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Assessing technology integration in teaching and learning within open distance education

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ABSTRACT

Technology for teaching and learning in engineering is assessed in this study on specific variables related to graduate attributes, assessment, technology use and student performance in open distance education. The results revealed the consistency of the variable measurements. Technology was shown to be very satisfactory for all variables, which displayed generally some degree of acceptable correlation. Hence, the variables under investigation were consistently interrelated and correlated when considering technology as common element to the variables. The use of software or other technological tools were also shown to be satisfactory in the context of school of Engineering, University of South Africa

Keywords: Assessment, Graduate Attributes, Learning and Technology.

1. INTRODUCTION

Teaching and learning have witnessed a drastic change in the last decades due to the development of information and communication technology (ICT), that offer electronic means to support education. Just to name few; desktops, laptops, notebooks, and cell phones, have become indispensable in enhancing teaching and learning through management learning systems (LMS). Hence, online learning has been supported via platforms such as Wimba, WebTycho, Sakai, Microsoft Teams, Moodle, Google Classroom etc.

This is inherent to both face-to-face and online education. The advancement of technology in education sector has seen progress as far back as the invention of pencil. Teaching and learning had adopted different strategies and tools like chalkboard, radio, film projector, video, personal computer, CD ROM Drive and so on. However, we are at the era of fourth industrial revolution where the inclusion of social media, virtual learning and simulation in teaching and learning is a reality. The essence is to improve the overall learning objectives and outcomes [1]. The cloud computing has also become the reality of improving nowadays' teaching and learning in higher education [2]. The existence of web technology with all communication software such as email, discussion forum, blogs and so on have made possible both synchronous and asynchronous modes of teaching and learning. Hence, virtual and in-person education in institutions of higher learning is enabled [3].

There are many advantages of technology use in education, for example, learning is self-directed and independent as students do their tasks and activities at their own time, pace, and space [2]. Hence, the geographical isolation and limited access to face-to-face learning [4] are no longer an issue. Technology providers have made possible online synchronous learning. These learning opportunities are self-directed and do not require a human to facilitate learning, rather, technology officiates/facilitates the learning process, and, in the asynchronous e-learning context, the learner negotiates meaning independently. Distance education mediates learning through technology and has given an opportunity to study to many people since space and time are no longer a barrier to teaching and learning. On the other hand, online asynchronous learning enables self-learning and brings a balance between personal life and work [4]. Despite the many advantages of technology use, there are disadvantages that need to be pointed out, some of which are poor internet connection,

lack of digital skills and lack of physical social interaction [2]. Irrespective of the challenges, technology integration into teaching learning has become indispensable.

The University of South Africa (UNISA) is an open distance institution that has existed 150 years ago and has been championing in Africa and beyond the use of technology to mediate teaching and learning. It also offers the newly implemented engineering technology programmes, which are based on graduate attributes. These are gauged through continuous assessments, where students should demonstrate competencies or performance level. Therefore, this study takes the opportunity to evaluate preliminarily technology use for teaching and learning, especially for these new programmes, by using students as participants.

2. METHODOLOGY

Non-probability sampling

A non-probability sampling, specifically purposive sampling, was suitable for the survey to obtain responses from engineering students at the UNISA. A questionnaire was used and designed in the functionalities of https://forms.office.com. Five variables were considered associated with identical scale option, which are (a) Level of technology use in different modules in engineering (TechUse); (b) Technology is an added value to graduate attribute (GA), (c) Alignment between technology and the purpose of assessments (Ass), and (d) Technology significance for student performance (Perform). Besides, the last variable, type of technology, which has its own scale option.

Qualitative research method

Qualitative research method was used to obtain the students' perceptions on integrating technology into teaching and learning. Perceptions were then converted into scale from 1 to 3, with 1: very satisfied, 2: satisfied and 3: need improvement, whereas for the last variable options 1, 2 and 3 were associated with software, related tools, and none respectively. Hence, descriptive statistics was used in the analysis of the results.

Reliability analysis

The reliability analysis was conducted to determine consistency, stability, and dependability of a measurement derived from the questionnaires. Hence, Cronbach Alpha coefficient and the online available freeware were used [5]. The values of this coefficient are between 0 and 1 related to internal consistency, which shows the degree to which all the items being tested measure the same concept [6]. Hence, Alpha coefficient translates and reflects how well items within a test are inter-related. A rule of thumbs value level of reliability Cronbach's alpha used by Ahdika, 2017 [7] as adapted from Hair *et al.*, 2010 [8] was followed. Table 1 shows how the frequency of each scale level of variableP measures were calculated from the participants' responses. Pearson correlation was computed for the different variable pairs to evaluate the strengths of association among the variables. A rapid assessment of correlation coefficient was based on the usual rule of thumb (Table 2).

Table 1: Reliability based on values of Alpha

Value of Alpha	Reliability
0.0 <Alpha <=0.2	Less reliable
0.2< Alpha <= 0.4	Rather reliable
0.4 < Alpha < =0.6	Quite reliable
0.6 < Alpha < =0.8	Reliable
0.8 < Alpha < 1	Very reliable

Table 2: Pearson correlation coefficient range based on linear regression

Value of R	Correlation strength
0.0 <R< =0.1	Absence of correlation
0.1<R<= 0.3	Low correlation
0.3 <R< =0.5	Intermediate correlation
0.5 <R<= 0.7	Strong correlation
0.7 <R< =1	Very strong correlation

3. RESULTS AND DISCUSSION

Reliability of participants' responses

Results of reliability of the responses from participants are shown in Table 3 and the focus is more on the Cronbach Alpha coefficient.

Table 3. Calculated Cronbach Alpha and related statistics

Items	Cronbach Alpha	Std. Alpha	G6(smc)	Average R
All items	0.732	0.725	0.708	0.397
GA excluded	0.774	0.777	0.726	0.537
Ass excluded	0.594	0.598	0.544	0.332
TechUse excluded	0.540	0.542	0.462	0.283
Perform excluded	0.708	0.699	0.657	0.436

These results as shown in Table 3 revealed the degree of consistency to which the survey questionnaire measured the responses from the different participants. The responses were deemed to be acceptable and consistent since the values of Cronbach Alpha were relatively high.

Frequency of scale level of different variables

Figure 1 (a)-(e) showed that the proportion of students who were very satisfied, was the highest for all variables under investigation. This was followed subsequently by satisfaction and need improvement levels. Students scored higher software usage, followed by related tools. Hence, it was found that all modules used teaching software or related tools. This could be a positive sign to enhance learning. Some of the important characteristics of the different variables are represented in Table 4.

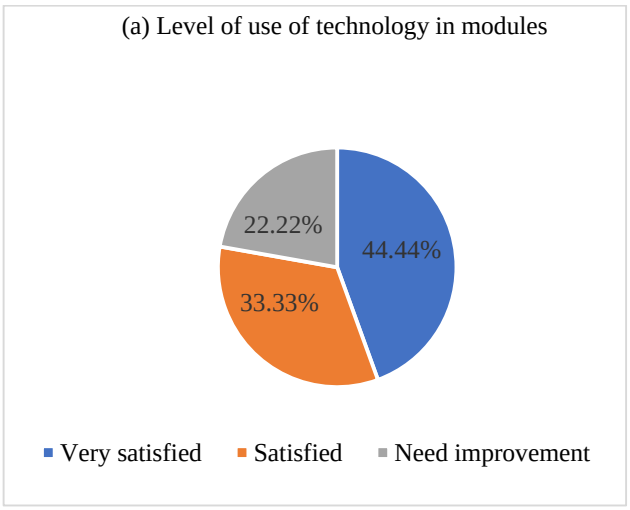

Figure 1. (a) Level of technology use in different modules in engineering (TechUse)

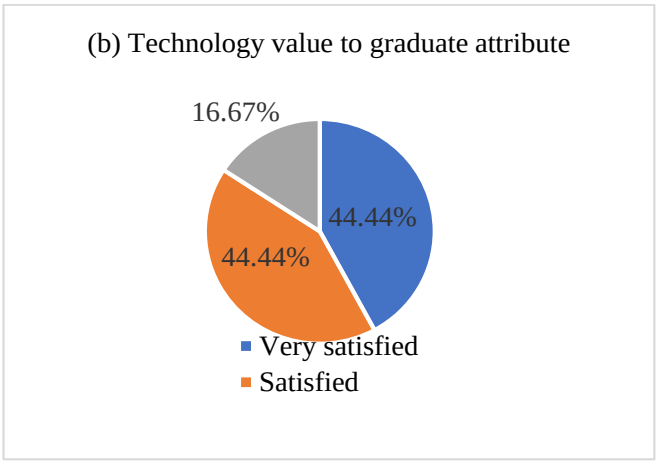

Figure 1. (b) Technology is an added value to graduate attribute (GA)

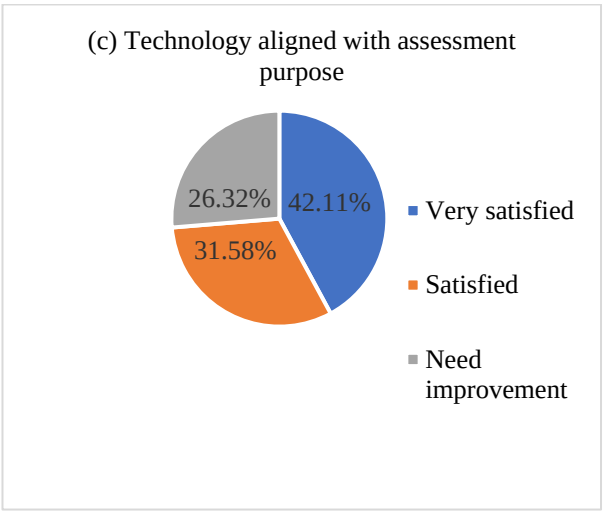

Figure 1. (c) Alignment between technology and the purpose of assessments (Ass)

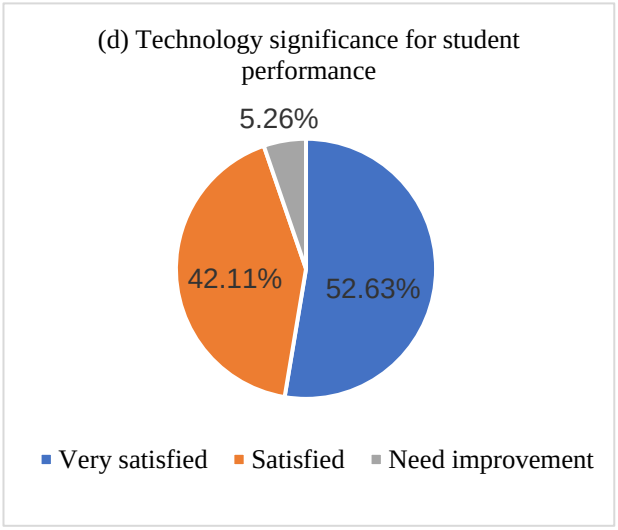

Figure 1. (d) Technology significance for student performance (Perform)

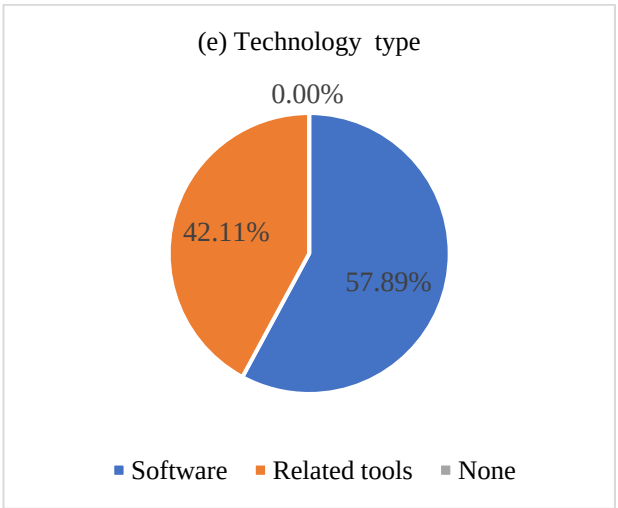

Fig. 1. (e) Type of technology.

Table 4. Basic statistical characteristics of students' perceptions on technology integration

	GA	Ass	TechUse	Perform	Type
Mean	1.74	2.11	2.16	1.63	1.42
Standard Error	0.17	0.20	0.21	0.14	0.12
Median	2	2	2	2	1
Mode	1	3	3	2	1
Standard Deviation	0.73	0.88	0.90	0.60	0.51
Sample Variance	0.54	0.77	0.81	0.36	0.26
Kurtosis	-0.88	-1.71	-1.75	-0.55	-2.11
Skewness	0.47	-0.22	-0.34	0.31	0.35
Confidence Level(95.0%)	0.35	0.42	0.43	0.29	0.24

The lowest average showed that generally perceptions were more between satisfactory and very satisfactory levels for GA, Perform and type variables. However, Ass and TechUse, on average, were between satisfactory and need for improvement. The marginal frequency distribution for each variable could be roughly not departing from its mean value since the skewness coefficient values were close to zero. The responses related to students' perceptions did not show high variability.

Strength of correlation

The correlation values between the different variables under investigation are shown in Table 5.

Table 5. Level of association between variables for technology integration

	GA	Ass	TechUse	Perform
GA	1			
Ass	0.31	1.00		
TechUse	0.32	0.68	1.00	
Perform	0.15	0.40	0.53	1

These results revealed that correlations among variables were all positive. It could mean that there was some degree of correlation among variables. They ranged from low to high correlations. The lowest correlation was between the technology alignment and graduate attribute and technology significance for student's performance. This signals the existence to some degree of the association between performance of student and graduate attribute, but such association is not solely attributed to technology use, as a medium of instruction to achieve good results, in online education. To enhance further online education, technology integration should be explored to include aspects from the recent irresistible applications of artificial intelligence (AI). Hence, innovative teaching applications put more emphasis on deep-learning techniques [9], such as peer cooperation, task-oriented or problem-oriented learning, in this way one could cater for multi-dimensional learning and explore ways for cultivating future learners across the board [10]. This study opens an opportunity for UNISA to incorporate AI in teaching and learning methodologies. This may include in-depth learning, engagement of fewer teaching staff, instantaneous feedback, and innovative assessment methods [11].

4. CONCLUSIONS

Technology is indispensable in online education, specifically in digital era and enable to achieve learning outcomes of teaching and learning. This preliminary study has shown that technology plays pivotal role for students to achieve acceptable performance, in relation with graduate attributes, which are tests in different assessments in the school of engineering. Nonetheless, areas of improvement were noticed for integrating technology into teaching and learning, specifically for aspects related to alignment between technology and the purpose of assessments, and level of technology use in different modules. Increased sample sizes for such a study should be considered in future, to have a holistic understanding of integration of technology in teaching and learning and this study could be adjusted and extended to other faculties of the university. The influence of technology usage on student performance should be investigated.

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