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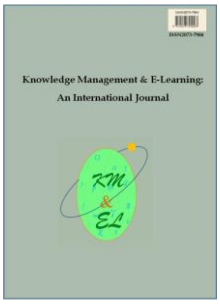

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Usability and user evaluation of an integrated multimedia e-learning management system

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Abstract: The usability of multimedia E-Learning management systems (MEMSs) is critical as it leverages institutions in the educational value chain. The paper aims to investigate the usability effect of an integrated MEMS called Towards Student-Centered Integration of Multimedia E-Learning (TSIME) used at the University of Zimbabwe. This study adopted a quantitative approach, where two self-administered questionnaires were used to gather data on a sample of students and lecturers (n = 492) across ten faculties. Design quality, interaction and feedback, content availability and ethical issues were key independent variable constructs while attitude towards use, overall satisfaction, and likelihood to use TSIME being dependent variables. The results were analysed using descriptive and inferential statistics. The structural Equation Model was used to measure how multimedia design features influence overall satisfaction and likelihood to use. The results showed that ethical issues and content availability were not influencing the use of TSIME while attitude influenced overall usage and satisfaction. Interaction and feedback, as well as design quality, have a significant effect on the likelihood to use TSIME.

Keywords: Higher education; Multimedia e-learning management systems; Usability testing; Evaluation

Biographical notes: Taurayi Rupere is a researcher and lecturer in Computer Science a University of Zimbabwe. His interest is in studies involving multimedia e-learning implementation, design and usage. This is a Human Computer Interaction (HCI) branch. This research is part of his Ph.D. studies in multimedia e-learning integrated framework design. Taurayi has published in national and international journals and this research is one of the studies on usability in e-learning systems. Some of his research interests is in game theory design using computer graphics.

Prof. Jakovljevic is a Research Fellow at Department of Science and Technology Education, College of Education, University of South Africa. She was a Senior Lecturer at Department of Information Systems, University of the Witwatersrand and a part time Academic Associate at the Department of Business Information Systems, University of Johannesburg. She was appointed as an Associate Professor at Department of Economics, University of Zadar,

Croatia and promoted to an Academic Advisor at University of Zagreb. She performed duties as an Editor-in-Chief of the journal *Oeconomica Jadertina*, University of Zadar. Prof Maria Jakovljevic has been involved in multi-disciplinary research in the areas of information systems, knowledge management, technology education, social pedagogy, psychology, and artificial intelligence. She has a South Africa patent titled 'Automatic Health Assistance Device (AHAD)'. She developed and presented multiple courses in Information Systems, Research methodology, innovation, web-based learning, and other fields. She has published in national and international accredited journals, and she serves as a reviewer for Journal of information and Organizational Sciences (JIOS) and Innovation in Education and Teaching International, among others. Currently she is researching and designing AI systems with application in Health and technology-enhanced learning and teaching.

1. Introduction

Educational institutions across the world have been investing in Information and Communication Technology (ICT) to improve education and the rate increased in the past two decades (Zaharias & Poylymenakou, 2009). High educational institutions now see multimedia E-Learning as a competitive advantage in this knowledge-based economy. This has been attributed to the increased demand by students for more flexible and interactive learning options, of late being caused by world disasters such as the COVID – 19 pandemics (Weldon et al., 2021). There is also the economic pressure on educational institutions that now regard technology as a measure of reducing costs (Zuvic-Butorac & Nebic, 2011), expanding audiences and provide better services (Chiheb, Faizi, & Afia, 2011). Multimedia E-Learning has been identified as an enabler for students and institutions in their learning activities. However, studies by (Fernandez, Insfran, & Abrahão, 2011) showed that there are dropouts by students in multimedia E-Learning environments than in traditional learning scenarios. The main reason among others is the poor design and usability of multimedia E-Learning applications (Zaharias & Poylymenakou, 2009).

The development of Multimedia E-Learning Management Systems (MEMSs) used in high educational institutions tends to focus more on the system itself and in some cases neglecting the users' needs. MEMSs are different from most software due to their interactivity and technological aspects involved. They are dynamically evolving (Freire, Arezes, & Campos, 2012) and have different technological features and educational goals. MEMSs should hide system complexity (Guo et al., 2009) and provide flexible and easy interaction with potential learners (Vovides et al., 2007). However, as (Guo et al., 2009) posits, MEMS efficiency, effectiveness and performance are measured by user satisfaction, not on the interface and design aspects alone. Satisfaction is also determined by the key ICT applications as alluded by (Hu et al., 2021).

1.1. Usability and user evaluation in multimedia e-learning

According to Hornbæk (2006) and Chilana et al. (2011), usability is a key issue in computing and Human-Computer Interaction (HCI). The key issue and important aspect arise on how to measure it since it is defined in different ways and the definition varies in different models and standards where they are applied. It has not been explained and defined homogenously and concisely (Abran et al., 2003) by researchers and standardisation bodies. As Chen, Wu, and Ma (2010) posits, usability is a complex and multi-dimensional concept in HCI and E-Learning where the process is seen as dynamic relating to both organisational change and educational innovation. The difference in explanation is due to the aspects of usability (e.g., from a user perspective or from the developer or the system itself) but generally, the definition tends to emphasize the same aspects (Ghalib & Chandrashekara, 2010). In HCI, usability is used to determine how users are satisfied with using computers (Asarbakhsh & Sandars, 2013).

Evaluation is a process of systematically collecting data that informs what it is like for a particular user or group of users to use a product for a particular task in a certain type of environment (Preece, Rogers, & Sharp, 2007). Evaluation is done at different stages of system development. Evaluation starts at the system design, followed by system development and lastly on or after usage of the system. Evaluation done on the system involves experts drawn to evaluate at different system development stages (heuristic evaluation) while evaluation on users (user evaluation) looks at the participation and usage of the system itself (Pribeanu, Balog, & Iordache, 2009; Wong et al., 2003). According to Chilana et al. (2011), evaluation should be an iterative process where each stage or phase feeds to the next stage. User evaluation is done by evaluating the users upon having used the system, by looking at their behaviour, perception towards the MEMS and through their experience using the system.

The study looks at the usability testing and evaluation (user evaluation) of a MEMS integrated with SNS, called Towards Student-Centered Integration of Multimedia E-Learning (TSIME). TSIME is a type of MEMS-based on the Claroline structure and has been used at the University of Zimbabwe for more than ten years as shown in Fig. 1.

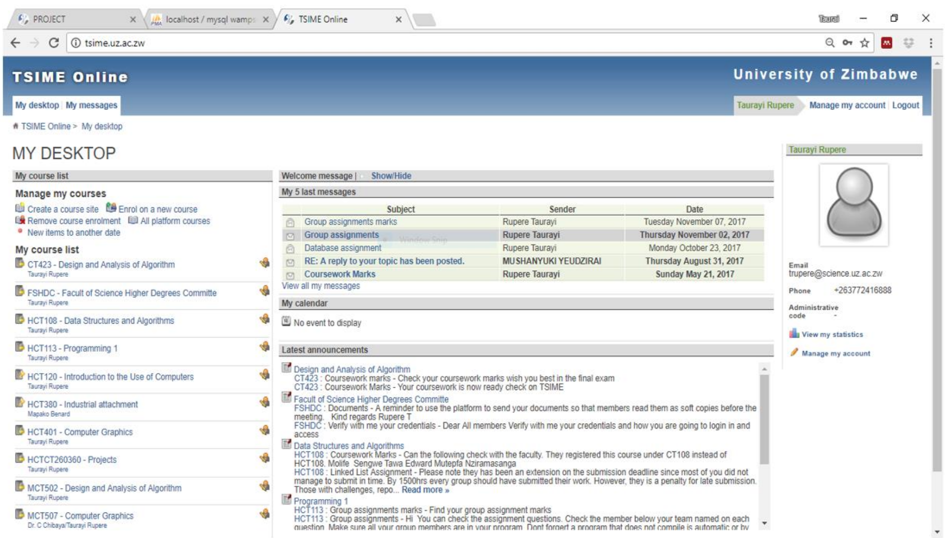

Fig. 1. Screenshot of the old TSIME platform

However, due to the changes in technology and user demand, it was prudent that the system also needed to evolve with the user needs. Users were complaining about the lack of animations and video interactions hence they were reverting to traditional learning. The current TSIME environment which was used for the past ten years was not interlinked and integrated with any SNS.

Multimedia interactive design elements that use audio, video, animations, and text were determined. These were implemented on the existing TSIME taking aspects of design quality, interaction, and feedback and navigation for users. The implementation also involved the integration of the TSIME with the Mahara (a Social Networking Site or Service) mobile application for social networking that gave ease of access to users. Restriction of users on TSIME was solved by integrating with SNSs that promote users to communicate peer to peer without hassles. Mahara is a student focused SNS. Both Claroline which provides the TSIME environment and Mahara are open-source platforms. They were incorporated using a Single Sign-On (SSO) from one platform. The University environment was then supported through an online SNS. A SNS is, however, a web-based administration that enables users to make an open or semi-open profile inside a limited framework and be able to shape associations with other clients of the framework (Boyd & Ellison, 2010). They were sorted out around clients and then gave reasons for keeping up social connections by finding out information that had been contributed by other users (Mislove et al., 2007: 5).

Connections in SNSs were done through posting and remarking on messages, pictures and recordings about user profiles that were associated, hence this supported collaboration among users (Mahara, 2013). Mahara gave users/clients the same number of views that each user enjoys (Hafer & Kiy, 2013). Usability testing and evaluation were done on and during the improvements and integration of TSIME using the HE methods (Rupere & Jakovljevic, 2020). The identified heuristics were corrected during development. Users (students and lecturers) were then allowed to use the integrated system for more than a year at the University of Zimbabwe. Against this background, the research looks at the usability testing and evaluation of the integrated TSIME.

2. Research purpose and questions

The main purpose of the research was to determine the usability effect of an integrated MEMS on user satisfaction and attitude towards use. This was achieved by exploring the effect of quality design, content availability, interaction, and feedback as well as the ethical issues have on user satisfaction and attitude towards the use of TSIME. The study tried to answer the following research questions.

1. Which TSIME design attributes (design quality, content availability, interaction, and feedback as well as ethical issues) have a positive effect on user (students and lecturers) satisfaction?
2. What effect do the TSIME design attributes (design quality, content availability, interaction, and feedback as well as ethical issues) have on usage?
3. What is the perception/attitude of users (students and lecturers) to TSIME design attributes (design quality, content availability, interaction, and feedback as well as ethical issues)?
4. What is the overall user (students and lecturers) satisfaction and likelihood to use TSIME?

3. Theoretical framework for usability and user evaluation of multimedia e-learning management system

Various researchers and bodies tend to associate usability in E-Learning environments depending on the time it is measured (Granić, 2008) and tend to define it over briefly. Usability can be measured before the system is used by users, when being developed or implemented and after the system had been used (Chilana et al., 2011). Hence, different methodologies for testing are applied at different stages (Albion, 1999). By measuring usability at different stages, it ensures that fewer problems are encountered, and users can finally enjoy using the system. However, as Abran et al. (2003) posit, the usability of software properties varies with targeted audiences of the software system. Usability for a mobile system is different from the usability of a web-based system even though there may be some common aspects. Hence, the usability of software intended for a particular audience is viewed from three main viewpoints, which are the end-users who use the system, the system developers/ designers and the management that includes the administrators who are decision-makers.

In multimedia E-Learning, usability testing and evaluation help users to evaluate interactive MEMS and to support their task (Oztekin et al., 2013). It is measured from the time users are using (during the learning process) (Pribeanu et al., 2009) to the time when they finish the learning. It is essential to make sure that MEMSs are easy to use, learning is efficient, effective and satisfactory to users (Hwang & Salvendy, 2010). The efficiency and effectiveness of MEMS are measured by how users spend time on different tasks. A system that takes too much time to complete a task is deemed to be less effective and efficient and as such, users tend to be frustrated and disregard such a system. The examination of users' performance is critical in how users see the effectiveness of the system. Therefore, there are critical aspects of user evaluation that determine the usability of MEMS that tend to be missing.

In their study, (Ozkan & Koseler, 2009) suggested a multidimensional approach for LMS evaluation using six dimensions in the Hexadecimal E-Learning Assessment Model (HELAM). Their study looked at the quality in terms of system, service and content as well as learner perspectives, instructor attitude and support issues. They considered the system quality, service quality, content quality, learner perspective, instructor attitude and support issues. However, the researchers did not investigate relationships among the six dimensions. Also, their study lacked the institutional, design and management aspects. Sun et al. (2008) also provided six other dimensions from the learners, instructors, courses, technology, design and environment. The learners, instructors and environment are from the user perspectives while the courses, technology and design are from the system perspective. Their study showed that course flexibility and course quality are aspects of the MEMS that hinder usage.

Another study by (Lanzilotti et al., 2006) focused on the quality of MEMS. The concept of quality was refined when they came out with a new framework that looked into the technology, interaction, content and services (TICS) model. Quality cannot be measured independent of the content of the MEMS. Nowadays, pedagogic approaches consider users as active elements in the learning process who can acquire and develop competence through activities that involve the use and creation of learning resources (Ferrer & Alfonso, 2011). The aspect of quality was also emphasized by (Weldon et al., 2021) in their study highlighting that deliverance of quality education being a multifaceted needing a multi – factorial approach. Against this design quality for MEMS, the following hypotheses were formulated for the usability testing and evaluation of MEMS:

***H1**: The quality design of TSIME has a positive effect on user satisfaction*

***H2**: The quality design of TSIME has a positive effect on user attitude/perception*

***H3**: The quality design of TSIME has a positive effect on the use of TSIME*

The four dimensions were considered critical when designing or evaluating MEMS: *content, quality, design, interaction, and* user-system interaction. Of the four dimensions, user-system interaction was considered to be a particularly important dimension.

Content involves MEMS facilitating the acquisition of materials such as books online, the software involved in simulations, data analysis and metadata. Hence, content besides quality does relate to the technological aspects of MEMS. Users need to first use the product to get a feel for the quality product and content while designers and implementers check quality and content from its intended usage. The storage patterns, accessibility and availability of the content are determined by the technology used. *Quality, design, interaction, and content* are critical for any E-Learning system (Khan, 2006; Wong et al., 2003). However, quality, design and content aspects can be analysed from a different dimension. One dimension is in terms *of service offered* while the other is concerned with *the quality of the system* itself. Content need to be up to date (Im, 2021) and users should not face difficulty in finding appropriate e-learning content. Against this background for content availability, the following hypotheses were formulated:

***H4**: The content availability of TSIME has a positive effect on user satisfaction*

***H5**: The content availability of TSIME has a positive effect on user perception/attitude*

***H6**: The content availability of TSIME has a positive effect on the use of TSIME*

One aspect that should be considered when implementing MEMS is the adaptation to the cognitive characteristics of the users (Ruiz et al., 2008). Also, (Ardito et al., 2006) highlighted the essentiality of the pedagogical dimension. They alluded that the design of MEMS should take the way the users learn, and that MEMS should provide good interactivity with its users. For MEMS to be adaptable, they should investigate the technological and pedagogical aspects during the design and implementation. Researchers Muniz and Moraes (2012) and Ozkan and Koseler (2009), focused on tools used by students and teachers on different learning management systems, like hyperlinks and navigation tools. They investigated whether usability problems hamper the use of tools on the platforms by teachers and students from the user perspective. For users to adapt fairly, MEMS needs to be available and accessible anytime. The content should provide good navigation and feedback with good interaction. Communication or general interaction between users (students and teachers) have issues (Weldon et al., 2021), hence MEMS should afford good interaction to users. Good design and well functionality of MEMS that incorporates pedagogical and background of users reflects an adaptable system. Against this background on pedagogical aspects, the next hypotheses were formulated:

***H7**: The interaction and feedback of the TSIME positively affect the user's satisfaction towards the system*

***H8**: The interaction and feedback of the TSIME positively affect the user's perception/attitude towards the system*

***H9**: The interaction and feedback of the TSIME positively affect the use of TSIME*

Research on evaluating and testing usability has been conducted by several scholars (Adebesin, de Villiers, & Ssemugabi, 2009; Blecken, Bruggemann, & Marx, 2010; Fahrni, Rudolph, & De Schutt, 2004; Kakasevski et al., 2008; Muniz & Moraes, 2012). Most of these studies were centred on the usability of E-Learning applications from teacher or student perspectives. Other researchers (Padayachee, Kotzé, & Van Der Merwe, 2011; Ssemugabi & De Villiers, 2010; Sulaiman et al., 2009; Zuvic-Butorac & Nebic, 2011) looked at the usability of course management systems in E-Learning environments from the system perspective. Researchers, Spiliotopoulos et al. (2010), Wong et al. (2003) and Machado and Tao (2007) looked at usability from the system and user perspectives but focusing much on the system and administrative aspects.

Guidelines by different authors (Ardito et al., 2006; Nielsen, 1993; Squires & Preece, 1999; Kim & Kim, 2008; Van Biljon & Pretorius, 2009; Granić & Ćukušić, 2011) on usability have been studied and put forward. However, some guidelines have been generalized and their application on MEMS still needs more research. Of these, some looked into the effectiveness of learning tools while others researched on web applications and human factors in E-Learning (Wong et al., 2003).

In their study, Padayachee et al. (2011) came up with a usability study for a course management system used in higher education. They used the Heuristic Evaluation (HE) using user interface design. Similar to this study is the research done by (Kirner, Custódio, & Kirner, 2008), who looked at usability from a teacher's point of view using the Moodle platform. Also similar to this study, researchers Kherraf et al. (2010) used the quality attributes of software by determining it in the project plan cycle. They used a user-based evaluation method. However, all these studies lacked aspects to deal with ethics and the attitude towards using the MEMS. Attitude tends to be determined by the user background and experience of users. Ajzen (2005) in Bervell & Umar (2018) posits that attitude represents an individual's favourable or unfavourable assessment of engaging in a behaviour of interest. Attitude is viewed as a potential adopter evaluation to a MEMS to carry out all the tasks provided by the platform with ease. Students and lecturers exhibit a better attitude due to their background and previous use of ICT gadgets. However, as Bervell and Umar (2018) proclaimed, attitude towards a system in E-Learning environments can be caused by the instructors which can then cascade to the students. If lecturers show a bad attitude where they do not provide feedback and do not interact with students using the platform, students will likewise do the same (Muniz & Moraes, 2012). The following four hypotheses emanate from this background on ethics and the attitude towards using the MEMS:

H10*: The ethical issues of TSIME have a positive effect on user satisfaction and attitude on usage*

H11*: The ethical issues of TSIME have a positive effect on user perception/attitude on usage*

H12*: The ethical issues of TSIME have a positive effect on the use of TSIME*

H13*: Attitude has a positive effect on the use of TSIME*

H14*: Attitude has a positive effect on user satisfaction in using TSIME*

Usability testing is not based on a single attribute or parameter of the user interface. It is also not based on looking at design principles, but a combination of various usability attributes and parameters (Berking & Gallagher, 2010). These attributes and parameters are generated from the administrative point of view (ethical), then the developers (design quality, interaction and feedback) of the MEMS and lastly the users (attitude and positive perception). Hence the attributes and parameters are grouped into the system, user, and administrative parameters. Criterion drawn from these attributes should then be tested and evaluated by system users. Therefore, all these studies pointed out the critical dimensions in evaluating and testing the usability of MEMS which are quality, interaction, accessibility, availability, feedback, design and content that provides good functionality and navigation.

In this research context of MEMSs, the quality, design and content usability were determined during development by expert testing using agreed heuristics during the integration of SNS and MEMS (Rupere & Jakovljevic, 2020; Alsumait & Al-Osaimi, 2009; Granic, Glavinic, & Males, 2004) done by heuristic evaluation (HE). Hence, experience plays a major role in determining satisfaction to a certain extent where those with less experience in IT systems may need the motivation aspect to be satisfied. However, this study managed to identify another critical dimension which most researchers omitted. The ethical dimension looks at how users behave and stick to the layout rules from the institution and instructors. Also, attitude towards use is another dimension that depends on the dimensions discussed above. Hence, there is a need to determine how these dimensions have an overall impact on users in multimedia E-Learning environments. The following hypothesis originate on the use of TSIME:

***H15**: Overall satisfaction has a positive effect on the use of TSIME*

Fig. 2 shows the conceptual framework with dependent and independent variables as well as the initial hypotheses.

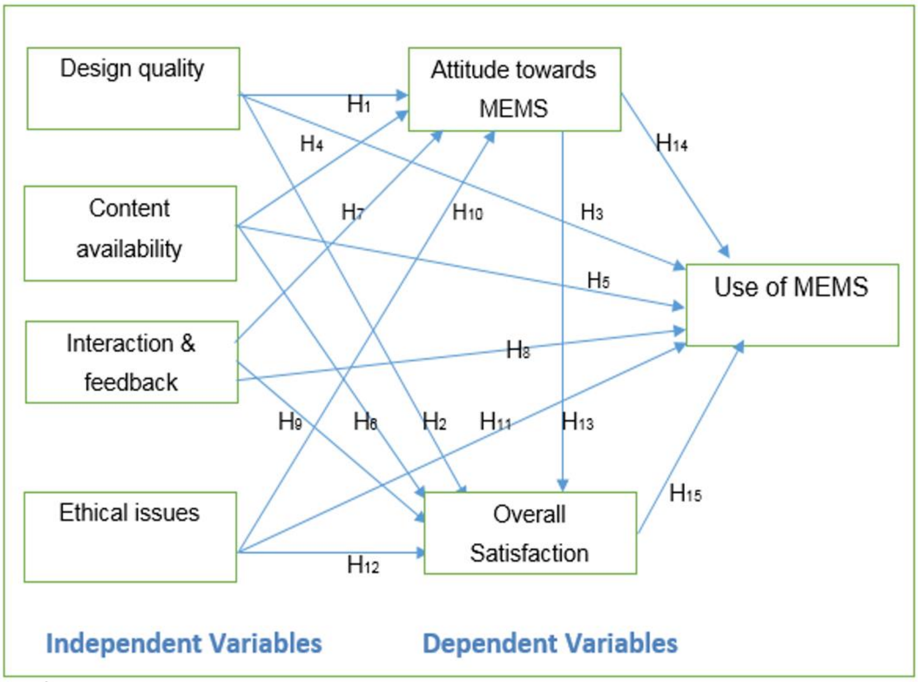

Fig. 2. Conceptual framework

Various methods have been used to measure usability from the user perspective. According to (Tan, Liu, & Bishu, 2009), the quality of the usability evaluation is determined by the method used. Studies on the user perspective, as Almarashdeh, Sahari, and Zin (2011) posits, reveal a lot of innovative approaches to improve learners through training and technical support, but there is a lack of scientific evaluations that are credible that looks at the various usability criteria. This raises numerous questions when trying to evaluate MEMSs from the users' perspective such as: What are the physical characteristics of the learners?; Are the learners really satisfied with the learning and usage of the platform?; Is the platform not too much complicated for them?; What are the learners' backgrounds and history concerning the MEMS?; Are they able to navigate properly on the links?; and Are learners motivated and what benefit do they get from using MEMS?

4. Method

4.1. Instruments

The research study used a quantitative approach. It used a survey design in which two self-administered questionnaires (students and lecturers) were used to gather data who had used the TSIME integrated with SNS at the University of Zimbabwe. The questionnaires were similar in constructs only differing on the demographic sections. Section A of the questionnaires had the demographics section followed by section B that had the key independent variables construct questions while the last section C had the dependent variables construct questions. The key independent variable i.e., *design quality, interaction and feedback, content availability and ethical issues* were measured using a 5-point Likert scale ranging from 1 representing *Strongly disagree* to 5 representing S*trongly agree*.

The other dependent variables, a*ttitude towards learning, overall satisfaction, and usage of TSIM*E were also measured on a 5-point Likert scale like the independent variables. Effectively, the cut-off point considered was 3.0 (Field, 2016).

4.2. Sampling and data collection

The questionnaires were digitised i.e., transformed into an electronic form that was used on mobile devices or tablets with an open-source software suite called Open Data Kit (ODK), which enables data collection in near real-time and exact locations. The researchers used five research assistants to gather data from the students and lecturers for two weeks. The research assistants used tablets loaded with ODK to gather data and the completed questionnaires were sent to a central server. SPSS v25 and Amos v25 were used for analysis.

A stratified probability sampling method was used to ensure that all students and lecturers (respondents) in the faculties had equal opportunities to participate in the survey. The sampling technique minimized bias associated with non-probability sampling techniques where a selection of research respondents is based on subjectivity (Langdridge & Hagger-Johnson, 2009). The total population was 17000 that consisted of students and lecturers drawn from ten faculties at the university. Of the 17 000 at the university, 16 000 comprised students while 1000 were lecturers. The sample (263 for the lecturers) and (374 for students) was determined using the scientific sample size determination proportionally distributed among the ten faculties. A total of 492 users (338 students and 154 lecturers) participated in the survey with a response rate of 90%-students and 57%-lecturers.

4.3. Reliability and validity of the instruments

The reliability of the questionnaires was measured using Cronbach's Alpha statistics. For all the variables, Cronbach's Alpha coefficient confirmed above 0.7 to show reliability as shown below in Table 1.

Table 1
Reliability analysis

	Cronbach's alpha	N of items
Design quality	.905	7
Content availability	.874	8
Interaction and Feedback	.793	5
Ethical issues	.904	7

Validity was measured using external validity and construct validity. External validity was confirmed from the preceding response rate evaluation, as the computed response rate was within the tolerable threshold of the minimum sample size computed from the power analysis (Herrmann et al., 2013; Erdfelder et al., 2009). The sample size used in this research was scientifically representative, and thus confirming the external validity aspect. Construct validity was evaluated from two facets, first, convergent validity, and second, discriminant validity. This was achieved using SPSS Amos v25 with the results shown in Fig. 3.

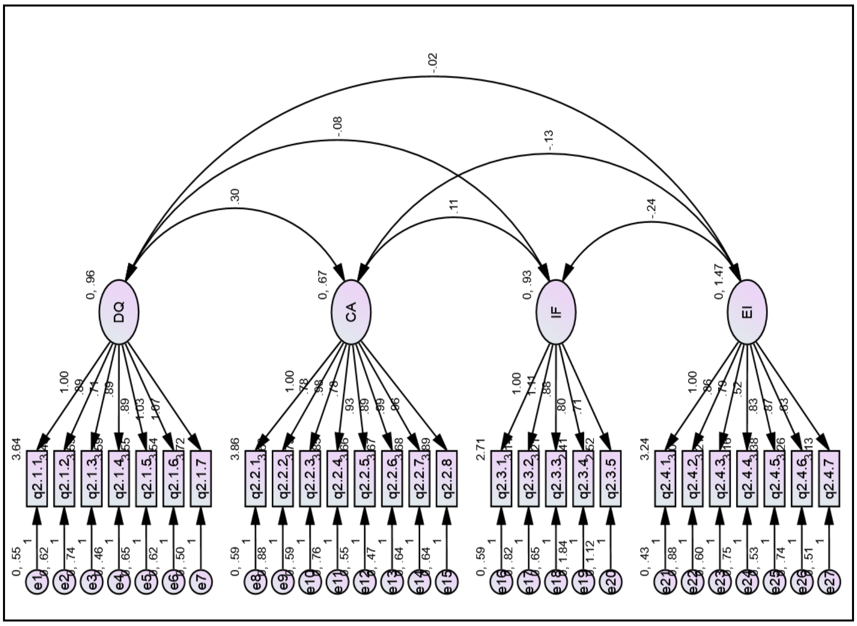

Fig. 3. Convergent and discriminant validity

According to Annum (2014) as well as Heale and Twycross (2015), the minimum threshold for discriminant validity is 0.85, while for convergent validity, the minimum accepted is 0.5. Hence confirming the four constructs of which none of the linkages had a coefficient greater than 0.85, with the highest being 0.30 between design quality and content availability. Effectively, this confirms that the aspect of discriminant validity was confirmed (see Fig. 3).

For the convergent of items to each of the constructs, from the four dimensions, the least was observed within ethical issues (0.52) and is greater than the minimum acceptable, it was confirmed again that none of the items across all the four dimensions was eliminated from the study hence confirming that the items used to measure each, and every construct sufficiently and coherently converged, validating convergent validity.

4.4. Data analysis

Normality was determined using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Since the data set had respondents > 50, the Kolmogorov-Smirnov test was used and the significance values were all < 0.05 (Kalaiselvan & Bhaskara Rao, 2016). Hence, nonparametric tests (Spearman) were used for the tests.

The results were analysed using descriptive and inferential statistics. Structural Equation Model (SEM) was used to measure the inferential statistics between the dependent and independent variables that determined how the multimedia design attributes have an influence on satisfaction by users and the likelihood to use. With a view to testing the research hypotheses, the research being multivariate, Structural Equation Modelling (SEM) was considered as the optimal approach to the evaluation of the research hypotheses (Field, 2016; Hair et al., 2010). SPSS Amos v25 was used, being a covariance-based SEM tool, which was optimal owing to the sample size which was adequate (Finney & DiStefano, 2006). To further help validate the appropriacy of the use of SEM, the other key assumption was identified as being multivariate normality (Hair et al., 2010).

5. Results

5.1. Demographic statistics

While the study focused on the four research independent variables, along with the two endogenous variables, it was highly imperative that the key demographic attributes attached to the respondents be examined as these eventually assisted in the validation of the research outcome from the context of the background of the respondents. A total of 492 users (338 students and 154 lecturers) participated in the survey with a response rate 90%-students and 57%-lecturers.

5.1.1. Users' experience using TSIME

From the response rate by faculty (Table 2), it is evident that students and lecturers from the Education and Science faculties embrace the use of TSIME than other faculties. It translates that if lecturers do not use TSIME it also applies that student will likewise not use it.

Table 2
Demographic profile of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Lecturer	Agriculture	16	10.4	10.4	10.4
	Education	39	25.3	25.3	35.7
	Science	50	32.5	32.5	68.2
	Engineering	5	3.2	3.2	71.4
	Commerce	13	8.4	8.4	79.9
	Law	5	3.2	3.2	83.1
	Social Studies	12	7.8	7.8	90.9
	Arts	8	5.2	5.2	96.1
	Institutes and Units	6	3.9	3.9	100.0
	Total	154	100.0	100.0	
Student	Agriculture	20	5.9	5.9	5.9
	Education	81	24.0	24.0	29.9
	Science	109	32.2	32.2	62.1
	Engineering	3	.9	.9	63.0
	Commerce	37	10.9	10.9	74.0
	Social Studies	40	11.8	11.8	85.8
	Arts	19	5.6	5.6	91.4
	Institutes and Units	29	8.6	8.6	100.0
	Total	338	100.0	100.0	

The results also confirmed that most of the lecturers had substantial experience with the use of TSIME, with the majority having used it for at least 2 years. On the other hand, most of the students had used TSIME for a single semester, one year, or two years (see Table 2). To evaluate the extent of the difference in terms of the experience between the students and the lecturers, the variable being an ordinal categorical variable, a non-parametric Mann-Whitney Test was computed (Field, 2016). See Table 3.

As shown in Table 3, the relative experience with the use of TSIME was rather high among lecturers as compared to students. Also, with a *p*-value computed $0.000 < 0.05$, it follows that the proportions of the respondents' experience with the use of TSIME across two groups were statistically significant. This generally confirms the afore-established relative experience of lecturers over students. These discrepancies eventually affected the aggregate model as there seemed not to be parity concerning the experience aspect. In this regard, the presentation of the results was split across these two categories such as to be able to establish the variability in the perceptions of both the students and lecturers with respect to the research constructs.

5.1.2. Access gadgets to TSIME

The study looked at the type of gadgets used to access the TSIME platform. The key dimensions were the desktop, laptop, tablet/iPad, smartphone and personal digital assistants (PDA). The modal gadget used by the lecturers to access TSIME was the desktop, and this was evident among 85.9% of the lecturers, while 81.9% of the lecturers used laptops. On the other hand, with respect to the students, the only modal gadget used to access TSIME was the laptop with 86.1%. With respect to the tablet/iPad, this was used by 29.5% of the lecturers, and 32.5% of the students. The use of smartphones and PDAs was more dominant among the students than lecturers, and the use of desktops was rather low among the students (24.9%) as compared to the lecturers (85.9%), and the most likely factor was the high mobility of the students which made the reliance on desktops less likely, but rather the need to depend on on-the-go gadgets such as the laptops as well as the tablets and smartphones.

Table 3
Demographic profile of respondents

Ranks				
	Lecturer/Student	N	Mean Rank	Sum of Ranks
How long have you been using TSIME?	Lecturer	154	302.23	46544.00
	Student	338	221.11	74734.00
	Total	492		

Test Statistics[a]	
	How long have you been using TSIME?
Mann-Whitney U	17443.000
Wilcoxon W	74734.000
Z	-6.022
Asymp. Sig. (2-tailed)	.000

Note. a. Grouping Variable: Lecturer/Student

5.2. Dimensions for independent variables

5.2.1. Design quality

The first dimension measured was design quality. Table 4 shows that there was remarkably high variability among the responses as evidenced by the extremely high standard deviations, all of which were > 1.0, along with kurtosis statistics, virtually all of which were negative. The latter is reflective of a platykurtic distribution, suggesting the absence of coherence among the respondents (Field, 2016).

This meant that while all the items were confirmed as measuring the construct, they had significantly differing ratings across the various students. One possible argument could be possibly the varying tastes and priorities of the respondents.

5.2.2. Content availability

The second dimension measured was content availability. A total of 8 items were used to measure the extent of content availability as shown in Table 5. Content availability confirms that generally, the students tended to have a rather positive outlook.

Table 4
Perceptions on design quality

		N	Mean	Std. Deviation	Skewness	Kurtosis
Lecturer	I found the TSIME environment attractive	154	3.48	1.320	-.424	-1.088
	I can explore and navigate through TSIME with easy	154	3.54	1.248	-.560	-.893
	The graphical user interface makes me access the TSIME without problems	154	3.45	1.150	-.646	-.513
	The TSIME environment is user-friendly and provides good help	154	3.73	1.179	-.910	-.175
	TSIME have special features that allow me to do my work with ease	154	3.54	1.097	-.927	.060
	The texts for TSIME are expressive and easier to read	154	3.52	1.274	-.515	-.970
	The images are appealing	154	3.54	1.349	-.699	-.792
	N (listwise)	154				
Student	I found the TSIME environment attractive	338	3.72	1.184	-.815	-.384
	I can explore and navigate through TSIME with ease	338	3.46	1.143	-.654	-.665
	The graphical user interface makes me access the TSIME without problems	338	3.66	1.082	-.799	-.090
	The TSIME environment is user-friendly and provides good help	338	3.53	1.065	-.611	-.663
	TSIME have special features that allow me to do my work with ease	338	3.55	1.239	-.852	-.336
	The texts for TSIME are expressive and easier to read	338	3.54	1.293	-.653	-.771
	The images are appealing	338	3.80	1.223	-.882	-.362
	N (listwise)	338				

Table 5
Perceptions on design quality

		N	Mean	Std. Deviation	Skewness	Kurtosis
Lecturer	Uploading of course outlines, documents, assignments and on TSIME is easy	154	3.54	1.274	-.636	-.800
	I am comfortable with how I structure my courses on TSIME	154	3.42	1.147	-.474	-.649
	I find it easy to access the course content on TSIME without difficulties	154	3.59	1.286	-.410	-1.132
	TSIME environment makes it easier for me to share and access what I learn with the learning community	154	3.49	1.254	-.706	-.618

	Course management becomes easy with the use of TSIME	154	3.42	.982	-.807	-.054
	I find it easy to store information on TSIME	154	3.32	1.142	-.384	-.906
	Information can be retrieved without problems on TSIME	154	3.37	1.154	-.685	-.433
	I find it easy to update information on TSIME	154	3.64	1.413	-.641	-.921
	N (listwise)	154				
Student	Uploading of course outlines, documents, assignments and on TSIME is easy	338	4.01	1.010	-1.228	1.130
	I am comfortable with how I structure my courses on TSIME	338	3.73	1.115	-.816	-.191
	I find it easy to access the course content on TSIME without difficulties	338	3.80	1.012	-1.017	.560
	TSIME environment makes it easier for me to share and access what I learn with the learning community	338	4.01	.948	-.996	.590
	Course management becomes easy with the use of TSIME	338	3.78	1.080	-.709	-.314
	I find it easy to store information on TSIME	338	3.83	.881	-1.185	1.649
	Information can be retrieved without problems on TSIME	338	3.82	1.103	-.785	-.403
	I find it easy to update of information on TSIME	338	4.01	.934	-.969	.714
	N (listwise)	338				

It should be confirmed that there was a significant variability as evidenced by the consistent platykurtic distributions, with the kurtoses across all the items being negative.

5.2.3. Interaction and feedback

The third dimension was interaction and feedback, which was measured by 5 items as shown in Table 6. From the results, basing on the feedback from the lecturers, all 5 items were negatively rated, being all rated < 3.0, and this was characteristic of the poor interaction and feedback among lecturers.

This generally confirms that the lecturers hardly necessitated the formation of groups among the students as part of their setting up of the portal. With respect to the students, three of the items were poorly rated, with two of the items that were negatively rated by the lecturers being positively rated by the students.

5.2.4. Ethical issues

Ethical issues were measured by seven items, three of which had to be reverse coded to ensure compliance with the positivity of the question as shown in Table 7. Comparing the feedback from the students and lecturers, it can be argued that the principal differences were with the perceptions on the strong misuse of academic resources on TSIME by students, which was negative among the lecturers and positive among the students.

Table 6
Perceptions on interaction and feedback

		N	Mean	Std. Deviation	Skewness	Kurtosis
Lecturer	I often use the group setup and management	154	2.52	1.195	.349	-1.152
	Dissemination of information and feedback through TSIME has been made easier	154	2.53	1.264	.566	-.958
	I collaborate with my peers/lecturers and students using TSIME easily	154	2.69	1.163	.481	-.824
	I use TSIME chat regularly	154	2.62	1.924	2.167	7.121
	I regularly use the forums and wikis on TSIME	154	2.62	1.116	.145	-.827
	N (listwise)	154				
Student	I often use the group setup and management	338	2.80	1.242	.250	-1.125
	Dissemination of information and feedback through TSIME has been made easier	338	3.42	1.368	-.524	-1.054
	I collaborate with my peers/lecturers and students using TSIME easily	338	3.44	1.094	-.176	-1.099
	I use TSIME chat regularly	338	2.32	1.358	.700	-.900
	I regularly use the forums and wikis on TSIME	338	2.47	1.323	.943	-.174
	N (listwise)	338				

Further, the facilitation of the proper use of academic resources through adherence to academic regulations was poorly rated by the students as compared to the rating by the lecturers. It seems lecturers have a divergent view of misuse by students while students have also the same notion.

The aggregate statistics for the independent variables construct are summarized in Table 8. Design quality was positively rated across both categories, being > 3.0 with the highest rating observed among the students. The least standard deviation and greatest skewness were observed among the students, and this confirms the respective harmony among the students. The latter argument can be confirmed by the mesokurtic distribution observed among the students (kurtosis = 0.053) as compared to the platykurtic distribution among the lecturers (kurtosis = -0.680).

The aggregate kurtosis for the content availability construct was leptokurtic (kurtosis = 2.120), indicative of the fact that the overall rating was consistent across the students, while among the lecturers, this was platykurtic with a kurtosis of -0.318.

Table 7
Perceptions on ethical issues

		N	Mean	Std. Deviation	Skewness	Kurtosis
Lecturer	TSIME have helped to reduce plagiarism	154	3.60	1.163	-.580	-.756
	There is no strong misuse of academic resources on TSIME by students	154	2.61	1.345	.432	-1.031
	There is no writing assistance and inappropriate tutoring	154	2.53	1.074	.301	-.912
	TSIME have helped to reduce copyright and copy protection issues	154	3.55	1.247	-.325	-1.315
	TSIME allow confidentiality in my work	154	3.40	1.218	-.704	-.501
	There is no misrepresentation in collecting and representing data by tutors and students on TSIME	154	2.67	1.226	.485	-1.014
	TSIME provide proper use of academic resources through adherence to academic regulations	154	3.54	1.150	-.724	-.587
	N (listwise)	154				
Student	TSIME have helped to reduce plagiarism	338	3.07	1.444	-.280	-1.411
	There is no strong misuse of academic resources on TSIME by students	338	3.12	1.405	.127	-1.333
	There is no writing assistance and inappropriate tutoring	338	2.91	1.292	.014	-1.437
	TSIME have helped to reduce copyright and copy protection issues	338	2.99	.932	.560	-.190
	TSIME allow confidentiality in my work	338	3.38	1.263	-.630	-.867
	There is no misrepresentation in collecting and representing data by tutors and students on TSIME	338	2.77	1.422	.345	-1.309
	TSIME provide proper use of academic resources through adherence to academic regulations	338	2.94	.940	-.146	-1.001
	N (listwise)	338				

Basing on the interaction and feedback outcome, both ratings by the students and lecturers were below 3.0, and thus indicative of a poor rating. The kurtosis for these two was negative and thus indicative of the extremely high variability of the responses. In other words, the ratings differed significantly across the students and lecturers. The latter may have been influenced by the different levels of experience by the users of the system, which entailed remarkably diverse perspectives. There was extremely high variability among the students over lecturers with respect to the ethical issues.

To establish whether the two groups had a relatively similar rating of the dimensions of the independent variable, or whether that was statistically different, being a scale variable, the parametric ANOVA test was considered. The results are presented in Table 9.

Table 8
Descriptive statistics of aggregate independent variables

			N	Mean	Std. Deviation	Skewness	Kurtosis
Design Quality	Lecturer	Design Quality	154	3.5427	.99544	-.840	-.680
	Student	Design Quality	338	3.6078	.93817	-1.167	.053
Content Availability	Lecturer	Content Availability	154	3.4724	.92103	-1.022	-.318
	Student	Content Availability	338	3.8728	.70171	-1.526	2.120
Interaction and Feedback	Lecturer	Interaction and Feedback	154	2.5961	.98471	.448	-1.259
	Student	Interaction and Feedback	338	2.8911	.97322	.189	-1.149
Ethical Issues	Lecturer	Ethical Issues	154	3.4694	.95472	-.731	-.726
	Student	Ethical Issues	338	3.0816	1.00157	-.556	-1.342

Table 9
Test of homogeneity of variances on design quality

		Levene Statistic	df1	df2	Sig.
Content Availability	Based on Mean	24.868	1	490	.000
	Based on Median	8.953	1	490	.003
	Based on Median and with adjusted df	8.953	1	453.104	.003
	Based on trimmed mean	22.091	1	490	.000
Interaction and Feedback	Based on Mean	1.001	1	490	.318
	Based on Median	.006	1	490	.937
	Based on Median and with adjusted df	.006	1	463.370	.937
	Based on trimmed mean	.736	1	490	.392
Ethical	Based on Mean	5.996	1	490	.115
	Based on Median	2.217	1	490	.137
	Based on Median and with adjusted df	2.217	1	489.909	.137
	Based on trimmed mean	5.910	1	490	.015
Design Quality	Based on Mean	3.526	1	490	.061
	Based on Median	2.501	1	490	.114
	Based on Median and with adjusted df	2.501	1	486.259	.114
	Based on trimmed mean	3.675	1	490	.056

From the computations, the p-values for the Levene tests based on the mean and median were all > 0.05, for design quality, interaction and feedback and ethical issues while content availability had a p-value < 0.05. From this basis, it can be argued that the homogeneity assumption was validated, thus validating the applicability of ANOVA as shown in Table 10.

Table 10
ANOVA test on independent variables

		Sum of Squares	df	Mean Square	F	Sig.
Design Quality	Between Groups	.448	1	.448	.490	.484
	Within Groups	448.222	490	.915		
	Total	448.670	491			
Content Availability	Between Groups	16.960	1	16.960	28.101	.000
	Within Groups	295.725	490	.604		
	Total	312.684	491			
Interaction and Feedback	Between Groups	9.208	1	9.208	9.650	.002
	Within Groups	467.551	490	.954		
	Total	476.759	491			
Ethical Issues	Between Groups	15.912	1	15.912	16.328	.000
	Within Groups	477.515	490	.975		
	Total	493.427	491			

$F(1, 490) = 0.490$; $p = 0.484 > 0.05$. In this respect, with a *p*-value > 0.05, we retain the null hypothesis assuming equality of distributions. In other words, there was not enough statistical evidence that the mean ratings of the design quality were statistically significant. Thus, the design quality was equally rated by the lecturers and students.

However, the other three variables had a *p*-value; $p < 0.05$. Effectively, it followed that there was substantial statistical evidence that there was a difference in the ratings by the students and lecturers with respect to the content availability, interaction and feedback and ethical issues dimensions. In other words, the ratings by the students for these variables were relatively high as compared to the ratings by the lecturers.

The robust tests for the equality of means were computed in this respect to cross-validate the ANOVA results and do confirm this equality as shown in Table 11.

Both the Welch and the Brown-Forsythe tests yielded a *p*-value > 0.05 for design quality, confirming the equality of the mean ratings on the design quality by the students and lecturers. Both appreciate the design quality on TSIME. However, the other three dimensions have a *p*-value < 0.05. This is the fact that students tend to be the beneficiaries hence they always find information regarding the courses they are enrolled in and this could be sufficient for them. However, the lecturers owing to their vast experience with other learning management systems could be best in the knowledge relating to the limited capacity of the TSIME platform, and hence their relatively low rating on content availability. Also, again, as put forth earlier, one possible explanation for this discrepancy could be the aspect of information asymmetry between the two, with the lecturers having a significant experience with other MEMS and their ratings would best be reflecting the gap that exists between the two groups, and thus the propensity of the lecturer ratings being severer than student'.

It can also be argued that the fact that the students themselves rated the ethical issues poorly as compared to the lecturers, their ratings could probably be more reflective of the real situation on the ground, being the perpetrators. In other words, the over-rating by the lecturers could have been due to their ignorance of the violations by the students leveraging on the TSIME system.

Table 11
Robust tests of equality of means on design quality

		Asymptotically F distributed	df1	df2	Sig.
Design Quality	Welch	.469	1	281.003	.494
	Brown-Forsythe	.469	1	281.003	.494
Content Availability	Welch	23.015	1	237.099	.000
	Brown-Forsythe	23.015	1	237.099	.000
Interaction and Feedback	Welch	9.566	1	293.130	.002
	Brown-Forsythe	9.566	1	293.130	.002
Ethical Issues	Welch	16.924	1	309.570	.000
	Brown-Forsythe	16.924	1	309.570	.000

5.3. Dimensions for dependent variables

This section examines the three dependent variables of the study, which were *the attitude towards the use of TSIME, overall satisfaction with TSIME and usage of TSIME*. The three variables were measured using the 5-point Likert scale.

It can be confirmed from Table 12 that the lecturers had a positive attitude toward the use of the TSIME platform than the students. The fact that the kurtosis for the satisfaction levels of the lecturers was the most positive, and thus leptokurtic was indicative of the overall consensus among the lecturers with respect to their overall satisfaction.

Table 12
Descriptive statistics on dependent variables

		N	Mean	Std. Deviation	Skewness	Kurtosis
Attitude toward TSIME	Lecturer	154	4.06	.786	-1.004	1.687
	Student	338	3.57	1.046	-.260	-1.066
Overall satisfaction	Lecturer	154	4.22	.698	-1.618	5.919
	Student	338	3.80	.980	-.488	-.728
Likelihood to access and use TSIME	Lecturer	154	3.43	1.143	-.501	-.410
	Student	338	3.24	1.216	-.315	-1.140

Nevertheless, with a rather lower mean of 3.80, the students had the least rating of satisfaction as compared to the lecturers. The kurtosis for the distribution of the students was the least, and being negative, generally confirms the lack of consensus among the students, as also verified with the relatively high standard deviation. The lecturers seemed to be more likely to access the TSIME platform than the students from a descriptive point of view. The difference between the attitudes between the lecturers and the students was statistically significant, the ANOVA test was computed, Table 13.

Table 13
ANOVA test on dependent variables

		Sum of Squares	df	Mean Square	F	Sig.
Attitude toward TSIME	Between Groups	25.137	1	25.137	26.587	.000
	Within Groups	463.270	490	.945		
	Total	488.407	491			
Overall satisfaction	Between Groups	18.574	1	18.574	22.855	.000
	Within Groups	398.212	490	.813		
	Total	416.787	491			
Likelihood to access and use TSIME	Between Groups	3.659	1	3.659	2.569	.110
	Within Groups	697.821	490	1.424		
	Total	701.480	491			

From the outcome, two variables had $p < 0.05$, with the lecturers being significantly positive towards the use of the TSIME platform as compared to the students. It, therefore, explains the notion that if lecturers have a negative attitude towards the system that mainly translates to students as well. It becomes difficult for students to have a positive attitude while the lecturer perceives it the other way. In other words, the lecturers were more satisfied with the system than were the students.

However, based on the outcome for the other variable, $F(1, 490) = 2.569$; $p = 0.110 > 0.05$, and with the *p*-value exceeding the cut-off point, the conclusion can be drawn that there was not enough statistical evidence that the difference in the ratings of the likelihood to use TSIME was statistically significant. Hence, while the likelihood to use TSIME by the lecturers was higher than that for the students, the difference was not so significant and thus, it can be argued that the level of use was at par. The main reason in this regard could be the fact that owing to the mandatory embracement of the TSIME platform, the usage aspect would probably not be affected by one's attitudes nor satisfaction. However, the latter would probably be pivotal towards the amount of time spent using the TSIME portal.

5.4. Testing of research hypotheses

The research overall sought to test the hypotheses as mentioned in the section above. The research being multivariate, Structural Equation Modelling (SEM) was considered as the optimal approach to the evaluation of the research hypotheses (Field, 2016; Hair et al., 2010). SPSS Amos v25 was used since it is a covariance-based SEM tool and was optimal owing to the sample size which was adequate (Finney & DiStefano, 2006). To further help validate the appropriacy of the use of SEM, the other key assumption was identified as being multivariate normality (Hair et al., 2010). The overall evaluation of multivariate normality for both the student and lecturers' datasets is presented in Table 14.

The multivariate critical ratio (c.r.) was 4.485, while the multivariate kurtosis was 8.114. As argued by Satorra and Bentler (2010) and Hair et al. (2010), multivariate critical ratios < 1.96 suggest that the kurtosis is not significant. In this case, with a ratio of 4.485 > 1.96, it follows that the multivariate kurtosis was significant.

Table 14
Multivariate normality

Variable	Min	Max	Skew	C.R.	Kurtosis	C.R.
InteractionandFeedback	1.400	4.600	.443	2.246	-1.258	-3.186
ContentAvailability	1.500	4.625	-1.012	-5.125	-.347	-.878
Ethical	1.286	5.000	-.724	-3.667	-.742	-1.879
DesignQuality	1.286	4.857	-.832	-4.215	-.697	-1.765
Attitude	1.000	5.000	-.995	-5.039	1.594	4.038
Satisfaction	1.000	5.000	-1.602	-8.116	5.690	14.414
Use	1.000	5.000	-.496	-2.515	-.435	-1.103
Multivariate					8.114	4.485

The multivariate critical ratio (c.r.) was 4.485, while the multivariate kurtosis was 8.114. As argued by Satorra and Bentler (2010) and Hair et al. (2010), multivariate critical ratios < 1.96 suggest that the kurtosis is not significant. In this case, with a ratio of 4.485 > 1.96, it follows that the multivariate kurtosis was significant.

The latter is supported by the fact that Cohen, West, and Aiken (2003) suggest a minimum multivariate kurtosis of 7.0, while Hair et al. (2010), suggest a minimum of 3.0. Yet, in light of the findings, the computed multivariate kurtosis was 8.114 and exceeded both thresholds, and in this regard, the researchers confirm that the dataset met the multivariate normality assumption for the use of the SEM approach towards the evaluation of the research hypothesis. The resultant Structural Equation Model is presented in Fig. 4.

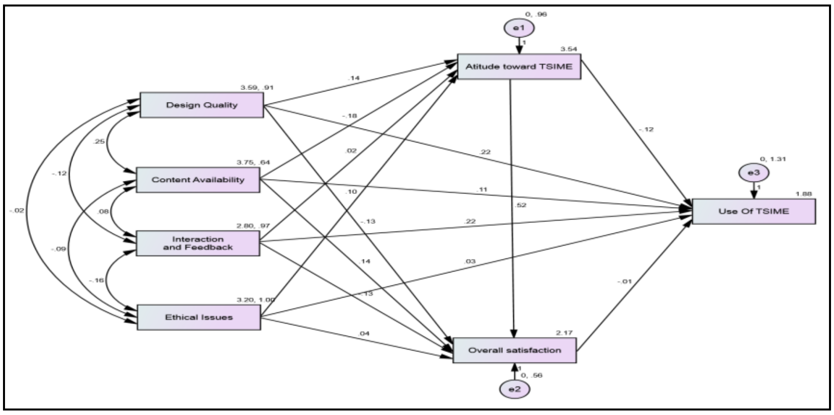

Fig. 4. Structural equation model

From the research outcome, with respect to the attitudes, three factors had a significant influence, with respective *p*-values being < 0.05, as shown in Table 15. The most significant was content availability ($p = 0.003$), while the second was design quality and the third being ethical issues. The non-significant exogenous variable was interaction and feedback.

Table 15
SEM regression weights

			Estimate	S.E.	C.R.	P
Attitude	<---	DesignQuality	.140	.050	2.810	.005
Attitude	<---	ContentAvailability	-.179	.060	-3.009	.003
Attitude	<---	InteractionandFeedback	.016	.046	.338	.735
Attitude	<---	Ethical	.099	.045	2.196	.028
Satisfaction	<---	DesignQuality	-.126	.038	-3.283	.001
Satisfaction	<---	ContentAvailability	.141	.046	3.047	.002
Satisfaction	<---	InteractionandFeedback	-.133	.035	-3.742	***
Satisfaction	<---	Ethical	.035	.035	1.014	.311
Satisfaction	<---	Attitude	.522	.035	15.083	***
Use	<---	Attitude	-.120	.064	-1.879	.060
Use	<---	DesignQuality	.221	.059	3.736	***
Use	<---	InteractionandFeedback	.221	.055	4.036	***
Use	<---	Ethical	.030	.053	.577	.564
Use	<---	Satisfaction	-.011	.069	-.162	.872
Use	<---	ContentAvailability	.106	.071	1.493	.135

From a satisfaction perspective, three of the four independent variables significantly influenced the satisfaction of the TSIME platform users. These include design quality, content availability as well as interaction and feedback. Of the three, the most significant was interaction and feedback (p = 0.000), while the second-rated was design quality (= 0.001) and content availability was the third (p = 0.002). The non-significant factor influencing satisfaction was ethical issues ($p = 0.311 > 0.05$). Attitude towards the use of TSIME had a significant influence on the overall satisfaction with the use of TSIME, and the relationship had a significantly high regression coefficient of 0.522, along with the relationship being significant at the 99.9% confidence level (p = 0.000).

From a user perspective, of the four principal independent variables, only two factors were key, and these include design quality as well as interaction and feedback. While the unstandardized regression weights were similar (0.221), considering the standardized regression coefficients, interaction and feedback was considered to be the highest (0.183) against 0.117 for design quality. Ethical issues, as well as content availability, were computed as not influencing the use of the TSIME platform ($p > 0.05$). Also, attitude toward TSIME, as well as satisfaction with the use of TSIME, did not influence the use of TSIME. As argued earlier, the most likely reason behind the non-significance of user attitudes or user satisfaction towards the use of the TSIME platform point to the mandatory embracement of the TSIME platform. In this regard, both the students and the lecturers would be obliged to use the system. The respective standardized coefficients are presented in Table 16 and the respective model fit tests are tabulated in Table 17.

Table 16
SEM standardized regression weights

			Estimate
Attitude	<---	DesignQuality	.134
Attitude	<---	ContentAvailability	-.144
Attitude	<---	InteractionandFeedback	.015
Attitude	<---	Ethical	.099
Satisfaction	<---	DesignQuality	-.131
Satisfaction	<---	ContentAvailability	.122
Satisfaction	<---	InteractionandFeedback	-.142
Satisfaction	<---	Ethical	.038
Satisfaction	<---	Attitude	.565
Use	<---	Attitude	-.100
Use	<---	DesignQuality	.177
Use	<---	InteractionandFeedback	.183
Use	<---	Ethical	.026
Use	<---	Satisfaction	-.009
Use	<---	ContentAvailability	.071

Table 17
SEM baseline comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	1.000		1.000		1.000
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

From the results, maximization was attained, and the Normed Fit Index (NFI) was > 0.9 (Cohen, West, & Aiken 2002; Finney & DiStefano 2006), and so were the Incremental Fit Index (IFI), and the Comparative Fit Index (CFI), all whose computed coefficients were > 0.90, thus confirming that the model fit was acceptable. Based on the results, the following null hypotheses were accepted concerning attitude or perception by the users.

***H1**: The quality design of TSIME has a positive effect on user satisfaction*

***H2**: The quality design of TSIME has a positive effect on user attitude/perception*

***H4**: The content availability of TSIME has a positive effect on user satisfaction and perception/attitude*

***H5**: The content availability of TSIME has a positive effect on user perception/attitude*

***H10**: The ethical issues of TSIME have a positive effect on user satisfaction on usage*

***H11**: The ethical issues of TSIME have a positive effect on user perception/attitude on usage*

However, regarding interaction and feedback to attitude towards use, the null hypothesis is rejected therefore accepting the alternative H7, H8.

H7: *The interaction and feedback of the TSIME negatively affect the user's satisfaction towards the system*

H8: *The interaction and feedback of the TSIME negatively affect the user's perception/attitude towards the system*

Concerning overall satisfaction, the attitude has a positive effect on the overall usage of TSIME hence, the null hypothesis was accepted.

H14: *Attitude has a positive effect on the use of TSIME*

The results also showed that overall satisfaction has no positive effect on usage, hence the alternative hypothesis is accepted.

H15: *overall satisfaction has a negative effect on the use of TSIME*

Regarding the use of TSIME, however, the independent variables design quality, as well as interaction and feedback, have a positive effect on the usage of TSIME, therefore, the null hypotheses were accepted.

H3: *Design quality has a positive effect on the likelihood to use TSIME*

H9: *Interaction and feedback have a positive effect on the likelihood to use TSIME*

The revised overall conceptual framework with the accepted hypotheses from the results is shown in Fig. 5.

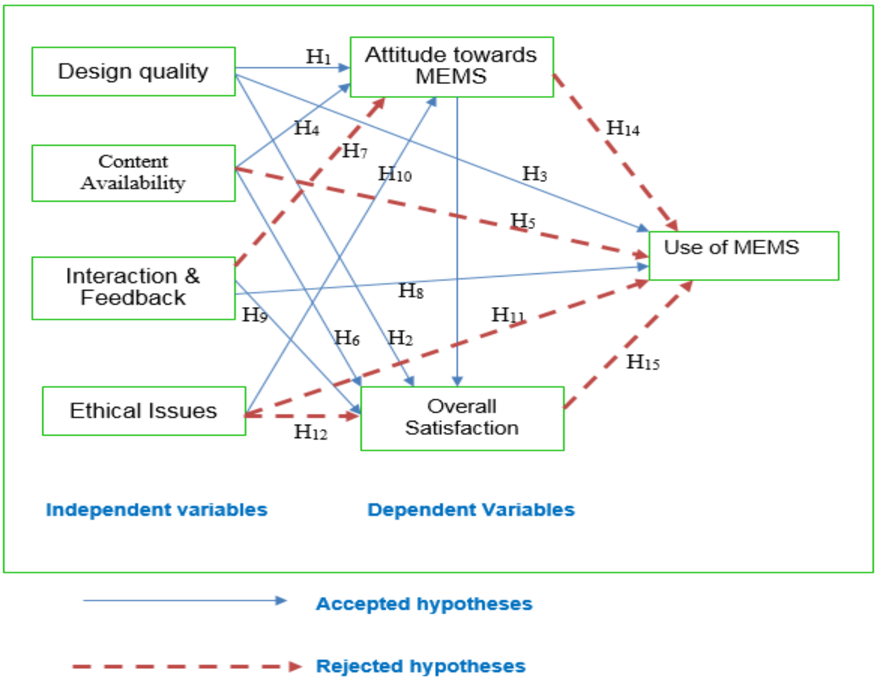

Fig. 5. Revised conceptual framework

Out of fifteen hypotheses, six were rejected and nine were accepted (see Fig. 5).

6. Discussions

6.1. Usability and user evaluation of TSIME

The study looked at the experience as a determinant factor in the usage of TSIME. The results showed that lecturers were more experienced than students. The lecturers might have been exposed to different E-Learning platforms than students. Although the experience was not tested against attitude and likelihood to use, studies by Elbitar (2015), as well as Bervell and Umar (2018), show that technology experience plays a significant role towards attitude. However, the lecturer's experience may not cascade to students' experience. It is with this regard that the experience needs to be looked in line with the MEMS characteristics (design quality, content availability, interaction and feedback as well as ethics).

6.2. Independent variables of attitude and overall satisfaction towards TSIME

The attitude dependent dimension was measured from the independent variables: design quality, content availability, ethical issues as well as interaction and feedback perspectives. The results showed that three factors: design quality, content availability and ethical issues influenced the attitude to use TSME hence the null hypotheses were accepted. The results also showed that overall satisfaction is affected by design quality, interaction and feedback, content availability and attitude towards learning hence the null hypotheses were accepted.

Design quality had a positive significance towards attitude and overall satisfaction. Both user segments, lecturers and students, positively rated design quality as a key variable to the attitude variable. A well-designed platform with a correct mix of multimedia components tends to attract users and make them want to use the platform. This auger well with previous studies by Hu et al. (2021), Ozkan and Koseler (2009) and Lanzilotti et al. (2006) who argued that the design quality of any platform plays a critical role to the attitude and likelihood to use of the platform. Although the design quality might have changed on the new platform, it cannot be measured independently of the content (Ferrer & Alfonso, 2011). The respondents might have rated design quality high due to the incorporation of SNS into the new platform.

As alluded by Mislove et al. (2007), users do feel the system is helping them if it enlights their day-to-day experiences and needs. So in another way, the role of SNS gives a new look that gives positive perspectives to both user segments. Pedagogical factors that investigate how courses are designed should apply to the design as well. Therefore, lecturers need to be trained and equipped with relevant pedagogical skills in line with how the platform is designed. Training can then cascade to the students.

Content availability had a positive effect on attitude and overall satisfaction. The content depends on information uploaded by users. If lecturers upload the correct and relevant content, students tend to feel the effect. Wong et al. (2003), argued the same about the content being a positive influence on attitude, likelihood to use and overall satisfaction. However, from a student perspective, content should not be just a repository of information without a lecturer role. The lecturer's roles include the guidance of the content and giving up-to-date information. If lecturers frequently use the platform, they will be forced to upload relevant information. What Ferrer and Alfonso (2011) pointed that content cannot be measured independently of quality, this research showed that the variables are independent and the effect of one has no role in the outcome of the other.

Experience with the use of platforms affects how the content will be uploaded with relevant training.

The study also showed that the ethics dimension positively influences attitude towards the platform but not to the overall satisfaction. Lecturers negatively perceive that student misuse academic resources on TSIME while on the contrary it was positively rated by the students. Further, the facilitation of the proper use of academic resources through adherence to academic regulations was poorly rated by the students as compared to the rating by the lecturers. It seems lecturers have a divergent view of misuse by students while students have also the same notion. It is the notion of lecturers that students cheat. If a minor proportion of students are found to be cheating, lecturers always paint the students as a whole to be perpetrators. Khan (2006) alluded to the role of the institutional dimension towards the ethics dimension. The institution should enforce these ethical malpractices with stringent measures to those who try to have the practice. They influence the attitude towards use. However, if students see a loophole and the MEMS and lecturers do not detect the malpractice, student attitude towards the platform will be negative.

Fig. 4, though interaction and feedback are provided by MEMS, have shown that they may not give the correct attitude towards use. The study also showed that lecturers were not necessitating the formation of student groups for collaborative learning. It means MEMS might be interactive and offering feedback, but users still may have a bad attitude towards it. In addition, for students who are mainly beneficial in terms of usage, the results from the study reflect that if lecturers do not use the MEMS it cascades to students. This explains a similar study by Bervell and Umar (2018) who emphasized the role of the instructors to attitude towards use which had a negative role to attitude, this might be a reflection on the gadgets used by both students and lecturers.

Both sets of users were mainly using desktops and laptops to access TSIME hence the facilities offered by the SNS may not be fully utilized. The learning institutions can allow the concept of bring your own device and limit the devices to a certain number. The use of desktops might not auger with the SNS that may be popular to students than lecturers. Hence the right attitude should be shown by lecturers first as they are the initiators of the learning. It, therefore, explains the notion that if lecturers have a negative attitude towards the system that mainly translates to students as well. It becomes difficult for students to have a positive attitude while the lecturer perceives it the other way.

6.3. Attitude towards the use of and overall satisfaction with TSIME

Attitude towards the use of MEMS is affected by the design quality, content availability and ethical issues. For a user to have a good attitude to use MEMS, the MEMS must have good design quality with content that should always be available also taking into consideration the ethical issues. However, it is not only the right attitude that gives the overall satisfaction as eluded by Ajzen (2005) and Bervell and Umar (2018) but other factors like the background of the users, their experience in using technological gadgets. From the system perspective, overall satisfaction is affected by the attitude in line with content availability, design quality, and interaction and feedback.

6.4. Likelihood to use TSIME

From a user perspective, of the four principal independent variables, only two were the key factors that affected the likelihood to use TSIME, hence we accepted the null hypothesis. These were design quality as well as interaction and feedback. If a system is interactive to users, the likelihood to use TSIME is high. However, the mandatory embracement of TSIME to all users might have played a role in the overall satisfaction and attitude which had a negative effect on the use. This is contrary to studies done by Almarashdeh, Sahari, and Zin (2011) and Asarbakhsh and Sandars (2013).

That means for users to generally be satisfied with any MEMS, consideration should be taken on the design quality, content availability, interaction and feedback and then also looks at the attitude of the users.

The usage of MEMS is mainly affected by design quality and interaction and feedback. In any case, if MEMS are to be considered in terms of usage thereby giving value to the users, they must be designed with quality and offer interaction and feedback to the users.

7. Conclusion

7.1. Summary of the findings

Findings from the study show that the experience of users influences MEMS usage especially the lecturers which may then cascade to students. The key findings reveal the need for training to users looking at their background. From the independent variables that were the key variable construct dimensions, findings show that ethical issues and content availability were not influencing the use of TSIME while attitude had an effect on overall usage and satisfaction. Institutions should enforce ethical issues to users. Interaction and feedback, as well as design quality, have a significant effect on the likelihood to use TSIME. The attitude dimension is affected by the design quality, content availability and ethical issues.

7.2. Implication for theory

The results strongly support usability testing and evaluation of MEMS. A poorly designed and implemented MEMS, offer poor interaction and feedback to the users. It is not only the interaction and feedback dimension but also the design quality. However, though MEMS should provide good interaction and feedback as well as good quality design, the issue of training of the users is fundamental, especially for lecturers. If lecturers embrace MEMS, this will cascade to students. One way is to make the learning through MEMS mandatory to all lecturers and students especially in the world pandemics such as COVID-19.

7.3. Recommendation for practice

Institutions can include multimedia E-Learning gadgets to be part of the fees so that every student and lecturer can all have the necessary E-Learning tools. Another way is to subsidize the learning gadgets to affordable prices for both the students and lecturers. About students partaking in the learning through MEMS, is to integrate with different social media which they almost use daily into the learning environment. Learners tend to create knowledge through their day-to-day social patterns that will have been integrated into MEMS. Also, they create interest and develop skills independent of others through sharing ideas and experiences with the platform. Through multimedia E-Learning, users have confidence and feel the presence when grasping tasks.

The lecturers then play a peripheral role. However, this needs higher educational institutions to undertake the financial burden that is needed to do such changes as the return of investment is high. MEMS should be dynamic and move with the user learning trends rather than operate for a long time without changes done as it becomes merely a resource dumping. Now and then the systems should be changing and being integrated with the new user needs. Training is overly critical to both users. Lecturers need to be trained on pedagogy that will be in line with multimedia platform usage. Of critical to the users' perceptions is to identify the user background and social experience with the ethics dimension, and then try to incorporate these in the training and integration of MEMS. Another critical dimension is the ethical issues. Institutions should punish the perpetrators that violate ethical malpractices. Poor ethical practices tend to affect student attitude, overall usage, and likelihood to use the platform. Overall acceptance and attitude tend to positively increase if MEMS are changing with the user needs. Evaluation of user needs should be regularly done, and findings incorporated into the MEMS.

7.4. Limitation of the study

The study was limited to usability testing and evaluation of a further implemented integrated MEMS from already used MEMS. In addition, the MEMS was used in a mixed learning environment (blended) but not in a distant learning environment. The views from a campus-wide environment might be different from a distant wide setup. The study also needed to include the pedagogical factors that are included in course design as well as the institutional dimensions that are considered in choosing in multimedia E-Learning set up.

7.5. Recommendation for further study

The study recommends other underpinning factors for MEMS design and acceptance such as institutional dimensions that can be evaluated through qualitative approaches and be solidified with the results from this study. In addition, factors like connectivity and costs of accessing the MEMS need to be factored especially in a distance learning environment. Lastly, the study also needs to factor in the usability testing and evaluation of mobile learning environments and integrate with this study and see how users perceive and accept the MEMS.

Author Statement

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