EVALUATING THE EFFICACY OF INSTITUTIONAL WORKSHOPS ON EDUCATIONAL TECHNOLOGY INTEGRATION IN A SOUTH AFRICAN HIGHER EDUCATION INSTITUTION

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Abstract
Rapid technological progress calls for continuous professional development in digital literacy for academic staff to accommodate the transformative integration of educational technology within education. This research assesses the effects of faculty participation in such workshops and its subsequent practical application in educational contexts. Utilising purposive sampling, twenty-one academic members who consistently attended educational technology workshops during 2021-2023 completed a closed-response online questionnaire using Microsoft Forms. The study incorporates the Kirkpatrick's Evaluation Model's (KEM) and the Technological Pedagogical Content Knowledge (TPACK) framework to provide rigour in its evaluation of training efficacy. Our findings reveal substantial barriers to sustained technology integration, namely limited post-workshop support, insufficient time for practical application, unreliable infrastructure, and varying levels of digital literacy among academic staff. This data highlights the need for strategic enhancements in workshop structure and presentation to better cultivate substantial technological integration within teaching practices.
Keywords: Educational technology integration, Higher education, Technology adoption, Technology-enhanced learning, Kirkpatrick model, TPACK framework.
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1. INTRODUCTION

Global technological advancements, fuelled by artificial intelligence (AI), have profoundly affected organisations and personal lives landscape (Benbrahmi & Mehor, 2025; Rashid & Kausik, 2024). AI has also been a transformative force in education, reshaping teaching methods as institutions integrate educational technology into their teaching approaches (Hughes et al., 2025; Ngcobo & Msomi, 2025). In

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adapting these new digital technologies, educational organisations aim to enhance student engagement, improve learning efficacy, and expand educational access (Selwyn, 2020). This incorporation of technology into academic practices has supported the development of personalised and flexible learning environments, adequately preparing students for the requirements of digital fluency in the modern world (Kirkwood & Price, 2014).

As a result, many educational institutions provide digital literacy training in the form of workshops to equip their faculty members with the new teaching skills (Vyortkina & Elsawy, 2024). These workshops form part of professional development that should be ongoing to keep up with the rapidly changing technology (Ma et al., 2025; Sims & Fletcher-Wood, 2021). The role of these workshops is to close the gap between inadequate teacher training and fast-paced developments in technology. The effectiveness of these workshops in improving teaching skills, expanding knowledge, shifting attitudes, and building capabilities that support student learning outcomes necessitates a thorough evaluation (Ahadi et al., 2021)

During this transmission, digital platforms, such as e-learning systems, have shown potential in supporting active teaching and improving knowledge retention among academic staff (Liu & Yu, 2023). Nevertheless, the successful integration of such technologies demands more than simply providing access to digital tools. This is due to several factors that can impede effective technology integration. These may include limited technological expertise, resistance to change, and insufficient sustained support (Mercader & Gairin, 2020). It therefore becomes necessary to provide a supportive environment and comprehensive professional development for academic staff. Institutional workshops on educational technology are a common approach to preparing academic staff for technology integration. Research, however, suggests a lack of lasting impact on teaching practices resulting from these workshops. This failure frequently results from persistent obstacles, such as insufficient ongoing support and inadequate technological proficiency among personnel (Hennessy et al., 2022).

Mercader and Gairin (2020) and Kaushik and Agrawal (2021) identify academic staff's perceptions, attitudes, and readiness as significant barriers to effective technology adoption. Antwi-Boampong (2020) notes that even with training, many staff struggle to embed technology into their instructional design. Hennessy et al. (2022) emphasize that a lack of continuous support limits the impact of workshops, while Hu et al. (2021) underscore the importance of understanding factors influencing information and communication technology application in professional development to create effective training programs. Akram et al. (2021) further highlights a gap in technological knowledge among academic staff, despite their proficiency in content knowledge, suggesting a need for professional development focused on technology integration skills.

This study focuses on evaluating the effectiveness of educational technology workshops at a South African higher education institution, using Kirkpatrick's Evaluation Model (KEM) (Kirkpatrick & Kirkpatrick, 2008)

and the Technological Pedagogical Content Knowledge (TPACK) theory. The study addresses the following research questions: (1) How do academic staff perceive the effectiveness of institutional workshops in enhancing their knowledge and skills in educational technology integration? (2) What persistent barriers do academic staff face when applying knowledge gained from workshops to their teaching practices? (3) To what extent does the structure, content, and facilitation of institutional workshops align with the principles of the KEM and TPACK framework to support sustainable technology integration?

The study hypothesizes that revising institutional workshops based on KEM and the TPACK framework will reduce barriers and enhance academic staff's abilities to integrate educational technology effectively, thereby improving student engagement and instructional outcomes. By examining academic staff's perceptions, persistent barriers, and the alignment of workshop design with these frameworks, the study aims to provide actionable insights for enhancing professional development programs.

2. LITERATURE REVIEW

The integration of educational technology in higher education has transformed learning and teaching, yet its effective adoption remains challenging, particularly in resource-constrained settings of developing nations, like South African universities. Existing scholarship on workshop evaluation is limited to developed nations, ignoring the unique infrastructural and implementation difficulties that characterize e-learning adoption in low- and middle-income countries (LMICs) (Barteit et al., 2020). Assessing the contribution of professional development workshops to the advancement of technology integration is crucial in our current global era of artificial intelligence. Innovative pedagogical approaches are enabled by educational technology; however, the implementation of such technology is challenged by educator attitudes, preparedness, and institutional limitations (Tondeur et al., 2020). Professional development workshops on educational technology are critical for equipping academic staff with the skills to integrate technology effectively. However, studies highlight persistent gaps between workshop participation and practical application in teaching environments (Ghavifekr & Rosdy, 2020). Key obstacles include insufficient follow-up support, time constraints, and resistance to change, which limit sustained technology adoption (Alenezi, 2021).

In South African higher education, contextual challenges such as unreliable infrastructure and varying student digital literacy exacerbate integration difficulties (Czerniewicz & Brown, 2020). Workshops often fail to address these localized needs, resulting in limited practical application (Ng'ambi et al., 2020). Furthermore, the lack of post-workshop mentoring and inadequate time for practice undermines long-term

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technology adoption (Maphalala & Mpofu, 2021). This study builds on these insights by combining Kirkpatrick's Evaluation Model (KEM) (Kirkpatrick & Kirkpatrick, 2008) and the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) to evaluate educational technology workshops at a South African higher education institution. Through the identification of obstacles, such as inadequate support and contextual incongruence, the study seeks to guide strategic enhancements in workshop design to cultivate significant technology integration.

3. THEORETICAL FRAMEWORK

A notable gap exists in educational research concerning the use of structured evaluation models and pedagogical frameworks to assess and enhance workshop effectiveness in integrating technology sustainably. Structured evaluation models and frameworks, such as Kirkpatrick's Evaluation Model (KEM) (Kirkpatrick & Kirkpatrick, 2008) and the Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006) framework, offer potential solutions for assessing and improving these professional development initiatives. The study adopts a two-pronged approach by adopting both KEM and TPACK as theoretical lenses through which to evaluate educational workshops. By combining KEM and TPACK, this study provides a comprehensive framework to evaluate workshop design and delivery. Kirkpatrick's model assesses training effectiveness, while TPACK ensures alignment with educators' technological, pedagogical, and content needs. Together, they address both the process and content of professional development, offering insights into overcoming barriers to technology integration in a resource-constrained setting.

The Kirkpatrick's (1959) KEM model enduring popularity stems from its usefulness and adaptability to various training environments and high performance in evaluating training (Alsalamah, & Callinan, 2022; Hagene, 2025). KEM offers a structured approach to assess training programs across four levels: (1) Reaction, which measures participants' satisfaction with the workshop; (2) Learning, which evaluates knowledge and skills gained; (3) Behaviour, which examines the application of learned skills in teaching practices; and (4) Results, which assesses institutional outcomes, such as improved teaching quality. This model is particularly relevant for identifying gaps between workshop participation and practical application, as it emphasizes behavioural change and organizational impact (Bates & Sangrà, 2020). In the context of this study, KEM guides the evaluation of how workshops influence academic staff's ability to integrate technology effectively, highlighting barriers like insufficient follow-up support.The TPACK framework complements KEM by focusing on the interplay of technological, pedagogical, and content knowledge. Research indicates that TPACK-aligned workshops enhance educators' ability to design technology-enhanced lessons, but their success depends on contextual relevance and ongoing support (Chai et al.,

2021). In this study, TPACK informs the analysis of how workshops equip academic staff to address contextual challenges, such as unreliable infrastructure and varying student digital literacy, ensuring technology-enhanced teaching is meaningful.

4. METHODOLOGY

A structured survey was developed using Microsoft forms and distributed electronically to academic staff at South African higher education institution. The survey included demographic questions and Likert-scale questions that evaluated participants' perceptions of educational technology workshops' content, facilitation, structure, and alignment with institutional goals from 2021 to 2023.

The study employed a purposive sampling technique to select participants. Researchers targeted academic staff members who attended educational technology workshops from 2021–2023 as provided by a support unit referred to as LTDC in this study. This method ensured the sample comprised individuals with relevant first-hand experience. An online survey was distributed to thirty participants who had consistently attended training workshops. Nevertheless, the study achieved a response rate of 21 participants.

Ethical approval for the study was secured through the institutional review board. Participation was voluntary, with informed consent secured from each respondent. To maintain confidentiality and anonymity, the study design ensured that no identifying information was gathered or disclosed.

The statistical analysis of the data was conducted using the Statistical Package for the Social Sciences (SPSS) version 2018. A principal component factor analysis was used to identify the factors in the study guided by the principles of the TPACK framework. Means were used to identify the factors that were more perceived as challenges participants encountered in the educational technology situation. The reliability of the scales was determined using Cronbach Alpha. The researchers also examined the mean, standard deviation, and Cronbach Alpha for each item. Furthermore, the researchers performed a multiple regression analysis to ascertain the predictive capacity of the TPACK framework and generic issues regarding the intention of academic staff to attend. Percentages and frequency counts were used to analyse the demographic information of the participants. This robust methodology facilitates a comprehensive assessment of the educational technology workshops, yielding practical insights to inform the enhancement of future professional development programs.

5. FINDINGS AND DISCUSSION

5.1 Biographical data

This sub-section presents a narrative of the demographic characteristics of 21 academic staff members who participated in a study. A nearly equal gender distribution was observed, with a slight female majority (52.4%) compared to males (47.6%), suggesting equitable representation. The majority of respondents (52.4%) were aged 35–44, indicating a predominantly middle-aged sample. A notable proportion of the population fell within the 25–34 and 45–54 age brackets (19.0% each), compared to a mere 9.5% in the 55+ category. The sample exhibited a strong academic profile; 61.9% possess a Master's degree, 28.6% a doctoral degree, and 9.5% an Honours Bachelor's degree.

A significant portion (33.3%) of the teaching staff possesses 5–10 years of experience. Substantial groups also include those with less than 5 years (28.6%), 11–15 years (14.3%), and 16–20 years (14.3%), while a smaller proportion (9.5%) has more than 20 years' experience. This distribution indicates a concentration in the early to mid-career stages. The faculty affiliations indicate that Applied and Health Sciences are most prevalent (38.1%). This is followed by Management Sciences (33.3%) and Engineering (28.6%). Despite a slight bias favouring Applied and Health Sciences (the data collector's faculty), the resulting sample demonstrated a relatively even distribution. The study's sample size (n=21) may restrict the generalizability of the results to the broader university staff. However, the sample's diversity in age, qualifications, teaching experience, and faculty affiliation provides a reasonably representative overview of academic staff within the confines of this institution.

5.2 Crosstabulation of experience with use of technology and gender

The findings displayed in Table 1 have important implications for training program development, institutional policy, and future research. The data on training and support shows consistent and frequent technology usage across both male and female participants. This suggests the high relevance and utility of advanced technological training, particularly in AI tools and learning management systems.

TABLE 1. CROSSTABULATION OF AGE AND GENDER SHOWING PERCENTAGES WITHIN EACH GENDER

Crosstabulation of experience with use of technology and gender			
Items	Gender		
	Male	Female	Total
Rarely	0 (0,0%)	1(9,1%)	1(4,8%)
Occasionally	2 (20,0%)	1(9,1%)	3 (14,3%)
Frequently	2 (20,0%)	4 (36,4%)	6 (28,6%)
Always	6 (60,0%)	5 (45,5%)	11(52,4%)
Total	10 (100,0%)	11(100,0%)	21(100,0%)

Source: Authors' research

However, the existence of a small but significant cohort of rare, primarily female users underscores the necessity of maintaining optional baseline technological support. This dual approach caters to both

advanced and less experienced users. Advanced users can hone their skills, while those with limited digital literacy, including some female participants, can access basic resources on a voluntary basis.

A noteworthy gender imbalance emerged in the self-reported "always" technology usage category (males: 60%; females: 45.5%). This demands a careful consideration in policymaking for both academic and professional settings. The observed gap could be attributed to a number of contributing factors. These could include variations in role assignments and responsibilities, uneven access to technological resources, and diverse levels of comfort with technology integration (Chugh et al., 2023). Institutional examination of resource allocation, training provision, and workplace culture is warranted in light of the findings, which suggest a potential contribution to the disparity (Christopoulos & Sprangers, 2021). Additional research is necessary to ascertain whether these patterns genuinely reflect discrepancies in technology engagement or indicate underlying barriers hindering equitable technological integration across genders.

5.3 Crosstabulation of experience with use of technology and qualifications

Table 2 reveals several important implications regarding technology use across different academic qualifications. First, the high adoption of technology is evident across all groups, with most participants, whether PhD holders, Master's graduates, or Bachelor's Honours recipients reporting that they "frequently" or "always" use technology. This suggests a strong integration of technology into their professional or academic activities, likely reflecting broader trends in digital reliance across higher education and research fields (Makda, 2025; Yusuf et al., 2024).

TABLE 2. CROSSTABULATION OF EXPERIENCE WITH USE OF TECHNOLOGY AND QUALIFICATIONS SHOWING PERCENTAGES WITHIN EACH QUALIFICATION

Crosstabulation of experience with use of technology and qualification				
Items	Qualification			
	PhD	Master's Degree	Bachelor Honours Degree	Total
Rarely	0 (0,0%)	1 (7,7%)	0 (0,0%)	1 (4,8%)
Occasionally	1 (16,7%)	2 (15,4%)	0 (0,0%)	3 (14,3%)
Frequently	2 (33,3%)	3 (23,1%)	1 (50,0%)	6 (28,6%)
Always	3 (50,0%)	7 (53,8%)	1 (50,0%)	11 (52,4%)
Total	6 (100,0%)	13 (100,0%)	2 (100,0%)	21 (100,0%)

Source: Authors' research

The parallel technology usage patterns among PhD and Master's participants are noteworthy. A statistically insignificant difference in technology use was observed between PhD holders (33.3%) and Master's participants (23.1%). This could reflect a greater intensity of technological engagement among PhD researchers, perhaps due to the demands of their research and teaching duties.

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The exception to this pattern is one Master's participant who indicated infrequent technology use. Although this scenario might represent a limited instance where technology's influence is negligible, possibly within specific theoretical fields or pedagogical approaches, it constitutes an anomaly within a predominantly tech-savvy sample. These results highlight the necessity of proactive institutional responsiveness to individual needs, notwithstanding minimal technological resistance. Hence, provision of supplemental training and diverse approaches is recommended.

5.4 Crosstabulation of type of training most beneficial and gender

Several important implications for training program design and execution are derived from the crosstabulation analysis shown in Table 3. A key finding is the strong, gender-neutral preference for interactive and AI-based tools, demonstrated by 40.0% of male and 45.5% of female respondents. The alignment in prioritization demonstrates that cutting-edge, technology-driven training resonates similarly with both genders. This reflects the overall trend of digital transformation in education and professional development. The growing interest in these innovative tools presents a significant opportunity for educational institutions to develop inclusive training programs that address the increasing demand for AI and interactive learning solutions.

TABLE 3. CROSSTABULATION OF TYPE OF TRAINING MOST BENEFICIAL AND GENDER SHOWING PERCENTAGES WITHIN EACH GENDER

Crosstabulation of type of training most beneficial and gender			
Items	Gender		Total
	Male	Female	
Basic digital literacy	0 (0,0%)	1 (9,1%)	1 (4,8%)
Advanced Learning Management Systems training	3 (30,0%)	2 (18,2%)	5 (23,8%)
Interactive and AI-based tools	4 (40,0%)	5 (45,5%)	9 (42,9%)
Pedagogical strategies for technology integration	3 (30,0%)	3 (27,3%)	6 (28,6%)
Total	10 (100,0%)	11 (100,0%)	21 (100,0%)

Source: Authors' research

Importantly, the analysis further discloses meaningful distinctions based on gender, thus requiring careful consideration in the training's development. A significant observation is the complete lack of male participants (0.0%) choosing basic digital literacy training, in contrast to the modest yet noteworthy female participation (9.1%). This disparity could reflect variations in baseline technological proficiency or comfort, implying that supplemental digital literacy training may prove beneficial for certain female students. In addition, the data reveal a notable difference in the preference for advanced LMS training between male (30.0%) and female (18.2%) participants. This disparity could stem from variations in occupational roles, technological comfort levels, or prioritized learning outcomes. A nuanced strategy that accommodates gender-specific training requirements, while maintaining a core focus on universally applicable content is necessitated by these variations.

These findings indicate that training program architects should strategically balance broad accessibility with focused support. The significant combined preference (71.5%) for interactive/AI tools (42.9%) and pedagogical technology integration strategies (28.6%). This strongly suggests that the majority of resource allocation and development should focus on these areas. Comprehensive training initiatives should be cantered on these areas of high demand. Conversely, the insignificant interest in basic digital literacy skills (4.8% overall) implies a selective delivery approach is warranted. It is recommended to offer optional modules or targeted programs, with a focus on groups such as female participants who may benefit from foundational support. This data-driven approach of allocating resources ensures that training programs are both effective and efficient, primarily serving the majority's needs while also offering specialized support where needed.

5.5 Analysis of TPACK framework construct

Table 4 lists nine items related to the TPACK framework, with mean scores, standard deviations, and a Cronbach's Alpha of 0.918 for the construct.

TABLE 4. TPACK FRAMEWORK ITEMS DESCRIPTIVE STATISTICS

	TPACK Framework Construct			
Items	Mean	Std. Deviation	Interpretation	Cronbach's Alpha
The educational technology workshops improved my ability to use educational technology skills effectively.	3,81	0,981	High; strong perceived improvement in technology skills (TK).	0.918
I feel confident navigating and utilizing the Blackboard Learning Management System after attending the educational technology workshops	3,43	1,028	Moderate; reasonable confidence in Blackboard use (TK)	
The educational technology workshops provided adequate training on the technical features of educational technology tools.	3,24	1,136	Moderate; technical training somewhat adequate (TK)	
The educational technology workshops enhanced my understanding of how to design technology-supported teaching strategies.	3,33	1,155	Moderate; some improvement in designing strategies (TPK).	
The training in educational technology workshops helped me to integrate educational technology into my teaching practices to foster student engagement.	3,62	,805	High; good support for integrating tech for engagement (TPK/TPACK).	
The educational technology workshops helped me align my subject content with appropriate technological tools.	3,48	1,030	Moderate; reasonable alignment of content and tools (TCK)	
I can now identify educational technology tools that best suit my subject area.	3,38	,973	Moderate; improved ability to select subject-specific tools (TCK).	
The educational technology workshops effectively demonstrated how to integrate technology, pedagogy, and content knowledge in teaching.	3,19	,873	Lowest; limited effectiveness in holistic TPACK integration.	
I feel confident in designing lessons that integrate technology to meet specific learning outcomes after attending educational technology workshops	3,48	,981	Moderate; reasonable confidence in lesson design (TPACK).	

Source: Authors' research

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Table 4 indicates that educational technology workshops are most effective in building Technological Knowledge (TK) and supporting technology integration for student engagement (TPK), but they fall short in demonstrating holistic TPACK integration and providing adequate technical training. These gaps align with barriers like inadequate support and failure to address practical challenges (Table 4), supporting the hypothesis that revising workshops with TPACK-focused, practical content and enhanced support could reduce barriers and improve technology integration (Koehler et al., 2013). The high Cronbach's Alpha (0.918) confirms the reliability of these findings.

5.6 Barriers to technology construct

The Cronbach Alpha, the mean and standard deviation of all the items of the barriers to technology construct were identified in Table 5. The construct reliability value of 0.761 exceeded the standards recommended threshold of 0.70, confirming that the items shared a common variance with the other items. The reliability value in the construct was obtained after removing two items that did not have strong relationship with others. Hence, construct analysis was considered ideal for the six items out of eight in Table 5.

TABLE 5. BARRIERS TO TECHNOLOGY ITEMS DESCRIPTIVE STATISTICS

	Barriers to Technology Construct			
Items	Mean	Std. Deviation	Interpretation	Cronbach's Alpha
I have access to sufficient technical support when implementing educational technology.	2,90	,944	Slightly below neutral; suggests moderate lack of technical support.	0.761
The UoT in SA provides adequate follow-up support after the educational technology workshops.	2,71	1,007	Below neutral; indicates inadequate follow-up support.	
I feel confident using the knowledge and skills gained from the educational technology workshops in my teaching practices	3,67	,796	Above neutral; reflects moderate to high confidence in applying skills.	
I feel motivated to incorporate educational technology in my teaching practices.	3,67	,796	Above neutral; indicates moderate to high motivation.	
I have sufficient time to experiment with and integrate new technologies into my teaching	2,86	,910	Slightly below neutral; suggests limited time for integration.	
The educational technology workshops addressed practical classroom challenges associated with using educational technology.	2,90	1,044	Slightly below neutral; indicates workshops partially address practical challenges.	

Source: Authors' research

The results indicate that support-related barriers (especially follow-up support) and workshop design barriers (addressing practical challenges) are the most significant obstacles to technology integration, followed by contextual barriers (time). Attitudinal barriers (confidence and motivation) are less prominent, suggesting workshops are effective in fostering positive attitudes. These findings align with the literature (Hennessy et al., 2022; Akram et al., 2021) and support the hypothesis that revising workshops using KEM

and TPACK frameworks could reduce barriers by enhancing support and practical, TPACK-focused content.

5.7 Alignment with Kirkpatrick model and TPACK framework construct

Table 6 lists nine items evaluating workshop alignment with KEM and TPACK principles, with mean scores, standard deviations, and a Cronbach's Alpha of 0.940 for the construct.

TABLE 6. ALIGNMENT WITH KIRKPATRICK MODEL AND TPACK FRAMEWORK

	Alignment with Kirkpatrick Model and TPACK Framework Construct			
Items	Mean	Std. Deviation	Interpretation	Cronbach's Alpha
The educational technology workshops included interactive and hands-on activities that helped me learn effectively.	3,70	,979	High; effective interactive learning.	0.940
The educational technology workshops provided real-world examples of technology integration in teaching and learning.	3,35	1,137	Moderate; some real-world relevance.	
The sessions were well-structured and paced to support effective learning.	3,30	1,261	Moderate; structure somewhat effective.	
The educational technology workshop content was relevant to my teaching needs and context.	3,60	,883	High; content relevant.	
The training provided actionable strategies for integrating technology into teaching.	3,30	,979	Moderate; strategies somewhat actionable.	
The educational technology workshops balanced the focus between technical, pedagogical, and content knowledge	3,10	,968	Low; weak TPACK balance.	
The facilitators were knowledgeable and approachable during the training sessions	3,90	,912	Highest; strong facilitator quality.	
I received adequate follow-up resources or guidance after attending the educational technology workshops	2,90	1,071	Lowest; inadequate follow-up.	
The educational technology workshops aligned with the best practices in professional development for technology integration	3,50	,946	Moderate; fair alignment with best practices.	

Source: Authors' research

Table 6 also shows that educational technology workshops align well with Kirkpatrick's Level 1 (Reaction) through strong facilitators and interactive activities, but they fall short in Level 3 (Behaviour) due to inadequate follow-up support and in TPACK integration due to weak balance across technical, pedagogical, and content knowledge. These findings align with barriers (Table 3) and TPACK gaps (previous table), strongly supporting the hypothesis that revisions addressing support and TPACK alignment will reduce barriers and enhance technology integration. The high Cronbach's Alpha (0.940) confirms the reliability of these results.

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5.8 Challenges academic staff members face after attending the LTDC workshops

To determine the most important challenges academic staff members faced in the educational technology workshop organised by the LTDC, the means of the variables were compared in Table 6. The data in Table 7 reveals several key insights about the challenges academic staff encountered following their participation in LTDC workshops. Most prominently, integration of the TPACK Framework emerged as the most significant challenge, with the highest mean score of 3.44 and substantial variability (SD = 0.996). This indicates that participants experienced considerable difficulty applying the Technological Pedagogical Content Knowledge framework in their teaching practices after the workshops.

TABLE 7. THE MOST IMPORTANT CHALLENGES ACADEMIC STAFF MEMBERS FACE AFTER ATTENDING THE LTDC WORKSHOPS

	Mean	Standard Deviation
TPACK Framework	3.44	0.996
Barriers to Technology	3.12	0.92
Alignment with Kirkpatrick Model and TPACK Framework	2.97	1.02

Source: Authors' research

The high standard deviation suggests wide variation in these experiences, potentially stemming from the framework's inherent complexity, differences in prior technological proficiency among staff, or insufficient follow-up support to reinforce workshop concepts. Alongside this primary challenge, staff also reported moderate but persistent obstacles in two key areas: technology adoption barriers (Mean = 3.12) and alignment between the Kirkpatrick evaluation model and TPACK framework (Mean = 2.97). These findings point to ongoing difficulties in both practical technology implementation and connecting workshop content to measurable teaching outcomes.

Across all categories, the relatively high standard deviations (ranging from 0.87 to 1.02) are particularly noteworthy, as they reflect significant diversity in staff experiences and perceptions. The greatest variability appeared in TPACK Framework integration (SD = 0.996) and Alignment (SD = 1.02), underscoring inconsistent understandings and applications of these concepts among participants. This variation highlights the need for more tailored approaches in future workshop design and follow-up support to address the diverse needs and challenges faced by academic staff.

5.9 Inferential statistics

In Table 8, the data analysis examines Pearson correlation coefficients among three key variables associated with educational technology workshops. The first variable, KEM and TPACK overall (Binned), likely represents participants' self-assessed TPACK scores, which may have been evaluated using KEM to measure the effectiveness of training. The second variable, Perceptions to Barriers (Binned), captures participants' views on potential obstacles hindering the application of workshop content in their teaching practices. The third variable, Overall perception of educational technology workshops (Binned), reflects

participants' general satisfaction or evaluation of the workshops. Together, these variables provide insights into how participants' knowledge, perceived challenges, and workshop perceptions interrelate, offering valuable feedback for improving future training initiatives.

TABLE 8. CORRELATION COEFFICIENTS AMONG KEY VARIABLES

Correlations				
		Kirkpatrick_TPACK Overall (Binned)	Perceptions to Barriers (Binned)	Overall perception of LTDC workshops (Binned)
Kirkpatrick_TPACK Overall (Binned)	Pearson Correlation	1	,255	,308
	Sig. (2-tailed)		,266	,174
	N	21	21	21
Perceptions to Barriers (Binned)	Pearson Correlation	,255	1	,636**
	Sig. (2-tailed)	,266		,002
	N	21	21	21
Overall perception of LTDC workshops (Binned)	Pearson Correlation	,308	,636**	1
	Sig. (2-tailed)	,174	,002	
	N	21	21	21
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: Authors' research

The analysis revealed several key findings regarding the relationships between the variables. First, the correlation between Kirkpatrick_ TPACK and perceptions of barriers showed a weak positive association (*r* = 0.255), which was not statistically significant (*p* = 0.266). This suggests that, while there may be a slight tendency for participants with higher TPACK scores to perceive more barriers, the relationship is too weak to draw definitive conclusions. Second, the relationship between Kirkpatrick_TPACK and Overall Perception of Workshops exhibited a moderate positive correlation (*r* = 0.308), but this also lacked statistical significance (*p* = 0.174). Although this points to a potential trend where higher TPACK scores align with more favourable workshop perceptions, the results are not conclusive. The most notable finding emerged between perceptions to barriers and overall perception of workshops, where a strong and statistically significant positive correlation (*r* = 0.636, *p* = 0.002) was observed. This indicates that participants who reported fewer barriers tended to have a more positive view of the workshops, or conversely, those with a more favourable perception of the workshops perceived fewer obstacles. This significant relationship underscores the importance of addressing barriers to enhance participants' overall workshop experience.

The analysis identified only one statistically significant relationship: the strong correlation between participants' perceived barriers and their overall perception of the workshops. This finding suggests that reducing obstacles such as logistical challenges, technical difficulties, or insufficient support could lead to more positive evaluations of the educational technology workshops. In contrast, the other examined correlations, including those involving Kirkpatrick_TPACK, showed directional trends but failed to reach statistical significance. This is likely attributable to the small sample size (N = 21), which limits the power to detect meaningful relationships.

6. IMPLICATIONS FOR ENHANCING PROFESSIONAL DEVELOPMENT INITIATIVES

The findings from this study carry important implications for enhancing professional development initiatives. Regarding workshop design, the significant challenges surrounding TPACK Framework integration clearly indicate that current training approaches may be too theoretical or lack sufficient practical application. To address this, future educational technology workshops in South Africa should incorporate more hands-on, experiential learning components that allow participants to directly apply TPACK principles in simulated or real classroom scenarios. Additionally, establishing ongoing mentoring programs could provide crucial follow-up support to help staff bridge the gap between workshop concepts and daily teaching practice.

The persistent barriers to technology adoption identified in the results suggest that workshops alone may be insufficient for driving meaningful change. Institutions will need to complement training with comprehensive support systems, including improved access to technological tools, readily available technical assistance, and potentially incentive structures to encourage adoption. This multi-pronged approach would help address both the practical and motivational aspects of technology integration that staff currently find challenging.

The data also reveals important considerations for program evaluation. While alignment between the KEM and TPACK Framework was rated as slightly less problematic than other areas, it still represents a significant challenge that warrants attention. This gap suggests that participants struggle to connect workshop outcomes to tangible improvements in their teaching effectiveness. To strengthen this connection, future programs should incorporate clearer assessment strategies from the outset, including well-defined metrics for success and structured opportunities for participants to reflect on and document how they're applying workshop concepts in their teaching practice. These enhancements would help create a more robust feedback loop between professional development activities and measurable instructional improvements.

7. STUDY LIMITATIONS

It is crucial to acknowledge the limitations of this research, particularly the small sample size of only 21 participants, which significantly restricts the generalizability of these findings. While the patterns observed provide interesting preliminary insights, they should be interpreted with caution until validated through larger-scale studies. Expanded research with more diverse and representative samples could help verify whether these gender-based usage patterns persist across different populations and contexts. Additionally, qualitative research methods could provide deeper understanding of the reasons behind

these usage patterns, exploring whether they stem from personal preference, institutional barriers, or other sociocultural factors. These limitations notwithstanding, the current findings offer valuable starting points for organizations to consider when designing technology training programs and evaluating equity in technology access and adoption.

8. CONCLUSIONS

In this study, we investigated the effectiveness of institutional workshops designed to prepare academic staff at a South African higher education institution for integrating educational technology into their teaching practices. This study highlighted the critical role of institutional workshops in enhancing the integration of educational technology among academic staff at a South African higher education institution. Our findings underscored that these workshops significantly improved participants' technological proficiency and pedagogical understanding, fostering greater confidence in utilizing tools, such as learning management systems and multimedia resources. This aligns with the study's aim of evaluating workshop effectiveness through KEM and the TPACK framework. However, despite these positive outcomes, persistent barriers hinder the sustained application of acquired skills, including limited post-workshop support, insufficient time for practice, and contextual challenges such as unreliable infrastructure and varying student digital literacy levels. Addressing these barriers is essential for maximizing the impact of professional development initiatives. Additionally, the results indicate a pressing need for strategic improvements in workshop design and delivery, emphasizing active learning, collaboration, and contextual relevance to ensure academic staff can effectively integrate technology into their teaching practices. The study also suggests future research directions, particularly in examining the long-term effects of professional development on teaching practices and student outcomes, as well as exploring the adaptation of the KEM in higher education contexts. The current study contributes to understanding how institutional workshops can be optimized to support academic staff in navigating educational technology integration, ultimately enhancing teaching and learning experiences in higher education.

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DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that they have not used any Generative AI and/or AI-Assisted technologies during the preparation of this work.

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