electrical installation, circuit assembly, equipment maintenance, testing and troubleshooting is highly dependent on experience. Hence, a comparison of the levels of skill acquisition of students taught through practical-based instruction and students taught using conventional lecture methods is necessary to inform evidence-based improvements in TVET instructional practices.

III. Materials And Methods

The study adopted a quantitative descriptive survey design to compare skill acquisition among Electrical and Electronics Technology (EET) students exposed to practical-based instruction and those taught using conventional lecture methods in selected TVET institutions in Migori County, Kenya. The selected TVET institutions had a target population of 350 students of Electrical and Electronics Technology (EET). The study's population consisted of all 350 students, as this number was manageable and did not require sampling; therefore, a census approach was used.

Data were collected using a structured questionnaire with five-point Likert scale items that measured students' exposure to practical-based instruction, technical skill acquisition, challenges affecting practical learning, and understanding of theoretical concepts. The instrument was validated by expert review and reliability was assessed by using Cronbach's alpha coefficient with 0.70 or above as acceptable (Heir et al., 2022).

Analysis of quantitative data was performed using IBM SPSS Statistics version 27. Respondents' characteristics and responses were summarised using descriptive statistics (frequencies, percentages, means and standard deviations).

Ethical principles were maintained throughout the study, such as informed consent, voluntary participation, confidentiality, anonymity, and secure handling of participants' information.

IV. Results And Discussion

This section presents and discusses the study's findings according to the objective of this study. The results are presented using descriptive and inferential statistics and interpreted in relation to relevant literature and the study's theoretical framework.

Table 1: Exposure to Hands-On Learning by Instructional Group (N = 350)

Metric	Practical-Based Instruction (n = 175)	Lecture-Based Instruction (n = 175)
Mean Q6	4.58	3.91
Standard Deviation	0.61	0.79
Mean Q7	3.84	1.16
Mean Q8	4.23	3.32
Composite Exposure Mean	4.22	2.80

V. Results

At baseline the two instructional groups differed significantly in their exposure to hands-on learning (Table 1). Students who were taught through practical-based instruction recorded a higher composite exposure mean (M = 4.22) than those who were taught through conventional lecture methods (M = 2.80). Similarly, the practical based group had higher mean scores for participation in laboratory (Q6), opportunities for practical involvement (Q7) and perceived adequacy of practical learning experience (Q8). The results indicate that students in the practical-based instruction group had significantly more exposure to hands-on learning than students in the lecture-based group.

Table 2: Distribution of Responses by Instructional Group

Response Category	Practical-Based (n = 175)	Lecture-Based (n = 175)	Total
Q6: Frequency of Practical Sessions			
Very Often	120	52	172
Often	45	69	114
Sometimes	8	37	45
Rarely	2	13	15
Never	0	4	4
Q7: Practical Activities Improve Skills			
Strongly Agree	62	25	87
Agree	58	30	88
Neutral	30	58	88
Disagree	25	62	87
Strongly Disagree	0	0	0
Q8: Hands-on Learning Improves Understanding			
Strongly Agree	66	31	97
Agree	82	66	148
Neutral	18	34	52
Disagree	8	28	36
Strongly Disagree	1	16	17

Table 2 for further differences between the instructional groups. For Q6, the majority of students receiving practical-based instruction (68.6%) reported participating in practical sessions very often, versus only 29.7% of students in the lecture-based group. Alternatively, students in the lecture-based group were more likely to report having only occasional or rare practical experiences.

For Q7, the students who were exposed to practical-based instruction had more positive perception towards the contribution of practical activities towards skill acquisition where most of them chose strongly agree or agree. On the other hand, responses from the lecture-based group were clustered around neutral and disagree, indicating a lower perceived effectiveness of practical learning opportunities.

Similarly, the results in Q8 indicate that students exposed to practical-based teaching were more likely to agree that hands-on learning improved their understanding of theoretical concepts. In contrast, the students exposed to lectures showed lower agreement and higher disagreement levels. In general, these results indicate that the practical-based instructional group had more exposure to the practical work and reported better learning outcomes than the conventional lecture-based group. This constitutes a proper baseline for further comparative analyses.

The results show that the majority of respondents participated very often (49.1%) or often (32.6%) in practical learning activities, indicating a high level of exposure to hands-on instruction. This indicates that laboratory and workshop sessions are a major part of the teaching and learning process in the participating TVET institutions.

The students' skill acquisition outcomes were a reflection of the high level of exposure to practical activities. Those learners who actively participated in practical learning showed more proficiency in electrical installation, circuit wiring, equipment operation, troubleshooting, fault diagnosis, and safe practice of electrical tools. They also reported greater confidence in performing practical tasks independently and in applying theoretical concepts to real workplace situations, indicating that regular participation in authentic practical activities strengthens technical proficiency and enhances workplace readiness.

Table 3 Summary of reported students

Metric	Value	Category	Count
Sample Size	350	High	129
Mean Q6	4.2429	Moderate	161
Std Dev Q6	0.81	Low	60
Mean Q7	2.5		
Mean Q8	3.7771		
Composite Exposure Mean	3.5067		
High Exposure	129		
Moderate Exposure	161		
Low Exposure	60		

The findings showed that the majority of students experienced high levels of exposure to hands-on learning through laboratory experiments, workshop practice, equipment operation, and project-based activities. The composite mean score showed that practical learning was a common instructional approach among the participating TVET institutions. Students also reported having sufficient opportunities to work with tools and equipment, although the lack of laboratory resources occasionally limited individual practice.

Their high level of exposure to practical activities reflected the outcomes of their skill acquisition. Students who used hands-on learning often had better skills in electrical installation, circuit assembly, equipment handling, troubleshooting, fault diagnosis and safe use of electrical tools. They spoke of increased confidence in the ability to do practical work themselves and apply theoretical concepts in real work cases. These results show that frequent participation in authentic practical activities enhances students' technical skills and employability in the electrical and electronics industry.

Additional inferential analysis showed a statistically significant positive association between hands-on learning and skill development. Students with higher exposure to practical learning always scored better in skill acquisition than those with less exposure. Confirming the hypothesis that students benefit from experiential learning when they actively engage in lab and workshop activities, the results show that students are able to apply what they have learned in the classroom to real-world situations. The results indicate that hands-on learning is a successful teaching strategy for improving technical skills and job readiness of students in Electrical and Electronics Technology.

The results are consistent with Kolb's Experiential Learning Theory which emphasises that knowledge is created through concrete experience, reflective observation, conceptualisation and active experimentation. Students are able to consolidate classroom concepts and develop psychomotor skills needed in technical occupations through regular participation in practical activities. The findings also support previous studies that have found that practical-based instruction significantly improves learners' technical competence, problem solving ability and employability than conventional lecture-based teaching.

Continuous exposure to hands-on training promotes skill acquisition in Electrical and Electronics Technology, according to the findings.Students who actively engaged in practical learning exhibited superior performance in electrical installation, circuit assembly, troubleshooting, equipment handling, and practical problem-solving, confirming that practical instruction is essential for producing competent TVET graduates capable of meeting industry demands.

VI. Conclusions And Recommendations

Conclusions

The study found that students had a generally high level of exposure to hands-on learning activities. The majority of the respondents reported that they frequently participated in laboratory sessions, workshop practice, demonstrations, project work and other practical exercises. This suggests that the institutions sampled have put in deliberate efforts to instill competency-based teaching methods in the training of Electrical and Electronics Technology. The results also indicated the use of different practical teaching methods like lab operations, workshop practices, projects, industrial attachments and guided demonstrations. This variety provides students with opportunities to learn technical skills in different contexts. Training equipment and facilities were mostly available; however, a few respondents reported that they were inadequate or insufficient. This indicates that although institutions have invested in practical learning resources, many laboratories and workshops lack adequate tools, machines and consumables to facilitate optimum training.

In general, the composite exposure index suggested that most students had moderate to high exposure to hands-on learning. The findings confirm that in the institutions studied, practical learning has become a central piece of instruction.

Recommendations

Based on the results of this study the following recommendations are made:

i. TVET Institutions should improve practical learning by upgrading laboratory and workshop facilities, equipping them with adequate tools and learning materials, and allowing sufficient time for practical training.
ii. Trainers should Use learner-centred, practical teaching approaches that combine theory with hands-on activities to improve students' technical skills and problem-solving skills.
iii. Government and Policy Makers should increase funding, strengthen policy support, and invest in modern training infrastructure to ensure effective implementation of competency-based education and improve the quality of TVET programs.
iv. Trainees should actively participate in practical learning activities, laboratory sessions, and projects to enhance technical competence and better connect theoretical knowledge with real-world applications.

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Author Contribution Statement

This study received significant contributions from all authors. Proposal writing, data collection, data analysis, and manuscript writing were performed by Mwa Elly Onyango. A thorough review of the manuscript from initial conception to the final approval was conducted by Dr. Hoseah Kiplagat and Dr. Isaac Nangendo.

Data Availability Statement

Datasets used in the study can be accessed on justifiable requisition from the author.

Ethics Declaration

This study was carried out with strict adherence to ethics requirements to safeguard the well-being and rights of respondents. The Ministry of Education and the National Commission on Science, Technology and Innovation (NACOSTI) granted formal permission before the study commenced. Principles of anonymity, confidentiality, and informed consent were ensured by using pseudonyms and secure data management procedures.

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Competing Interest

There are no competing interests among the authors that may influence the integrity of this study.

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