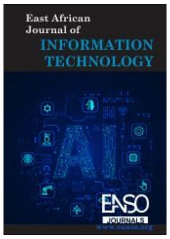

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Original Article

Validating Measures of Technological Acceptance Model in the Context of Lecturers at Kyambogo University

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Technological Application, Perceived Usefulness, Perceived Ease of Use, Behavioural Intention.

ABSTRACT

The study validated the measures of the Technological Acceptance Model (TAM) in the context of lecturers at Kyambogo University. Based on Davis (1986), the TAM was studied in terms of perceived usefulness, perceived ease of use and behavioural intention. In this correlational study that involved a sample of 195 lecturers at Kyambogo University, data were collected using a self-administered questionnaire. Descriptive statistics and structural equation modelling (SEM) using Smart PLS for partial least square structural equation modelling (PLS-SEM) were used to determine the presence of the three constructs of the TAM, namely perceived usefulness, perceived ease of use and behavioural intention. Descriptive results indicated that the above three constructs of the TAM were highly practised by lecturers at Kyambogo University. PLS-SEM showed that the indicators that were used to measure the above three constructs of TAM were appropriate measures. The study concluded that the indicators assessed in this article to measure the three constructs of TAM, namely, perceived usefulness, perceived ease of use and behavioural intention, are valid and reliable. It was recommended that researchers use the indicators assessed in this article to measure the three constructs of TAM.

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INTRODUCTION

The Technology Acceptance Model (TAM) is grounded in the Theory of Reasoned Action (TRA), which rests on the underlying assumption that the most accurate predictor of a given behaviour is an individual's intention. This intention, in turn, is shaped by both their attitudes toward the behaviour and their perceptions of social norms associated with it (Fishbein & Azjen, 1975). Building on the TRA, Davis (1986) developed the TAM (Technology Acceptance Model) to explain user acceptance behaviour. The model posits that beliefs influence attitudes, which, in turn, shape intentions and ultimately drive behaviour. Thus, TAM serves as a foundational framework for predicting human behaviour regarding the potential acceptance or rejection of technology (Guo et al., 2025). Davis (1989) postulates that user acceptance of technology is primarily determined by three factors, namely perceived usefulness, perceived ease of use and behavioural intention. These constructs shape an end user's beliefs about a given technology and, consequently, influence their attitude toward it, which, in turn, predicts its acceptance. Perceived usefulness denotes the extent to which individuals believe that utilizing a technological application or tool will enhance their performance or facilitate the achievement of their goals (Toros et al., 2024). In contrast, perceived ease of use pertains to individuals' belief that using a technological application is straightforward and effortless. Both perceived usefulness and perceived ease of use significantly influence individuals' sustained behavioural intention to consistently integrate technology in teaching (Burgess & Worthington, 2021)

However, the adoption of technology among academic staff at Kyambogo University remains low. For instance, Mugizi et al. (2023) reported a limited uptake of e-learning at the institution, attributing this to the reluctance of traditional academic staff who resist the paradigm shift towards online teaching methodologies. Further, academic staff often lack the technological skills necessary for designing online courses, which hinders the effective digitalization of teaching. Namutebi (2021) also found that academic staff face challenges in acquiring the technological competencies required for course design. In addition, Mugizi and Nagasha (2023) revealed that academic staff at Kyambogo University exhibit negative attitudes toward online learning, with many preferring to adhere to the traditional face-to-face, on-campus approach. Further, Nanyanzi (2023) adds that a significant number of lecturers fail to provide students with essential online reading materials, with the majority relying on handwritten notes, neglecting to cover the complete course content, and failing to respond to student inquiries online due to inadequate information and communication (ICT) skills. Nonetheless, a study done on the academic staff at Kyambogo University by Mugizi et al. (2023) reported that academic staff lack competence to integrate digital tools and platforms into teaching and learning. The above contextual and empirical evidence seems to suggest that technological acceptance seems to be low on the scores of the TAM. Therefore, this study aimed to validate the measures of TAM and indicators that can be used to measure the perceived usefulness, perceived ease of use and behavioural intention in the context of academic staff at Kyambogo University. Specifically, the study tested whether

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academic staff at Kyambogo University exhibited; (i) perceived usefulness, (ii) perceived ease of use iii) behavioural intention. It also proffered the indicators that can measure the three measures of TAM.

LITERATURE REVIEW

The TAM proposes three factors that determine the acceptance of technology by the academic staff, namely perceived usefulness, perceived ease of use and behavioural intention. Perceived ease-of-use is defined as the academic staff's assessment regarding the time and effort needed to learn and use a new technology (Wilson et al., 2021). Scholars such as Davis (1989), Venkatesh (2000) and Basuki et al. (2022) have measured perceived ease of use. For instance, Davis (1989) developed scale indicators to assess user interaction with technology, including confusion, frequent errors, frustration, reliance on user manuals, high cognitive effort, ease of error recovery, rigidity, unpredictability, cumbersome use, task recall efficiency, and helpful guidance. Venkatesh (2000) measured perceived ease of use through indicators such as clarity, low cognitive effort, and ease of operation and control over technology. On the other hand, Basuki et al. (2022) developed a scale with indicators measuring ease of use, understanding, interaction, and quick adoption of technology. Although these studies assess perceived ease of use, many indicators overlap, emphasizing the need for a standardized measurement tool. Consequently, this study develops a comprehensive measurement scale.

Perceived usefulness denotes the extent to which academic staff assess whether or not technology will have a positive impact on their teaching activities or make their life better (Nuryakin et al., 2023). Researchers (Samuel et al., 2018; Wilson et al., 2021; Teo, 2010) have measured perceived usefulness in their investigations. For instance, Samuel et al. (2018) measured perceived usefulness by assessing how technologies support research collaboration. Key indicators included access to educational sites, resource sharing, social networking, communication, and data exchange in professional interactions. Further, Wilson et al. (2021) developed a scale with indicators measuring how technology enhances performance, productivity, and ease of life. On the other hand, Teo (2010) assessed perceived usefulness based on indicators like improved work performance, increased productivity, and enhanced effectiveness through computer use. Although these studies identified indicators for measuring perceived usefulness, some were identical while others differed, suggesting a lack of a standardized measurement tool. This highlights the need to validate the indicators used in the current scale.

On the other hand, behavioural intention reflects the academic staff's tendency to use certain technologies to facilitate the achievement of teaching goals (Yu et al., 2021). A number of scholars (Silvertre et al., 2022; Yi et al., 2024; Chao, 2019) measured behavioural intentions in different study contexts. For example, Silvertre et al. (2022) validated the TAM among Dominican university students in the West Indies by measuring behavioural intentions through indicators such as intending to be a strong virtual classroom user and frequently checking notifications. Further, Yi et al. (2024) examined the factors influencing Chinese college instructors' sustained attitude and intent toward online teaching. They assessed behavioural intention using indicators such as incorporating virtual instruction to enhance teaching methods, utilizing digital resources for lesson support, guiding student autonomy through online platforms, employing digital tools for assessment and management, and integrating virtual platforms as a standard practice. In addition, Chao (2019) examined the factors influencing university students in Taiwan to adopt mobile learning. The study measured behavioural intention using the following indicators: assuming access to mobile learning, intending to use it, predicting future usage if access

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were available, and planning to use mobile learning in the future. These studies show that scholars use a variety of indicators to measure behavioural intention, though some overlap. This underscores the need for a standardized tool to assess this construct, leading to the development of this measurement scale.

METHODOLOGY

Research Design and Sample

This study utilized a correlational research design to examine the relationships among variables without manipulation, enabling the identification of the strength and direction of associations. The target population consisted of 405 academic staff members at Kyambogo University, drawn from various academic units. A sample of 200 was initially selected using Krejcie and Morgan's (1970) sampling table, but the final analysis included 195 participants after excluding incomplete responses and outliers. Simple random sampling where the study participants are selected based on chance was used to ensure equal selection chances and enhance the representativeness of the sample for generalizable findings.

Instrument

The data collection instrument was a self-administered questionnaire developed based on an earlier instrument developed by Davis (1989), which operationalized the technological acceptance model in terms of perceived technology use, perceived ease of use, and behavioural intention. The indicators were adopted from the comprehensive indicators developed by Teo et al. (2017). Indicators of perceived technology use in research included the usefulness of various computer and internet applications for tasks such as data collection, questionnaire design and data analysis, applying for ethical approval, data storage using Access, Integral, statistical analysis, citation and referencing, manuscript writing and dissemination, as well as maintaining and updating research profiles through platforms like Academia and ResearchGate. Indicators of perceived ease of use of technology applications encompass the ability to efficiently utilize a range of digital tools for various research activities. These included tools for writing and editing plagiarism checking, literature review, data collection, data analysis and management, applying for ethical approval, data storage, citation and referencing, manuscript writing, and managing research profiles on platforms such as Academia and ResearchGate. Further, indicators of behavioural intentions to use technology applications included frequent use of tools for writing support, advanced search tools for literature review; and data collection, data entry and analysis, applying for ethical approval, storing data, citation and referencing, identifying credible journals, manuscript preparation, and updating research profiles and sharing publications. The indicators for the various dimensions were measured using a five-point Likert scale, ranging from one to five, where one represented the lowest level (worst-case scenario) and five indicated the highest level (best-case scenario). The scale was anchored as follows: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Not Sure (NS), 4 = Agree (A), and 5 = Strongly Agree (SA).

Research Ethical Considerations

Ethical considerations were rigorously observed throughout the research process. In addition to obtaining ethical clearance from the Directorate of Research and Graduate Training at Kyambogo University, the researcher adhered to established ethical standards during data collection. Participants were fully informed about the purpose of the study and provided written informed consent prior to their participation. Measures were implemented to safeguard participants' privacy, anonymity, and confidentiality. Respondents were instructed not to reveal their identities on the research instruments, and anonymous codes were assigned to ensure no data could be traced back to individual participants. Confidentiality was maintained by assuring

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participants that all information would be used solely for academic purposes and securely stored until the conclusion of the study, after which the instruments would be destroyed. Additionally, the study upheld the principle of honesty by ensuring that the findings accurately reflected the data collected.

Data Analysis

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM), employing the SmartPLS 3 software, which is well-suited for estimating complex models involving multiple latent constructs and higher-order constructs (Sarstedt et al., 2020). Structural Equation Modelling (SEM) is a multivariate statistical technique used to test and estimate causal relationships among variables, often involving both observed and latent (unobserved) variables. It combines elements of multiple regression, factor analysis, and path analysis, allowing researchers to examine complex relationships and model them visually through path diagrams (Thakkar & Thakkar, 2020). The application of PLS-SEM facilitated the development of a model identifying appropriate indicators for the various dimensions of the TAM.

RESULTS

Background Characteristics of the Lecturers

The background information of the lecturers included their sex, age range, gender, highest level of education, designation at Kyambogo University and work experience. Regarding lecturers' sex majority were male (54.7%), while the females were 45.3%. The results on the age range of lecturers indicated that the greatest proportion was 40 to 49 years of age (42.2%), followed by those aged 30 to 39 (26.0%), then 50 years and above (24.5%), and those aged 29 and below (7.3%). These results indicated that lecturers below 29 years are generally fewer compared to those above 30 years. The results on the lecturers' highest level of education indicated that the majority percentage (60.9%) were PhD holders, while 33.9% were master's degree holders and 5.2% had a bachelor's degree. The results on designation indicated that the larger proportion (54.7%) were appointed as lecturers, followed by assistant lecturers (33.9%), teaching assistants (5.2%), associate professors (3.6%), senior lecturers (2.1%), and professors (0.5%) respectively. The results on teaching experience indicated that the majority percentage (39.1%) had been teaching for 6 to 10 years, these were followed by those who had been teaching for 3 to five years (27.6%), then those who had been teaching for more than 10 years (25.5%) and then those who had taught less than 3 years (7.8%). These results indicate a relatively equal proportion of participants per category of teaching experience, which shows the representativeness of participants.

Measurement Models

The measurement models comprised descriptive statistics, including mean values, as well as assessments of validity and reliability. Validity was evaluated through the Average Variance Extracted (AVE) and the Heterotrait-Monotrait (HTMT) ratio to establish discriminant validity. Reliability was assessed using Composite Reliability (CR) and Cronbach's Alpha coefficients. Additionally, multicollinearity was examined through the Variance Inflation Factor (VIF) values. The detailed results of these analyses are presented in Tables 1 and 2.

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Table 1: Descriptive Results, AVE and Heterotrait-monotrait (HTMT) Discriminant Validity Assessment

Measures	Measures	AVE	BIN	EAS	USE
BIN	3.95	0.563			
EAS	3.81	0.554	0.892		
USE	3.99	0.518	0.819	0.893	

Abbreviation: *AVE = Average Variance Extracted, BIN = Behavioural Intentions to Use Technology Applications, EAS = Perceived Ease of Use of Technology Applications, USE= Perceived Use of Technology Applications.*

The descriptive results in Table 1 indicate that the scores for the TAM in terms of behavioural intentions to use technology applications (mean=3.95), perceived ease of use of technology applications (mean=3.81), and perceived use of technology applications (mean=3.99) were high. The AVE value for convergent validity revealed that the different constructs that assessed the TAM dimensions were above 0.5, which is the threshold level (Alarcón et al., 2015)

The heterotrait-monotrait (HTMT) ratio of correlations was employed to assess discriminant validity, thereby determining whether the constructs were distinct and independently measured the dimensions of the Technology Acceptance Model (TAM). The results indicated that the HTMT criterion was satisfied, as all construct correlations within the TAM were below the conservative threshold of 0.90 (Henseler et al., 2015). Consequently, the discriminant validity of all constructs measuring the TAM was confirmed (Hair Jr. et al., 2020). These findings suggest that behavioural intention to use technology applications, perceived ease of use, and perceived usefulness each independently contributed to the measurement of the TAM.

Table 2: Reliability and Variance Inflation Factor

Constructs	A	CR	VIF
BIN	0.801	0.864	1.192
EAS	0.865	0.896	2.229
USE	0.863	0.894	2.198

The reliability analysis in Table 2 indicated that both Cronbach's alpha and composite reliability (CR) values exceeded the acceptable threshold of 0.70, confirming the internal consistency of the measurement indicators. Composite reliability was preferred due to its methodological robustness over Cronbach's alpha, which is limited by its assumption of equal indicator contributions and sensitivity to scale length (Hair Jr. et al., 2021). Unlike Cronbach's alpha, composite reliability accounts for the external characteristics of indicators, offering a more accurate reliability estimate (Dash & Paul, 2021). Additionally, collinearity diagnostics using the Variance Inflation Factor (VIF) showed no multicollinearity among the TAM constructs, as all values were below the threshold of 5, indicating construct independence (Kamis, 2019).

Structural Model for Technological Acceptance Model (TAM)

The structural equation modelling was done to determine the measures of TAM. The results are indicated in Figure 1.

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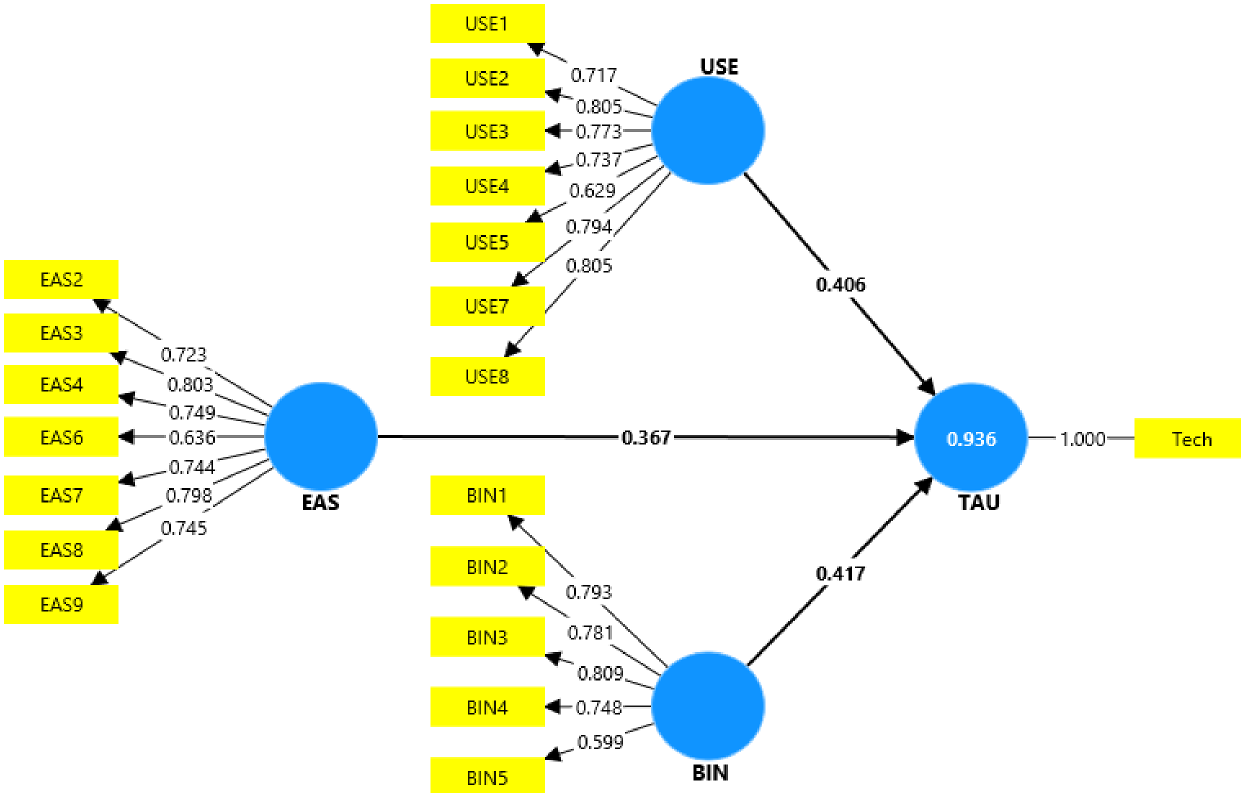
Figure 1: Structural Model for TAM



The results in Figure 1 show that technology applications use covered perceived use, ease of use and behavioural intention to use technology applications. Factor loadings show that for perceived use, all eight indicators were retained (USE1 to USE8). For perceived ease of use of technology applications, seven indicators (EAS2, EAS3, EAS4, EAS6, EAS7, EAS8, and EAS9) were retained out of eleven, the four indicators (EAS1, EAS5, EAS10 and EAS 11) were dropped because did not load above 0.5 which is the threshold level as recommended by Hair Jr et al. (2020). For the behavioural intention to use technology applications, five indicators (BIN1, BIN2, BIN3, BIN4, and BIN5) were retained out of the eleven, while six indicators (BIN6 to BIN11) did not above 0.5 and were dropped. All the indicators retained had factor loadings of above 0.50, which is the lowest accepted level. Therefore, the retained indicators for the three dimensions in the model were the valid measures of the three constructs of TAM. The items that did not load above 0.5 were removed from the model, and these did not measure the constructs of TAM.

DISCUSSION

The results indicate that, among the three constructs used to assess the TAM, namely perceived usefulness, perceived ease of use, and behavioural intention. Perceived usefulness emerged as the most robust construct. Specifically, all indicators associated with perceived usefulness were found to be valid measures of the construct. This finding affirms that the indicators assessed the construct in a manner consistent with prior scholarly research. The analysis for example, indicated that perceived technology use in research included the usefulness of various computer and internet applications for tasks such as data collection, questionnaire design and data analysis (Teo et al., 2017); applying for ethical approval, data storage using Access, Integral, statistical analysis (Samuel et al., 2018); citation and referencing, manuscript writing and dissemination, as well as maintaining and updating research profiles through platforms (Wilson et al., 2021). With the current study's findings being consistent with the previous measurement scales, it can be affirmed that the indicators studied are valid measures of perceived usefulness.

Secondly, with regard to perceived ease of use, it was affirmed that the majority of indicators measuring this construct were consistent with those identified in previous scholarly literature. For instance, the analysis highlighted indicators such as frequent errors, user frustration, reliance on manuals, and high cognitive effort (Davis, 1989); ease of error recovery, system rigidity, and unpredictability (Venkatesh, 2000); as well as cumbersome system use, task recall efficiency, and the availability of helpful guidance (Basuki et al., 2022). With the findings being consistent with the previous measurement scales, it can be affirmed that the indicators studied are valid measures of perceived ease of use.

Thirdly, for behavioural intention, it was established that the items that measured the construct were inconsistent with the findings of earlier researchers. Contrary to Silvertre et al. (2022) earlier findings, this study found that intending to be a strong virtual classroom user and frequently checking notifications. Further, utilizing digital resources for lesson support, and guiding student autonomy through online platforms (Yi et al., 2024). In addition, the current study established that employing digital tools for assessment and management, and integrating virtual platforms as a standard practice, were not valid measures of the behavioural intention (Chao, 2019). With the findings inconsistent with the previous measurement scales, it can be confirmed that the indicators studied are not valid measures of behavioural intention.

CONCLUSION

The study concluded that the three constructs used to measure the TAM, namely, perceived usefulness, perceived ease of use, and behavioural intention, were valid indicators of the model, with the exception of behavioural intention, which did not demonstrate the same level of validity. For perceived usefulness the indicators are usefulness of various computer and internet applications for tasks such as data collection, questionnaire design and data analysis, applying for ethical approval, data storage using Access, Integral, statistical analysis, citation and referencing, manuscript writing and dissemination, as well as maintaining and updating research profiles through platforms. For ease of use, the indicators are frequent errors, user frustration, reliance on manuals, and high cognitive effort, ease of error recovery, system rigidity, and unpredictability, as well as cumbersome system use, task recall efficiency, and the availability of helpful guidance. On the other hand, indicators of behavioural intentions to use technology applications are frequent use of tools for writing support, advanced search tools for literature review; and data collection, data entry and analysis, applying for ethical approval, storing data, citation and referencing, identifying credible journals, manuscript preparation, and updating research profiles and sharing publications.

Recommendation

The study recommends that researchers adopt the validated indicators presented in this article to assess the three core dimensions of the TAM, namely perceived usefulness, perceived ease of use, and behavioural intention. These indicators have undergone empirical testing and validation, thereby offering a reliable and robust framework for examining TAM across varied research contexts. Their use enables scholars to investigate, with greater confidence, the relationships between TAM constructs and other behavioural variables.

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For perceived usefulness, the recommended indicators include the utility of computer and internet applications for activities such as data collection, questionnaire design, data analysis, applying for ethical approval, data storage (e.g., using Access or Integral), statistical analysis, citation and referencing, manuscript writing and dissemination, as well as the maintenance and updating of research profiles on academic platforms.

In relation to perceived ease of use, relevant indicators encompass the frequency of user errors, levels of frustration, dependence on manuals, and cognitive effort required. Additional indicators include ease of error recovery, system rigidity and unpredictability, cumbersome system navigation, efficiency in task recall, and the availability of helpful guidance.

To measure behavioural intention, the study identifies indicators such as the frequent use of digital tools for writing assistance, advanced search functions for literature reviews, and activities including data collection, entry and analysis, ethical approval applications, data storage, citation and referencing, identifying reputable journals, manuscript preparation, as well as updating research profiles and sharing publications.

Limitations of the study

The study significantly identified the indicators associated with the constructs measured by the Technology Acceptance Model (TAM) within the context of academic staff at Kyambogo University, Uganda. However, certain limitations were noted. The findings revealed that some indicators did not validly measure their respective constructs, contrary to the conclusions of the majority of previous scholars. Moreover, the study was limited to a single public university in Uganda. Consequently, future research should aim to validate the TAM constructs across multiple institutions, including both public and private universities.

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