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Technology as a Determinant of Quality Assurance Implementation and Instructional Management in Technical and Vocational Education and Training Institutions in North Rift Region, Kenya

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Abstract: Effective quality assurance frameworks, such as ISO standards and national accreditation systems, promote accountability, align training outcomes with industry expectations, and foster trust in the qualifications awarded by TVET institutions. Technology does not merely complement instructional management but acts as a transformative driver of quality assurance, ensuring that TVET institutions produce graduates with competencies aligned to the rapidly changing industrial environment. Despite these aspirations, instructional management within many TVET institutions in Kenya remains traditional, with limited adoption of digital systems for monitoring teaching effectiveness, curriculum delivery, and learner assessment. Thus, the purpose of the study was to assess the effect of technology as a determinant of quality assurance implementation on instructional management in TVET institutions in North Rift Region, Kenya. The study employed mixed method research design ingrained with positivist and interpretivist philosophy. The target population comprised of 470 trainers of mechanical engineering departments, electrical engineering departments, building departments, management representatives from ISO 9001: 2015 accredited TVET institutions in the North-Rift region. Multistage sampling technique was used to select the respondents. Krejcie and Morgan (1970) table was used to calculate the sample size of 214 respondents which was proportionally allocated to the TVET institutions using Neyman Allocation formula. The primary data was collected using closed-ended questionnaires and semi-structured interview schedule. Data was analyzed using inferential statistics simple linear Regression analysis using SPSS version 25. From the findings coefficient of determination (R square) of 0.543 indicated that the model explained only 54.3 % of the variation or change in instructional management of TVET institutions. Technology ($t = 14.249$, $P < .05$). The study findings indicate technology significantly affects instructional management of TVET institutions in North Rift Region, Kenya. It therefore implies that as much as TVET through technology streamlines the process of accessing scholarly support, saving trainers and trainees time and effort in locating relevant resources or seeking assistance from educators it must embrace the principles of quality assurance. This is because quality assurance in the use of technological applications in engineering lectures ensures that the tools in use are pedagogically sound.

Keywords: Technology, quality assurance, instructional management

I. INTRODUCTION

Instructional management in Technical and Vocational Education and Training (TVET) institutions has emerged as a global issue that requires urgent attention because it directly influences the quality and relevance of skills imparted to learners for industrial growth. However, lapses in instructional have led to inefficiencies in skills delivery (Okolie et al., 2021; UNESCO-UNEVOC, 2023). These shortcomings contribute significantly to the persistent mismatch between the skills provided in TVET institutions and the dynamic requirements of labor markets, where industries demand practical competencies that are often absent in graduates . The result is a workforce that is underprepared for technological advancements and industrial innovation, undermining national development goals. In this context, quality assurance becomes fundamental as the cure because it ensures systematic planning, standardization, and continuous improvement in instructional delivery.

Effective quality assurance frameworks, such as ISO standards and national accreditation systems, promote accountability, align training outcomes with industry expectations, and foster trust in the qualifications awarded by TVET

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institutions (Mwangi & Kihara, 2022). As a concept, instructional management entails the systematic planning, organization, supervision, and evaluation of teaching and learning processes to ensure that training outcomes are aligned with labor market demands and industrial expectations (Chatvattana, 2021). However, many TVET institutions remain rooted in traditional practices, with outdated curricula, limited digital integration, and weak quality assurance mechanisms, which constrain their ability to prepare graduates for Industry 4.0 and the green transition (Wickramasinghe & Wickramasinghe, 2024). Implementation of international standards such as ISO 9001 and ISO 21001 has been identified as a critical driver of instructional management, as these frameworks institutionalize quality management principles, standardize teaching processes, and embed continuous improvement practices into educational delivery (Umam & Rahman, 2024).

Technology has become a central determinant of robust quality assurance (QA) implementation in Technical and Vocational Education and Training (TVET) because it enhances efficiency, transparency, and alignment between training and industry needs. At the same time, technology has become a decisive determinant of quality assurance implementation, where tools such as learning management systems, e-assessment platforms, and digital monitoring systems enable real-time feedback, performance tracking, and data-driven instructional decisions . Thus, technology does not merely complement instructional management but acts as a transformative driver of quality assurance, ensuring that TVET institutions produce graduates with competencies aligned to the rapidly changing industrial environment (Mwangi & Kihara, 2022). Nevertheless, significant research gaps persist, particularly in evaluating how the integration of ISO standards and digital quality assurance systems jointly transform instructional management in low-resource TVET contexts. Addressing these gaps is critical for strengthening instructional management globally and ensuring that TVET institutions contribute effectively to sustainable economic development.

Technical and Vocational Education Training (TVET) has been identified as a type of education that contributes to the development of a workforce that is skilled and can embrace the ideas of sustainability. Thus, effective instructional management supported by technology-driven quality assurance mechanisms is therefore essential in ensuring that TVET institutions deliver training that matches industry requirements (Ministry of Education, 2022). Similarly, Kenya's Vision 2030 and the Bottom-Up Economic Transformation Agenda (BETA) highlight the central role of Technical and Vocational Education and Training (TVET) institutions in equipping youth with technical and industrial skills necessary for economic growth (Government of Kenya, 2007; Republic of Kenya, 2022).

Despite these aspirations, instructional management within many TVET institutions in Kenyaremains traditional, with limited adoption of digital systems for monitoring teaching effectiveness, curriculum delivery, and learner assessment. Nyerere (2009) posits that TVET institutions continue to face quality related challenges despite most of them being certified under ISO standards. In this regard, Kenya has a large number of TVET institutions, but unable to make significant progress in acquisition of technical skills (Chepkemei, Watindi, Cherono, Ng'isirei & Rono, 2012). Nevertheless, significant research gaps persist, particularly in evaluating how the integration of ISO standards and Technology jointly transform instructional management in low-resource TVET contexts as North Rift Region. Hence, the study assessed the effect of technology on instructional management in TVET institutions in North Rift Region, Kenya. Thus the hypothesis of the study was.

H_{01} *Technology does not have a statistically significant effect on instructional management in TVET institutions in North Rift Region, Kenya*

II. LITERATURE REVIEW

Technology and instructional management

Durak and Saritepeci (2017) investigated the effect of technology use in education on classroom management within the scope of the FATİH project. The application was conducted in schools, which actually used interactive board, tablet computer and software technologies within the framework of the FATİH Project. According to the results obtained in the study, the average scores of intra-classroom relationship and behavior management sub-scale proportional to item count were higher compared to other sub-scales. The effect level of technology use by trainers in the classroom on classroom management was moderate. No statistically significant difference was found in terms of effect levels of technology use by trainers in the classroom on classroom management, except for the variable of daily internet use. However, the study was not conducted in TVET institutions.

Sabanci, Ozyildirim and Imsir (2014) explored English language trainers' views and experience about the effect of the ICT on the classroom management in secondary schools of Serik. This study adopted a case study, which is a qualitative research design. The data were gathered by using two techniques: interviews and classroom observations. Content analysis technique was used to analyses the data. The findings show that ICT use eases classroom management, helps

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saving time, provides more opportunities for more activities, limits non-disciplinary behaviors of the trainees and encourages leadership role of the teacher. However, the study was not conducted in secondary schools and focused on languages but not technical subjects providing a gap for the current study.

Falode (2018) investigated pre-service trainers' perceived ease of use, perceived usefulness, attitude and intentions towards the utilization of virtual laboratory package in teaching and learning of Nigerian secondary school physics concepts. Findings revealed that pre-service physics trainers perceived the virtual laboratory package easy to use and useful with mean scores of 3.18 and 3.34 respectively. In addition, respondents' attitude and intentions to use the package in teaching and learning of physics were positive with mean scores of 3.21 and 3.37 respectively. However, the study did bring out how technology affects instructional management.

Mohammed and Abuldughani (2017) investigated the possible relationship between trainees' use of technology and their achievements in physiology courses at five health colleges of the University of Dammam. The study was conducted on 231 trainees studying physiology during their 2nd year at one of five health colleges. This study observed a significant relationship between trainees' use of technology and their achievements in health colleges. The study also demonstrated that the most-used devices are laptops (50%) and phones (42%) followed by tablets (7%) and desktop computers (0.5%). Technology usage might produce comparatively more significant increases in academic achievement than would non-usage. However, the study focused on trainee and not the trainer using technology. Besides the study was conducted in a non-Kenyan context.

Loring (2019) investigate the impact of instructional technology on lesson effectiveness and obstacles to incorporating instructional technology into lesson design as perceived by elementary school trainers. A qualitative ethnographic method was used in this study. Triangulation was accomplished through the collection and analysis of direct interviews, and artifacts shared by educators and strengthened by information-rich data provided in direct observations. Major finding of the study showed high student engagement with the use of technology, and unavailability of the internet/Chromebooks as a big obstacle to technology integration. However, the study was conducted in anon-Kenyan context besides the study did not focus on instructional management as its outcome.

James (2017) studied the effects of technology on student motivation and engagement in classroom-based learning. The research was completed at an urban charter school on a population of 348 at the time of technology intervention through data analysis. The results showed that student's feel motivated through the specific use of technology in the classroom, whether it be for pedagogical purposes or for accommodations as required by an Individual Education Plan (IEP) or 504 plan. However, the study was not conducted in TVET institution with respect to quality management.

Verasia (2015) evaluated the strategies used in implementing the use of ICT in teaching and learning in public secondary schools in Mbeere South Sub-County, Embu County. The study examined the learner related, teacher-related and school-related strategies used in implementing the use of ICT in teaching and learning in selected public secondary schools. The study employed descriptive survey research design with a target population of 53 public secondary schools, 756 trainers and 2860 form two trainees in the public secondary schools in Mbeere South Sub County. The study obtained quantitative data, which was analyzed by use of descriptive statistics. The findings of the study showed that although the government established ICT policy and other initiatives such as Economic Stimulus Package (ESP) to enhance the use of ICT, secondary schools in Mbeere South Sub County have not adequately implemented ICT in teaching and learning. Further findings were that trainers lacked the necessary skills for the ICT uptake. However, the study did not show the effect of technology on instructional management.

Bottino (2020) proposed that ICT tools could influence and transform learning by fundamentally changing the way in which content can be taught and learnt. Numerous studies have shown that a small number of trainers is willing to integrate educational technology in their teaching activities (Stosic & Stosic, 2013; Hermans, Tondeur, van Braak, & Valcke, 2008). However, Durak and Saritepeci (2017) in their study recommended the need for investigating effects of technology integration in teaching-learning processes on classroom management at different levels of education in future studies to greatly contribute to the literature.

III. METHODOLOGY

The study adopted an explanatory research design. Within this design, a researcher analyzes the relevant quantitative results and then interprets the relationships between the study variables to explain the underlying causal links (Zoellner & Harris, 2017).

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The target population comprised of 470 trainers of mechanical engineering departments, electrical engineering departments, building departments, management representative of TVET institutions in North rift region, which have implemented QMS processes in the North-Rift region. A sample size of 214 was drawn from a total population of 470 trainers to represent the whole population using Krejcie and Morgan table 1970. A questionnaire was used to collect the primary data. The Quantitative data was analyzed by use of inferential statistics. This study used simple linear regression analysis. The beta (β) coefficients for the independent variable was generated from the model the regression model used, is given in equation (1):

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$……..……..…….(1)

Where, y represents instructional management

β_0 = Constant (Value. of change in y when x = 0)

β_1 represents the regression coefficients describing the degree of change in independent variable by one unit change of dependent variable.

X_1 represents technology

ε represents Error term (the residual error, which is an unmeasured variable)

All the above statistical tests were analyzed using the Statistical Package for Social Sciences (SPSS), version 25.

IV. RESULTS AND DISCUSSION

Effect of Technology as a determinant of quality assurance implementation on instructional management in TVET institutions

The simple linear regression analysis results were presented in Table 1

Table 1 Effect of Technology as a determinant of quality assurance implementation on instructional management in TVET institutions

	Standardized Coefficients		**Standardized Coefficients**		
	B	**Error**	**Beta**	**T**	**Sig.**
(Constant)	1.555	.169		9.175	.000
Technology	.606	.043	.737	14.249	.000
Model Summary statistics					
R	0.737[a]				
R Square	0.543				
Adjusted R Square	0.540				
Std. Error of the Estimate	.324				
R Square Change	.543				
Good of fit statistics					
F Change	203.021				
df1	1				
df2	171				
Sig. F Change	.000[b]				

a Dependent Variable: Instructional management of TVET institutions

Source: Research Data (2024)

Table 1 results show that technology explained 54.3% percent variation of instructional management of TVET institutions. This showed that considering the independent variable, there is a probability of predicting instructional management of TVET institutions by 54.3% (R squared =0.543). Finally, the study findings in Table 1 indicate that the coefficient of determination was significant as evidenced by F statistic of 203.021with p value 0.000 < 0.05 (level of significance). Thus, the model was fit to predict instructional management of TVET institutions in north rift region using technology. Therefore, the study confirms that technology as a determinant of quality assurance implementation significantly affect instructional management in TVET institutions.

H_{01} *Technology does not have a statistically significant effect on instructional management in TVET institutions in North Rift Region, Kenya*

The hypothesis of the study stated that technology does not have a statistically significant effect on instructional management in TVET institutions in North Rift Region, Kenya. However, findings in Table 1 show that risk taking had coefficients of estimate which were significant basing on $\beta_1 = 0.606$ (t = 14.249; p-value = 0.000 which is less than α =

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0.05). Thus, null hypothesis was rejected and the study concludes that technology has a statistically significant effect on instructional management in TVET institutions in North Rift Region, Kenya. This suggests that there is up to 0.606 unit increase in instructional management in TVET institutions for each unit increase in technology. Therefore, with technology, instructional management in TVET institutions can be effectively boosted. These findings are supported by Loring (2019), Durak and Saritepeci (2017) and Sabanci, Ozyildirim and Imsir (2014) who also found that high student engagement with the use of technology thus highly affecting instructional management. These findings are in line with the Cognitive Learning Theory. In cognitive psychology, learning is understood as the acquisition of knowledge: the learner is an information-processor who absorbs information, undertakes cognitive operations on it, and stocks it in memory (Huang, Spector & Yang, 2019). This implies that embracing technology by the trainer in teaching engineering courses has the capacity in entrenching quality in instructional management besides enhancing their own skills and knowledge as an educator. This is justified by the fact that exploring new technologies infuses confidence in the use of innovative teaching methods which is the aspiration of quality assurance in TVET. It therefore implies that as much as TVET through technology streamlines the process of accessing scholarly support, saving trainers and trainees time and effort in locating relevant resources or seeking assistance from educators it must embrace the principles of quality assurance. This is because quality assurance in the use of technological applications in engineering lectures ensures that the tools in use are pedagogically sound. The technology in use should be potent in helping the trainees and trainers in effectively confronting real-world engineering challenges.

V. CONCLUSION

Courtesy of the pragmatic verification of the alternative hypothesis, study concludes that technology has a statistically significant effect on instructional management in TVET institutions in North Rift Region, Kenya. This implies that embracing technology by the trainer in teaching engineering courses has the capacity in entrenching quality in instructional management besides enhancing their own skills and knowledge as an educator. This is justified by the fact that exploring new technologies infuses confidence in the use of innovative teaching methods which is the aspiration of quality assurance in TVET. The findings indicate that trainers in Technical and Vocational Education and Training (TVET) institutions hold a strong positive perception towards the use of technology in instructional management and quality assurance. Trainers perceive technology as not only simplifying scholarly collaborations but also making training processes more interactive and engaging. The belief that virtual laboratories and engineering technology packages would be easy to use reflects an openness to integrating Industry 4.0 tools into pedagogy. Furthermore, trainers acknowledge that technology adoption would improve their performance and enhance effectiveness in delivering engineering courses. This perception underscores the critical role of digital solutions in aligning TVET institutions with global standards and ensuring competency-based education outcomes.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made to enhance the integration of technology in instructional management and quality assurance in TVET institutions:

i. TVET Institutions should prioritize investment in digital infrastructure such as virtual laboratories and engineering software to support competency-based training. Institutions are further encouraged to strengthen their quality assurance systems by embedding technology-driven frameworks and to provide continuous professional development opportunities that build trainers' digital competencies.

ii. Trainers should embrace the use of educational technologies to improve instructional delivery and learner engagement. They are encouraged to exploit digital platforms for collaboration, knowledge sharing, and benchmarking of instructional practices. Trainers should also take responsibility for their own digital upskilling by engaging in online learning opportunities and certifications that expand their capacity to integrate emerging technologies into teaching.

Collectively, these recommendations aim to position TVET institutions in the North Rift region as centers of excellence in technology-driven training, ensuring effective instructional management, enhanced trainer performance, and alignment with global standards of quality assurance.

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