



Integrating technology in teaching and learning in universities in Lesotho: opportunities and challenges

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Abstract

Technology is now considered a critical toll in enhancing teaching and learning in universities owing to the fact that the ubiquitous nature of technology now allows students to access education from anywhere, at any time and at their own pace. The purpose of this study therefore was to investigate the extent to which universities in Lesotho have integrated technology in teaching and learning as well as identify factors that act as challenges and opportunities to effective integration technology in the universities. A quantitative research approach which utilised a structured questionnaire was employed to gather information while SPSS version 21 was also used to analyze data. A stratified random sampling technique was employed to select a sample of 125 lecturers from three universities to participate in the study. Results of the study showed that the level integration of technology into teaching and learning is overall not quite high and the following basic technology tools are being used to support the integration: use of learning management systems, projectors, computers and online activities. It also emerged from the study that factors that include opportunities for individualised staff development, availability of technical support, availability of a fair supply of infrastructure, continuous professional development act as the major opportunities for enabling effective technology integration. Results of the study also showed that limited financial resources, limited investment in new technology, lack of systematic and sustainable approaches for staff development to support effective technology integration were some of the major challenges faced.

Keywords Technology integration · Challenges · Opportunities · Teaching · Higher education · Technology tools

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1 Introduction

The integration of technology in higher education is now regarded as essential for the enhancement of the students' learning experiences and in the context of Lesotho, technology integration is still work in progress and is quiet slow. Despite the slow pace with which technology integration is being done in these universities, there is no known study that has been conducted to investigate challenges lecturers face in the process. Blended learning, which is mainly defined as the integration of the combination of face-to-face and technology can enhance students' perceptions of their learning environment and subsequently, their study experiences, learning outcomes, and ultimately academic achievement. In the context of Lesotho, educational stakeholders view educational technology as an effective way of enhancing teaching and learning. The main partners in Lesotho namely SchoolNet, Microsoft STIC and NEPAD e-School Projects are focusing on eLearning initiatives. Unfortunately, the current projects are concentrating on secondary and high schools in Lesotho with institutions of higher education being neglected. Internationally, institutions of higher learning are integrating technology as tool for enhancing the learner's experience, increasing learning effectiveness, convenience and access and enabling a cost-effective mechanism (Graham 2009). The introduction of these technologies within and outside the traditional classroom has transformed the global environment of higher education within institutions. These technologies can support and mediate the learning process significantly improving the quality of the teaching and learning experience (Council on Higher Education 2013). Various technological platforms have been developed and several teaching models outlined.

The impact of technological transformation and the growing role of ICT in society have driven to the adoption of technology in education. Institutions of higher education had to invest in technology (Ahmed and Kurshid 2015) in response to these global changes. The general rational of integrating technology in higher education is the belief that technology will present enormous concrete positive changes (Maguire 2005). In fact, ICT coupled with adequate pedagogical strategies does enable learners to better engage in their higher-order thinking (Lim 2007). A further rational can be drawn from a study by Adel and Dahmani (2008) on the impact of ICT on Student Performance in Higher Education which examined the relationship between the use of information and communication technologies and student performance. Their findings show that the integration of ICT in the teaching and learning process profound impact on the process of learning as it offers new possibilities for learners and lecturers. On the part of the government of Lesotho, to demonstrate the importance to which the government attached to the need to integrate technonlogy into education, the government came up with a higher education policy on Information Communication technology and its integration in education (Council For Higher Education 2013). The main tenets of the policy were: "*(i) to enable all HE Public Institutions in Lesotho to upgrade their ICT facilities in order to enhance and support teaching and learning, research and other functions, and (ii) to devise and implement strategies for HE Public Institutions to make effective use of ICTs in order to improve the quality and cost-effectiveness of their operations.*" (Council on Higher Education 2013).

The study was guided by the following research questions:

- What are the different educational technology tools that are mostly used by lecturers in universities in Lesotho?
- Which factors affect the effective integration of technology in universities in Lesotho?
- Which factors act as enablers of integration of technology in universities in Lesotho?
- How do biographic factors influence the integration of technology in universities?

2 Literature review

2.1 The concept of educational technology

Integration of technology in education relates to the use of technology to enhance teaching and learning and can be best understood in the context of the following six scenarios of learning: face-to-face, self-learning, asynchronous, synchronous, and blended learning (Negash et al. 2014). From these learning scenarios, it can therefore be observed that the ubiquitous nature of technology provides students with a multiplicity of options to access learning by allowing learning to occur anywhere and anytime and at their own pace (Gábor and Peter 2015).

2.2 Levels of technology integration in higher education

According to Hertz (2011), levels of technology integration in higher education ranges from sparse, basic, comfortable to seamless. Sparse integration represents rare use or rare availability of technology. Technology is rarely integrated into education. At the basic level, the usage or availability of technology is mostly in the lab, other than in the classroom. At the comfortable level, there is regular use of technology in the classroom. At this level, learners are conformable with various educational technology tools for learning and to create classroom projects. With regard to the seamless level, technology is employed daily in and outside the classroom for learning and for creation of projects as well as completion of assignments.

2.3 Approaches to effective technology integration in higher education

Adequate goals, expectations and effective criteria need to be developed for effective integration of technology in the teaching and learning process (Adbullah 2016). Internationally, there has been an increased recognition on the importance of integrating technology in the teaching and learning process. However, ‘specific use models of integrating technology in education remain broad and ill-defined’ (Price 2015). However, among some of the approaches that can facilitate effective integration of technology in higher education include the systematic, top-down, bottom-up, inside-out, and supportive approaches.

2.3.1 Systematic approach

According to Ayotola and Abiodun (2010), for effective integration of technology in the traditional classroom environment, a systematic approach should be considered which is a combination of top-down, bottom-up and inside-out processes (approaches).

2.3.2 The top down approach

This approach targets the management of the organization. Institutional management comes up with strategic plans and policies about acquisition, use and management of information technology facilities in the organisation. This also includes staff development of staff responsible for the use of the technology.

2.3.3 The bottom up approach

This approach includes implementing staff identifying areas of their technical competencies needing improvement and proposing staff development options. It also includes implementing staff proposing strategies for effective integration of technology in their departments.

2.3.4 The inside-out strategy

This strategy recognises the fact that “it is not the effectiveness of technology that determines if the technology will be used but the teacher’s perception of its efficiency” (Etmer (2005) cited in Ayotola and Abiodun (2010)). In this context, the attitudes, perception and behavior of students and lecturers should be considered as an important element in the effective integration of technology in higher education institutions. The above approaches resonate with factors which Bitner and Bitner (2002) proposed as being critical for effective integration of technology into higher education. These factors include: i) educators being encouraged to overcome fears of transformation, ii) educators must be trained on basic computer skills usage, iii) educators have to attain time management skills for efficiency and productivity as this will enable sufficient time for curriculum planning, iv) a pedagogical model for computer usage in the classroom has to be availed, v) a learning model for students to utilize in their search for information and knowledge acquisition has to be available, vi) a supportive environment which encourages experimentation, vii) Presence of on-site technical support in the institution.

2.4 Factors that affect the effective integration of technology in education

The integration of technology into higher education is a complex process. This is compounded by the fact that many of the HEIs embraced the integration of technology in their institutions without adequate institutional policies and strategies defined through enabling frameworks for developing and implementing the integration (Sife et al. 2009). Failure by many of the HEIs to build critical masses of support around the new technological has been a major challenge when integrating technology in higher education (Sife et al. 2009). The staff awareness and positive attitudes towards the new

technologies is essential in building support around the idea of effectively integrating technology in higher education. To address this problem, a full involvement of the stakeholders in the integration process is a key element (Sife et al. 2009).

Another challenge is that in some instances, the administrative support departments are not availed to support the teachers and students during the integration process leaving both staff and students with unresolved technical difficulties leading to demoralisation (Sife et al. 2009). Sife et al. (2009) argue that adequate technical support is not being available due to the few experts in developing countries. Failure by both staff and students to adopt and adapt to new roles as demanded by new technology is another challenge that is affecting effective integration of technology in HEIs. The integration of ICT in HEIs does not only deal with new technological hardware and software but should lead to the students and trainers adopting new roles and behaviors in the teaching and learning process (Sife et al. 2009).

Lack of adequate financial resources is another challenge currently affecting HEIs especially due to the continuing rising costs of technology. For a successful integration of ICT in HEIs, financial resources are a crucial factor (Sife et al. 2009). Unfortunately, in Lesotho “staff members and students do not have access to basic equipment, institutional internet services are limited or non-existent due to financial constraints” (Council on Higher Education 2013)..

2.5 Benefits of technology integration in higher education

The integration of technology in the teaching and learning process is more than just the availability of computers in the classroom or teaching basic computer skills and software in a computer lab as it requires dramatic changes in the way teaching and learning have been traditionally done as traditional classrooms have now been transformed into virtual ones and traditional black boards being upgraded to digital interactive boards (Al-Alawani 2014). The use of technology in the teaching and learning process is mutating, with different phases of integration being identified internationally (Ng'ambi et al. 2016). The integration of ICT in higher education has a potential of transforming the teaching and learning process by not only enhancing the learners learning experience but it also has a potential of creating a well-rounded graduate required in this knowledge economy (Ayotola and Abiodun 2010). Benefits of integrating technology in the teaching and learning process can be categorised into impact to teaching and the teacher as well as to learning and the learner.

2.5.1 Impact on students and how they learn

The integration of technology in the teaching and learning process has changed how students learn. Technology has had an impact on essential learning aspects which include critical thinking, individualised learning, teamwork, enhanced learner concentration and cognitive information processing abilities (Maguire 2005). Most critically integrating technology into higher education has led to active engagement of learners, improved student performance, improved student collaboration, improved feedback channels, as well as improved retention of information.

Active engagement and cognition Effective integration of technology in the teaching and learning process does not entail mere transmission of material to students but that students will have meaningful interaction with the content they learn through the medium of technology. In a learning environment where technology is integrated, learners tend to be more attentive and actively engaged with the learning process (Mugimu 2010). The integration of technology in the teaching and learning process goes beyond technology usability as it also impacts pedagogic and social factors in the classroom (Mugimu 2010; Gagnon 2014).

Students' performance The impact of technology on student performance has raised a number of academic arguments. In an earlier research by Gagnon (2014) it was found that there was no direct relationship between technology integration in the teaching and learning process and improvement in learners' achievement. However, a more current study by Cox (2015), found that in areas that involve higher-order thinking the integration of technology had a significant impact in the learners' achievements.

Collaboration The integration of technology in the teaching and learning process enables learners to work together in and outside the classroom. Learners can analyze and solve problems collaboratively through the use of technology (Barron et al. 2002).

Retention of knowledge Literature shows that integrating technology into the teaching and learning process is an important tool which students better retain information. In a research by Cox (2015) it was found that learners remembered more facts about the subject areas after completing the presentation when they participated in classes where technology was used than otherwise (Cox 2015). These results indicated that an effective integration of technology in the teaching and learning process does enhance the learners' retention levels.

Feedback and interactivity New technologies have created a new supporting technique for learner experience as they have enhanced interactive with enhanced feedback provision. An adequate designed system will enable the learner to have adequate evaluation of the acquired knowledge without the lecturer's interaction.

Impact of technology integration on teaching and teachers With regard to benefits of technology integration to teachers and teaching, the benefits of integration of technology in the teaching and learning process depends mainly on how lecturers view these technologies, how they personally use them and their level of ease of use of technology.

Demographic factors and technology integration A number of studies have shown the influence of demographic factors that include age, years of teaching experience, education level and gender in the integration of technology in teaching and learning in universities. Studies show that some biographic factors have influence on the integration of technology while others do not have any influence.

A study by Blackwell et al. (2014) found that teachers with more years of teaching experience have less favourable attitudes towards technology use and hence tend to use technology less often in their classrooms when compared to teachers with more years of experience. This is also confirmed in a studies by Karaca et al. (2013), National Center

for Education Statistics (2013) as well as by Shiboko (2015) who all found that teachers who have fewer years of teaching experience are more likely to use technology in their classes than teachers with more years of teaching experience. This was attributed to the fact that teachers with less years of experience have been trained in the era of technology unlike their counterparts and hence are more knowledgeable and skilled in the use of modern technology.

A study by Shiboko (2015) also showed that gender has an influence on the integration of technology in universities. The study showed that on average, females tended to have low levels of computer skills, interest and use due to their limited access to technology. An earlier study by Kay (2006) also showed that males tended to use technology in their teaching more than females.

With regard to educational levels, studies show that educational level has no influence on the integration of technology in universities. Studies by Mafote and Oluka (2012), Parette et al. (2010), Motshegwe and Batane (2015) all showed that educational level has no influence but what has influence is the technical training a person would have got on the use of technology. With regard to the influence of age on technology integration, Shiboko (2015) in her study found that younger teachers tended to use technology in the classroom more than older teachers who feel intimidated and are fearful of new technology.

3 Theoretical framework

Developed by Intel, the Intel transformation technology adoption model which is a global review of the Intel education programs which has been running for more than 10 years in more than 100 countries (Aslan et al. 2015), is used to guide the current study. In the current study integration of technology in the teaching and learning process is taken as a process of change in which teachers and students are participants. The Intel transformation technology model has four stages namely the start (early technology use), progress (developing technology use), prepared (advanced technology use), and one-to-one computing (personalized technology use). This model shows that by participating in a process of change related to teaching, 93.3% of the teachers tend to change their approaches in line with at least one of the model's success indicators, but these results vary from case to case and country to country. From the review, it was concluded that system factors in an institution can either promote or inhibit effective implementation of pedagogical changes (Price 2015). This study therefore seeks to establish to what extent technology integration, as a process of change, is being implemented in universities in Lesotho especially with regard to the four stages of the model.

4 Methodology

4.1 Population and sampling

Ary et al. (2014) define a "population as all members of any well defined class of people, events or objects. In the current study, the population was 416 academic staff in all the faculties of the 3 institutions of higher education in Lesotho was targeted for the study.

Lesotho has 3 universities, that is, one public and two private universities. A sample on the other hand is defined as a portion of the population (Ary et al. 2014). Therefore, a sample comprises of elements of a given population for an actual inclusion in the study (Vos et al. 2016). In this study, stratified random sampling which divided the population into a number of homogeneous, non-overlapping groups called strata (Cresswell et al. 2017; Vos et al. 2016) was used. It is within each defined stratum where simple random sampling was conducted. In this instance, the strata will be formed based on the degree offering institutions of higher education in Lesotho, with each institution being represented in the study much more precise than the simple random sampling. A sample of 125 lecturers from 3 universities in Lesotho was used in the study.

4.2 Data collection

The study employed a quantitative approach that used a structured questionnaire for data collection. To ensure that the questionnaire was reliable enough to collect the required data, it was first tested for internal consistency reliability using Cronbach's alpha index. Results of the test showed $\alpha = .83$ hence the instrument was considered reliable enough for the study. The instrument was also tested for content validity by subjecting it to expert opinion. Recommendations of experts were incorporated into the final instrument before administration. 125 online questionnaires were sent to the lecturers and 101 were returned making a return rate of 80.8%.

4.3 Data analysis

The researcher intends to use Statistical Package for Social Sciences (SPSS) version 24 to analyse data. A descriptive method was used to describe the distribution of the sample through frequencies, central tendency and dispersion. Hypothesis testing was done to examine how significant the relationship between technology integration and biographic factors is in universities in Lesotho. Hypothesis testing is considered as a technique of evaluating the credibility of data from the sample (Cresswell et al. 2017). One-way ANOVA was used for testing hypotheses while regression analysis was used to examine to what extent the enabling factors explain the extent of technology integration in Lesotho. Mann-Whitney U-test was used to determine the relationship between the level of technology integration and lecturers gender. For ease of analysis the research also used the criterion mean to analyse descriptive data where criterion mean is calculated from the average Likert scale values as follows: Strongly Agree (SA = 5), Agree (A = 4), Neutral (N = 3), Disagree (DA = 2), Strongly Disagree (SDA = 1). Criterion Mean (CM) = $(5 + 4 + 3 + 2 + 1)/5 = 3$. Using the CM of 3, any mean score less than 3 is considered to reflect a disagreement while any mean score above 3 shows agreement with the assertion presented.

5 Analysis of results

5.1 Demographic data

Table 1 shows that slightly more than half of the lecturers (57%) are aged between 31 and 40 years which means they are middle aged. This further means the universities

have people who are still fairly young to learn new ideas of integrating technology into their teaching processes. It is further shown in Table 1 that most of the university staff (69%) are male which means issues of diversity are still a challenge in these universities. Table 1 also shows that most of the lecturers (65%) are master's degree holders while very few (6%) are PhD holders. It shows there is still some work to get lecturers to the level of doctorate, a qualification mostly expected of university lecturers. Most of the lecturers (75%) have more than 10 years of teaching experience which means the majority of staff should be able to cope well with integrating technology into teaching and learning since they have been teaching for fairly long.

H_{02} : There is no significant statistical relationship between the level of integration of technology in universities and gender of the lecturers.

Results in Table 2 show that there is a significant relationship between the level of technology integration in higher education and the gender of a lecturer (Mann-Whitney = 632, $p = 0.00$, $p < 0.05$) with males scoring a median of 2.19 and mean rank of 41.25 while females scored a median of 2.81 and a mean rank of 60.12. These results show that female lecturers in Lesotho universities are more prone to integrating technology in teaching and learning when compared to their male counterparts.

Table 1 Biographic Data ($N = 101$)

Item	Actual numbers	Responses%
Age		
25 to 30 years	16	16
31 to 40 years	58	57
41 to 50 years	27	27
Gender:		
Female	32	32
Male	69	69
Highest educational qualification:		
Undergraduate	4	4
Honours	25	25
Doctorate	6	6
Masters	65	65
Years of teaching experience		
≤ 5 years	5	5
6 to 10 years	21	21
11 to 15 years	35	35
26 to 20 years	16	16
Over 20 years	24	24

H_{02} : There is no significant statistical relationship between the level of integration of technology in universities and level of education of the lecturers.

Table 3 shows that results were not statistically significant as $F(3, 92) = 2.033$; $p = 0.06$; $p > 0.05$, hence there was no evidence to suggest that the level of education of lecturers has a significant relationship with the level of technology integration in universities in Lesotho. This means that level of education is not a predictor of whether technology will be integrated in universities in Lesotho.

H_{03} : There is no significant statistical relationship between the level of integration of technology in universities and age of the lecturers.

Table 4 shows that results were statistically significant as $F(2, 92) = 6.674$; $p = 0.01$; $p < 0.05$, hence there was evidence that the age of lecturers has a significant relationship with the level of technology integration in universities in Lesotho. This means that age of lecturers is a predictor of whether technology will be integrated in universities in Lesotho.

H_{04} : There is no significant statistical relationship between the level of integration of technology in universities and years of teaching experience of the lecturers.

Table 5 shows that results were statistically significant as $F(4, 92) = 2.420$; $p = 0.09$; $p < 0.05$, hence there was evidence to suggest that the years of teaching experience of lecturers had a significant relationship with the level of technology integration in universities in Lesotho. This means that level of experience of lecturers is a predictor of technology integration in universities in Lesotho.

5.2 Technology tools currently in use by HEIs in Lesotho for technology integration

Results in Fig. 1 show that most popularly used tool for integrating technology into teaching and learning is the use of the projector (81%) followed by computer/laptop (73%), learning management systems (LMS) (67%), and online services (65%), and. There are no other tools used to integrate technology into teaching and learning outside these tools. These results are not a surprise as they show that lecturers in these universities continue to be attracted to the traditional projector and computer tools

Table 2 Mann-Whitney U-test between level of technology integration and lectures gender

	Type of institution	N	Median	Range	Mean Rank	Mann-Whitney	p
Score_B	Male	69	2.19	2.05–2.50	41.25	632.00	0.00
	Female	32	2.81	2.60–3.20	60.12		

Significant $p < 0.05$.

Table 3 Relationship between level of education of lecturers and level of technology integration

ANOVA	Sum of squares	df	Mean of squares	F	Sig
Between Groups	481.08	3	160.360	2.033	0.06
Within Groups	7255.11	92	78.860		
Total	7736.19	95			

Significant $p < 0.05$.

instead of the emergent learning management systems and online tools. This observation resonates with earlier observations raised in the introduction that integration of technology in higher education institutions in Lesotho is still work in progress. The relationships between the tools are cross tabulated in analysis that follow.

5.3 Relationship between online activities use and LMS use

Table 6 shows that 82% of lecturers have integrated either LMS or online activities in the teaching and of these 82%, 66% integrated both LMS and online activities in the teaching and learning process. 12% of the lecturers who have integrated online activities have not integrated learning management systems in their teaching. 16% of the lecturers have integrated learning management and but not online systems. 6% of the lecturers have integrated neither online activities nor learning management systems in their teaching.

5.4 Relationship between computers use and LMS use

Results in Table 3 show that 75% of lecturers in the selected universities in Lesotho have integrated either LMS or laptops/computers in the teaching and learning process. Of these 75%, 59% integrated both laptops/computers LMS in the teaching and learning process. 16% of the lecturers who use computers in the classroom have not yet integrated learning management systems in the teaching and learning process. 13% of the lecturers have integrated learning management systems but not computers in their teaching while the remaining 12% have integrated neither computers nor learning management systems for teaching purposes Table 7.

Table 4 Relationship between age of lecturers and level of technology integration

ANOVA	Sum of squares	df	Mean of squares	F	Sig
Between Groups	629.36	2	314.68	6.674	0.01
Within Groups	4337.71	92	47.149		
Total	4967.07	94			

Significant $p < 0.05$.

Table 5 Relationship between teaching experience of lecturers and level of technology integration

ANOVA	Sum of squares	df	Mean of squares	F	Sig
Between Groups	591.24	4	147.81	2.420	0.00
Within Groups	5620.35	92	61.091		
Total		96			

Significant $p < 0.05$.

5.5 Relationship between computers use and integration of online services

Table 5 shows that 86% of lecturers integrated either online activities or laptops/computers in the teaching and learning process. Of the 81%, 64% integrated both online activities and laptops/computers in their teaching. Only 17% of the lecturers use computers/laptops in the classroom but do not use online activities while the other 15% who use online activities do not use computers. 4% of lecturers use neither of the two technology tools. These results show clearly that the majority of lecturers who use computers in the classroom have actually integrated online activities in the teaching and learning process more that learning management systems Table 8.

5.6 Relationship between computer use and projector use in the classrooms

It is shown in the results in Table 5 that 88% of lecturers integrated either computers or projectors in their teaching. Of these 88%, 79% of the lecturers who use projectors also use computers in the classroom. 12% who use computers in the classroom do not use projectors while 9% of lecturers who use projectors do not use computers when teaching. 7% of lecturers neither use projectors nor computers in the classroom. These results have shown that to a greater extent, institutions of higher education in Lesotho have integrated both projectors and computers in the classroom Table 9.

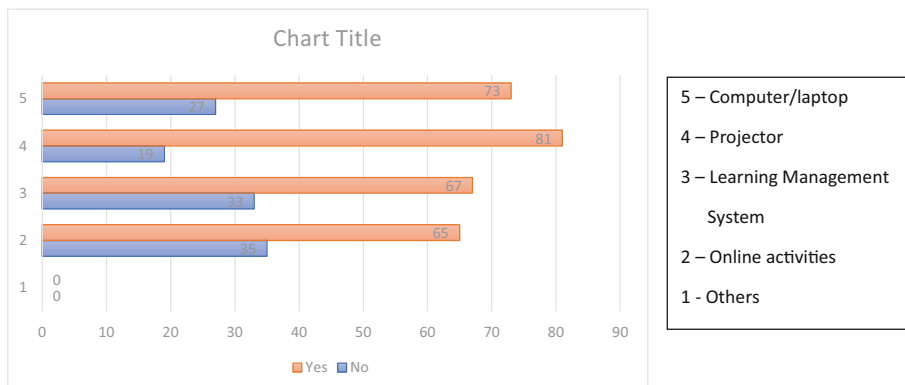


Fig. 1 Technologies integrated into teaching and learning

Table 6 Cross-tabulation: Learning management systems and online activities

		Online activities		Total
		Yes	No	
Learning management systems	Yes	66%	16%	82%
	No	12%	6%	18%
Total	78%	22%	100%	

5.7 Factors enabling integration of technology in teaching and learning

Table 10 shows that there are a number of factors that act as enablers of effective integration of technology in universities in Lesotho. From the results, it can be seen that staff development to capacitate implementing staff with the necessary knowledge and skills is take as the most important factor ($M = 4.41$; $SD = 1.0491$) in enabling effective integration of technology in the teaching and learning process in universities. Availability of technical assistance to support the integration process is also considered of paramount importance in the success of the integration process to ensure that the implementing staff are not bogged down with technical issues beyond them. Oce staff have been trained on how to integrate technology in the teaching and learning process, they would need continuous staff development so that they remain current with any changes in technology. As a result lecturers feel that continuous staff development is also very important ($M = 3.56$; $SD = 1.0617$) in enabling them to successfully integrate technology in education. Lecturers are also of the feeling that Infrastructure and support staff ($M = 3.70$; $SD = .6159$) represent a very important element in the success of technology integration in universities.

Other factors that are marginally perceived as enablers of effective integration of technology in the teaching and learning process in universities include The curriculum, pedagogy and content resources that take into consideration the integration of technology ($M = 3.08$; $SD = .8315$), adequate skills in computing ($M = 3.03$; $SD = 1.0500$), instructor involvement during the planning.

stage ($M = 3.00$; $SD = 1.0839$), and adequate time allocation for the lecturers ($M = 3.01$; $SD = 1.0371$).

Table 7 Cross-tabulation: Learning management system and computers

		Laptops/computers in the classroom		Total
		Yes	No	
Learning management systems	Yes	59%	13%	72%
	No	16%	12%	28%
Total		75%	25%	100%

Table 8 Cross-tabulation: computers and computers in the classroom

		Laptops/computers in the classroom		Total
		Yes	No	
Online activities	Yes	64%	15%	79%
	No	17%	4%	21%
Total		81%	19%	100%

5.8 Challenges to effective integration of technology in universities in Lesotho

Table 11 shows that the greatest challenge universities in Lesotho are facing with regard to the integration of technology in teaching and learning is that of inadequate resources ($M = 3.52$; $SD = .6159$) especially financial resources. The ripple effects of lack of financial resources are that the universities lack effective and sustainable approaches to integration of technology into teaching and learning ($M = 3.31$; $SD = .7300$) and also end up with limited investment in new technologies ($M = 3.28$; $SD = .5581$) to support effective integration of technology in teaching and learning. Continuous staff development opportunities in the universities, while viewed as potential enablers for effective technology integration, are also limited ($M = 3.27$; $SD = .7491$) to adequately support effective integration of technology in teaching and learning in the institutions. Results in Table 11 also show that technical support in the university during the process of integrating technology in the teaching and learning processes is adequate hence the issue of technical support from the technical departments in the universities is not a challenge at all ($M = 2.51$; $SD = .6533$). Also results in Table 11 show that overall staff in the departments have adequate expertise to be able to integrate technology in the teaching and learning process, hence the issue of expertise is not a challenge at all in the universities ($M = 2.80$; $SD = .8108$).

Based on results in Table 12, the adjusted R^2 which has a greater explanatory power than R^2 , is equal to 0.6349. This meant that 63.49% of low levels of integration of technology in universities in Lesotho is explained by the following factors: inadequate resources, lack effective and sustainable approaches, limited investment in new technologies, lack of adequate technical expertise in departments, inadequate technical support from the technical support department and limited opportunities for continuous staff development. The remaining 36.51% could be explained by other extraneous factors which were not part of this study.

Table 9 Cross-tabulation: computers * Projector in the classroom

		Projector in the classroom		Total
		Yes	No	
Computers in the classroom	Yes	79%	12%	86%
	No	9%	7%	16%
Total		88%	7%	100%

Table 10 Enabling opportunities for an effective integration of technology ($N = 101$, $CM = 3$)

Enabling Factors	Mean	S t d . Deviation
Individualized staff development to the lecturers needs	4.41	1.0491
Availability of technical assistance on demand	3.95	1.0427
Adequate time allocation for the lecturers	3.01	1.0371
Continuous staff development to support the integrated technology	3.56	1.0716
Instructor involvement during the planning stage	3.00	1.0839
Adequate skills in computing	3.03	1.0500
The curriculum, pedagogy and content resources that take into consideration the integration of technology	3.08	.8315
Infrastructure and support staff	3.70	.6159

6 Discussion of results

The purpose of the study was to investigate the status of integration of technology in the teaching and learning processes in universities in Lesotho. In doing so the study focused on technology tools used for integrating technology in the teaching and learning process in universities, level of integration done using these technology tools, enablers of and challenges to effective integration of technology in universities. With regard to technology tools used by universities in Lesotho to integrate technology in the teaching and learning process, results showed that use of computers/laptops, LMS, online activities and projectors are the main technology tools used. This then means that the integration of technology in Lesotho is still very limited with regard to technology tools used. The technology tools used are limited to the basic tools and do not go to more advanced tools such as e-real labs, flipped classrooms, robotics, artificial intelligence, gamification, and design thinking among others. This then shows that integration of technology in universities in Lesotho is still work in progress. Results further show that the current level of integration of technology in Lesotho universities despite identified constraints, is quite high meaning that universities see the importance of technology in enhancing teaching and learning. Extant literature shows that institutions of higher learning are integrating technology as tool for enhancing the

Table 11 Challenges affecting the integration of technology in the teaching and learning process

Inhibiting Factors	Mean	Std. Deviation
Unavailability of resources	3.59	.6278
Lack of effective and sustainable approaches to integration of ICT	3.45	.7361
Limited investment in new technologies	3.28	.5531
Lack of adequate technical expertise in departments	2.80	.8108
Inadequate technical support from the technical support department	2.51	.6533
Inadequate opportunities for continuous staff development	3.27	.7491

$N = 101$; $CM = 3$

Table 12 Regression model

Model	R	R ²	Adjusted R ²	Std Error of Estimate
1	0.8103	.6566	.6349	.2749

learner's experience, increasing learning effectiveness, convenience and access and enabling a cost-effective mechanism (Graham 2009). This is also confirmed by the Council on Higher Education (2013) that alluded to the fact that technologies can support and mediate the learning process significantly improving the quality of the teaching and learning experience.

The use of Learning Management Systems (LMS) particularly, which allows learning to be done even using mobile devices such as tablets and smart phones have made technology a ubiquitous tool where students can access education anytime and anywhere as confirmed by Gabor & Peter (2015) who argued that the now ubiquitous nature of technology provides students with a multiplicity of options to access learning by allowing learning to occur anywhere and anytime and at their own pace. Some of the specific reasons why universities are now investing much of their time and finances in technology is explained by the benefits integration of technology into teaching and learning produce. Such benefits include allowing for active learning and engagement, collaborative learning, more retention of knowledge, high student motivation, efficient feedback systems due to high levels of interactivity of technology systems (Al-Alawani 2014; Cox 2015; Gagnon 2014; Mugimu 2010; Ng'ambi et al. 2016).

The study further showed that there are a number of factors that act as enablers to effective integration of technology in the teaching and learning process in universities in Lesotho. Among such factors include opportunities for individualized staff development, availability of technical support, adequate time allocated for the technology integration, continuous staff development, instructor involvement during planning stage for the integration, adequate computing skills, the nature of the curriculum being integrated with technology, and availability of infrastructure. Of all these enablers, opportunities for individualised staff development and availability of technical support were viewed as the most critical enablers for effective integration of technology in the teaching and learning process in the universities. The issue of individualised staff development is very important because if individual teachers who are the implementers of the integration process do not have the requisite skills and knowledge, they will not have the confidence and motivation to implement the integration leading to failure of the process. Staff involvement during the planning stage of the integration process is also very important in ensuring effective integration as it allows for staff to assume ownership of and exhibit positive attitudes towards the process as well as to gain a fuller and better understanding of the whole technology integration process.

Studies show that "it is not only the availability of technology that determines if the technology will be used but the teacher's perception of its efficiency" (Etmer 2005) cited in Ayotola and Abiodun (2010). In this context, the attitudes, perception and behavior of lecturers should be considered as an important element in the effective integration of technology in higher education institutions hence the need for them to be well trained and to be involved in the integration process right from inception of the

idea. Availability of infrastructure such as high-speed Internet is also important for effective integration of technology in the teaching and learning process. Bitner and Bitner (2002) also alludes to the importance of the above enablers by arguing that for effective integration of technology into higher education, factors that include: (i) educators being encouraged to overcome fears of transformation, (ii) educators must be trained on basic computer skills usage, (iii) educators have to attain time management skills for efficiency and productivity as this will enable sufficient time for curriculum planning, (iv) a pedagogical model for computer usage in the classroom has to be availed, (v) a learning model for students to utilize in their search for information and knowledge acquisition has to be available, (vi) a supportive environment which encourages experimentation, and (vii) the presence of on-site technical support in the institution should be serious taken into consideration.

It emerged in the study that universities face the following challenges when integrating technology in the teaching and learning process: inadequate resources especially financial resources, lack of effective and sustainable approaches to integration, limited investment in new technologies, and inadequate opportunities for staff development programmes. With inadequate resources, universities in Lesotho are incapacitated to effectively integrate technology hence the need for the government and universities find sustainable ways of investing in adequate technological facilities and emerging technologies. The issue of inadequate financial resources is also raised in a number of discussions, for example Sife et al. (2009) highlighted that a lack of adequate financial resources is another challenge currently affecting HEIs especially due to the continuing rising costs of technology. This was also highlighted by the Council on Higher Education (2013) which alluded to the fact that in Lesotho “staff members and students do not have access to basic equipment and institutional internet services are limited or non-existent due to finances constraints”. Also, a lack of adequate staff development means that staff are not periodically getting updated on new and emerging technologies and all this have a net effective of either stalling the integration process or complete causing it to fail as staff will not be having the required expertise and this leads to frustration and negative attitudes. According to Sife et al. (2009) staff positive attitudes towards the new technologies is essential in building support around the idea of effectively integrating technology in higher education.

7 Conclusions

Based on the above results, a number of conclusions can be made. First, it can be concluded that integration of technology in universities in Lesotho is overall still work in progress due to the fact that the universities are still at the stage of using basic technology tools that include LMS, online activities, computers/laptops as well as projectors as some of the major technology tools they use to integrate technology into the teaching learning process. Second, universities in Lesotho face capacity challenges especially with regard to resources to be able to acquire new and emerging technologies to be able to effectively and successfully integrate technology in universities. This is seriously compromising the success of the integration process. Third, while there is acceptance that the following are the main factors that act as enabling conditions for effective integration of technology into teaching and learning: individualised staff development opportunities to address individual needs of staff,

availability of technical support on demand as well as provision of adequate infrastructure to support the implementation process, it is concluded that these enablers are still not being adequately addressed due to the challenges facing universities.

8 Recommendations

The following recommendations are important in enhancing the effectiveness of the integration of technology in universities. First, the universities need to improve financial investment in the process for the integration to be success. This is so because most of the other things that include having adequate infrastructure, having up-to-date technology, having adequate opportunities for staff development all hinge on having a stable financial position. Second, continuous professional development as a means of continuously capacitating implementing staff with new knowledge and skills is very critical for the success of the integration process. Third, involvement of all implementing staff in the planning of the technology implementation process is critical for generating a critical mass of staff who will support and demonstrate ownership of the process is another important enabler of effective technology integration.

8.1 Limitations of the study

The study was limited to quantitative approach and may have been more in-depth had it also included the qualitative approach. Also the study focused only on lecturers as participants and left out students as critical stakeholders in the technology integration matrix.

8.2 Opportunities for future research

Views of students on technology integration in universities need to be researched on and hence this offers an opportunity for future research. There is also room for future studies on the feasibility and benefits of using advanced tools such as e-real labs, robotics, artificial intelligence and gamification in the technology integration matrix in universities in Lesotho.

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Compliance with ethical standards

Competing interests The author declares that she has no competing interests.

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