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Predictors of Successful Adoption of Technology Supported Learning in Universities in Uganda: A Students' Perspective

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ABSTRACT

This study identified the predictors of successful adoption of technology supported learning (TSL) among students in universities. Presumably, the perspective of the students in understanding this study is crucial because students are key users of TSL systems and are faced with challenges in the adoption of such systems in learning institutions. We argue in the present study that predictors can be identified using Gestalts approach given the complex interactions between the organizational and individual factors. The extent of interaction between the factors was accomplished using the clustering algorithm. Data was collected from 184 students from Makerere and Gulu universities. Six clusters emerged out of the findings of which Cluster 4 students adopted TSL the most. These students indicated that successful adoption of TSL is best achieved when there is coherence between financial support and when they are in their second year of study.

Keywords

Predictors, technology supported learning, universities, Uganda, Gestalts approach.

INTRODUCTION

Predictors can be regarded as factors. In this paper they are regarded as factors required for successful adoption of technology-supported learning (TSL). These predictors can be categorized as organizational and individual factors. In this paper, organizational factors are operationalized as the availability of the goals of the university TSL policy, time to experiment with information and communication technology (ICT), financial support and commitment of university management. With regard to this paper, individual factors are operationalized as age, gender and level of education. Whereas it has been established that there are predictors that contribute to successful adoption of TSL, there is growing concern that if such predictors are not investigated, adoption of TSL information systems (ISs) may continue to be a challenge.

Universities in developing economies in particular have adopted technology-supported learning information systems (TSL ISs) to boost the knowledge society (Tchamyou, 2017). Since students are the key users of TSL (Bhardwaj & Goundar, 2018) in universities, understanding their perspective in the adoption of TSL would be paramount to educational re-engineering. In addition, students face challenges during their encounter with TSL (Gerasimova et al., 2018). They indicate that such challenges or factors include lack of self-discipline and motivation, financial implications and lack of face to face interaction with a tutor. Given the fact that these factors in adoption of TSL have a great impact on students, it is worth investigating such factors to augment their (students') learning in universities.

Other writers have reported disparities in who uses technology and at what age they are exposed to it. In order to understand the predictors of adoption and effective use of technology in education, the perspective of students regarding the adoption of technology and their views about what the institutions should provide to make this adoption possible is critical. However, not many studies have looked at this problem from the perspective of students who happen to use the TSL (Acosta et al., 2018). In the present study, the researchers investigate the predictors of successful adoption of TSL as perceived by students. The Gestalts approach was adopted given the fact that the predictors are complex and interactional making it difficult to measure their influence. Gestalts is defined as configuration of institutional components that has achieved a satisfactory high level of coherence (Venkatraman, 1989). Gestalts scholars argue that success is only achieved when the components achieve a satisfactorily high level of coherence.

The present study focuses on two categories of predictors; organizational and individual factors. The next section reviews these predictors and how they interact to influence the adoption of TSL. A conceptual framework based on the Gestalts approach is developed and tested with a sample of students from two institutions of learning in Uganda. An elaboration about the approach used in this paper is in the methodological framework. Following this is the results and analysis, and then discussion of findings. This paper ends with a conclusion.

LITERATURE REVIEW

Definition of Technology-Supported Learning

The change from the traditional curriculum to the digital curriculum has revolutionized higher education. Technology-supported learning has been defined and measured from different perspectives by researchers. Technology-supported learning has been defined by Hardaker and Singh (2011) "as an innovation situated in the interplay between structure and individual and how this leads to adoption and diffusion" (p.222). Eze et al. (2018) have defined TSL as technology-mediated learning that uses hardware and software systems to enhance the teaching and learning processes. Ayele & Birhanie (2018) indicate that TSL is a modern way of delivering learning resources to students in higher learning institutions. In this paper we choose to define TSL as e-learning, resulting from the interaction between the organizational and individual factors. Gerasimova et al. (2018) elaborates that TSL saves students' time, and also reduces travel time associated with the traditional face to face approach. TSL may encompass compact disc read-only-memory (CD-ROMs), digital texts, podcasts, learning management systems (LMSs), video-technology and websites among others.

While CD-ROMs are no longer used widely today, Kisanga and Ireson (2015) indicated at that time that they were a very reliable way of accessing content by students. Digital texts and podcasts have been presented as vital tools for student knowledge delivery in the medical field (Back et al., 2019). Learning

management systems also play a vital role in the delivery of academic resources to students in universities (Gwamba et al., 2018). Bond et al. (2018) indicate that LMSs are commonly used among students in higher education institutions in Germany. Nevertheless, a recent study by Kim et al. (2019) indicated that students had no experience with LMSs and video technology. Chopra et al. (2019) indicate that students are satisfied with web-based learning.

Organizational Factors and Technology-Supported Learning

Organizational factors such as management support, user training and financial incentives increase the adoption of TSL ISs in organizations (Ayele & Birhanie, 2018). Shah and Cheng (2019) argue that development of TSL policies is an opportunity of revolutionizing universities while engaging students. Back et al. (2019) suggest that students should practice with ICTs. A study by The and Usagawa (2018) revealed that if a person practices with ICTs, they gain confidence in using such tools. Shah and Cheng (2019) similarly indicate that distance learners are faced with many challenges which may force them to drop out of universities The students cited juggling work and study, caring for children, financial difficulty and academic writing among others as challenges to TSL.

Another area of concern raised by Shah and Cheng (2019) was the time spent by a student studying off-campus. Such time involves experimenting with ICTs. Furthermore, they argue that indicators such as online learning resources, relevant course materials and building student confidence are key to positive learning. Students perceive that commitment of university management in uploading the online resources, subscribing to relevant courses and ensuring that the lecturers build confidence in them contributes to the adoption of TSL.

Students perceived that organizational support plays a vital role in their adoption of TSL (Selim, 2007). A study by Bhardwaj and Goundar (2018) reveals that students perceive that university management does not support their use of TSL. We choose to look at the goal of the TSL policy, time to experiment with ICT, financial support, and commitment of university management as organizational factors that can influence students' adoption of TSL. Additionally, Moakofhi et al. (2017) argue that studying organizational factors is essential in understanding technological adoption.

Individual Factors and Technology-Supported Learning

Individual factors can be termed as personal factors depending on the author. The individual in question is a student. Kimiloglu et al. (2017) specify that individual factors can explain the adoption of TSL ISs. Parlakkılıç (2014) indicated that age influences the use of information technologies. In addition, Pereira et al. (2018) uphold that people tend to adopt TSL at an early age. Gerasimova et al. (2018) specified that the average age of students who adopted TSL at the Russian University of Economics was 23 years. They revealed that the majority of these students appreciated TSL. Another study by Bhardwaj and Goundar (2018) about students' perceptions of TSL shows that the majority of the students engaged in the study were aged between 21 to 30 years of age.

With reference to gender, female students showed a preference for humanities and social sciences while their male counterparts preferred engineering, natural science and ICT (Zuvic-Butorac et al., 2011). Nevertheless, Kim et al. (2019) report that female students are more experienced with TSL than males. Additionally, Rhema and Miliszewska (2014) revealed that there is no difference between female and male students when it comes to the acceptance of TSL in Libyan universities. Furthermore, Ramírez-Correa et al. (2015) studied gender behavior in relation to the students' acceptance of TSL in Chile and Spain. Their findings revealed that there is an insignificant difference between male and female students in the use of TSL.

The year of study of a student is perceived as the level of education in this paper. As per the level of education, Damanpour and Schneider (2006) revealed that education level contributes to the adoption of innovations. Technology-supported learning is perceived as something new hence an innovation. Whereas many studies have been carried out on age and gender, few studies seem to focus on the contribution of level of education to the adoption of technological innovations and less so in developing economies.

It should be noted that the definition of TSL in this paper considers the interaction between organizational and individual factors. This implies that organizational factors impact the individual factors in relation to the adoption of TSL and vice versa.

Interaction between Factors of Adoption of Technology-Supported Learning and Their Impact on Technology Supported Learning

Scholars often wonder whether the individual (student) should adapt to the organization or whether the organization (e.g. university) should adapt to the individual (Lippman, 2013). Lippman observes that debatably the preceding statements are incorrect. It is better to ask, "How do organizations shape the individual?" In turn, "How does the individual impact organizations?" In his argument, the university can be composed of the students, other individuals and the formal physical environment. Singh et al. (2005) argue that the structure of organizations has changed. They indicate that TSL is part and parcel of the organization. Organizational characteristics can impact on a students' ability to adopt TSL.

Universities are usually expected to provide policies, time for interaction, financial support and commitment to the students in relation to the adoption of TSL (Shah & Cheng, 2019; The & Usagawa, 2018). Students have to be in harmony with the university mission in order for the university to achieve organizational success. University TSL policy gives structure to how students should learn, assess and improve their TSL skills in a university (Makerere University Council, personal communication, January n.d., 2004). Maina and Njuki (2015) argue that organizational TSL policies influence the adoption of TSL. The Makerere University Council (personal communication, September n.d., 2015) highlights that TSL policies boost pedagogical practices and improve end user skills. If students are familiar with university TSL policies, chances are high that their intention, innovativeness and acceptance of TSL will be high.

The time students take in interacting with ICT is an important issue in learning environments (Salinas, 2004). Drent and Meelissen (2008) argued that time can be assessed according to experimenting, interacting and reflecting with ICT. Time has an impact on the adoption of TSL (Shah & Cheng, 2019) among students. Developing economies have been reported to have limited e-resources which reduces individual ability to experiment with such resources. The more students experiment with ICT the more their intention to use innovativeness and acceptance of TSL.

Universities are expected to assist students through financial support to boost their adoption of TSL (Angolia & Pagliari, 2016). They indicate that TSL comes with new support requirements. Additionally, they assert that financial support enhances adoption of TSL among students in higher education institutions. They highlight that in cases where institutions often purchase TSL facilities for the students, the TSL adoption rates tend to be high.

University management should be committed to supporting students to boost their adoption of TSL (Bhardwaj & Goundar, 2018). This can be achieved through training students on how to use TSL facilities (Kim et al., 2019). Students perceive that institutional support is one of the enablers for their adoption of TSL (Okai-Ugbaje, 2020).

According to Lippman (2013) students' age, gender and level of education influence their organizations. This can be observed through variations in the use of TSL policies in place, time one takes interacting with ICTs, making use of resources and also participating in activities within an organization. Literature indicates that TSL policies are common within learning institutions (Drent & Meelissen, 2008). Students can get acquainted with these policies, take time to practise with ICT, use acquired TSL facilities in the university and avail themselves to receive information from university management about TSL.

Whenever a new technology is adopted, it finds a society with inequalities in terms of age, gender and level of education. Thus, understanding the impact of age, gender and level of education in the adoption of TSL in organizations is paramount. Maina and Nzuki (2015) indicate that age is an important factor in understanding adoption of innovations in learning organizations. Pereira et al. (2018) indicate that adoption of technological innovations usually takes place at an early age. Adewole-Odeshi (2014) amplifies that older people tend to have low interaction with the learning organizations resulting in low adoption of technological innovations in such organizations.

The relationship between gender and different environments has been testified (Lee & Pituch, 2002; Martin, 1991). Lee and Pituch (2002) suggested that gender should not be left out in information technology (IT) adoption models. An early study by Martin (1991) on gender differences in technology adoption and telephone use, found that women's use of the telephone for socialization purposes helped to expand its use in both residential and business areas. Odewumi et al., (2018) indicate that females are disadvantaged when it comes to the adoption of information technology.
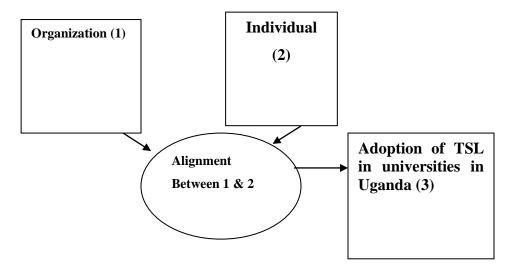
Damanpour and Schneider (2006), reveal that education level is an individual factor. They continue to argue that education is an important aspect of the adoption of innovations. Maina and Nzuki (2015) agree that level of education impacts on the learning organization during the adoption of innovations. In some instances, education is viewed as a management strategy that can ease implementation of specific innovations in particular organizations (Ferreira et al., 2015). There seems to be little research on how the level of education impacts on the learning organization during the adoption of innovations; this study acted as a basis to fill the gap. A first-year student may have no knowledge of the TSL policy in a particular learning institution which may affect their use of TSL facilities.

Theoretical Underpinnings of the Study

The interactions between organizational and individual factors have been presented indicating the complexities involved. These interactions were studied with different theoretical underpinnings. Factors can be studied from a theoretical point of view that seeks to predict TSL from both organizational (macro) and individual (micro) perspectives (Hardaker & Singh, 2011). Sometimes referred to as the "duality of structure", factors can be drawn from the works of Giddens 'theory of structuration' who argues that macro and micro perspectives are interlinked. Giddens theory is mapped to that of (Rogers, 2003)'s Diffusion of Innovations Theory to ensure that the factors of adoption of TSL are objectively measured. For instance, individual (student) was operationalized according to factors of age, gender and level of education. The concept of adoption of TSL has been operationalized as intention to use, innovative use and acceptance of TSL. Students can perceive that the factors encourage the adoption of TSL or not. The factors that predict successful adoption of TSL have been studied by using the conceptual framework in Figure 1.

Figure 1

The Conceptual Framework of Predictors of Successful Adoption of Technology- Supported Learning (TSL) in Universities in Uganda

Gestalts Perspective in this Study

To represent the complex interactions, we have incorporated Venkatraman (1989)'s Gestalts fit which is an alignment perspective. Venkatraman indicates that alignment aims at balancing related organizational components. This is usually done with the aim of achieving organizational success. Gestalts fit has been achieved by configuring factors that are unique, tightly integrated and fairly stable. We argue that measuring organizational and individual factors using a linear model is not appropriate. Thus, alignment as Gestalts was adopted to identify those configurations of organizational and individual factors that predict the adoption of TSL in universities.

If configurational factors of the framework (i.e. organizational and individual factors) are well aligned then there is greater interaction and thus an increase in the adoption of TSL. On the other hand, if the elements are misaligned the level of adoption of TSL is low. Thus, the following hypotheses were tested by the researchers. The greater the alignment between the organizational and individual factors the more the i) intention to use, ii) innovative use, and iii) acceptance of TSL in universities will be.

Table 1 provides the definitions of these factors. In the conceptual framework the third element is an outcome of the interaction or interplay between the first and second variables.

Table 1

Factors/ Constructs Employed in the Study

Factors/ Constructs	Operationalization	References
Organization	Goal of TSL policy, availability of time to experiment with ICT, availability of financial support and commitment of management.	Rogers, 2003; Shah & Cheng (2019)
Individual (student)	Student age, gender and level of education.	Glazier et al. (2019)

Factors/ Constructs	Operationalization	References
Interaction	The interaction between the main factors i.e. organization and the individual affect each other.	Drazine & Van de Ven (1985)
Perception	This is the student's perspective that indicates whether the factors encourage adoption or not	Gerasimova et al. (2018)
Alignment	Level of coherence.	Venkatraman (1989)
Adoption of TSL	Intention to use, innovative use and acceptance of TSL.	Rogers (2003); Davis (1989)

METHODOLOGICAL FRAMEWORK

To investigate the predictors of the successful adoption of TSL among students, the quantitative, survey, mixed and cross-sectional research designs were used (Creswell, 2014; Greene et al., 1989). A recent study by Shah and Cheng (2019) carried out on students' perceptions used a quantitative research design. Thus, the same design was adopted for this study. In quantitative designs surveys are usually used. The researchers used a survey to collect data from a total of 184 students. The survey was structured into four main parts; background information, adoption of TSL, organizational and individual factors. Bhardwaj and Goundar (2018) in their study on students' perceptions on TSL used a mixed research approach. The researchers adopted the said research approach whereby the largely quantitative and little qualitative techniques were used.

Besides lecturers, the population of study included students from both Makerere and Gulu universities. Students were chosen because they are the main users of TSL (Bhardwaj & Goundar, 2018) and they are faced with challenges in using this type of learning (Gerasimova et al., 2018). Purposive and simple random sampling were used for quantitative data. The given universities were purposively chosen because of the level of knowledge and use of TSL. Simple random sampling was used at departmental level to collect quantitative data from students of agricultural sciences because they are among the main users of TSL facilities at this level. Purposive homogeneous sampling was used for qualitative data. A total of six students were interviewed to complement the questionnaire data.

The study took place at a particular point in time hence it was cross-sectional in nature. Internal and external validity checks were used (Bhattacherjee, 2012). Internal validity was achieved by omitting extraneous variables so that changes in the response to variables is caused by the hypothesized explanatory variables. External validity was achieved by generalizing from Makerere and Gulu universities to other universities. These two universities were chosen because their lecturers have been motivated earlier, their students would have had more exposure to the technology adoption and with that experience, it would be appropriate to capture their perspectives. Validity of the student qualitative instrument was achieved through use of research experts who were used to validate whether the content in the instrument could get the data required (Ozkan & Koseler, 2009).

Additionally, the developed question concepts were derived from past relevant studies. This can be related to Bhardwaj and Goundar (2019) who captured students' perceptions on TSL based on the modification of concepts from relevant past studies. Studies on students' perceptions taking a quantitative approach are usually carried out using reliability tests. Kim et al. (2019) carried out a reliability test on a questionnaire that was administered to undergraduate students in a university in Korea using Cronbach's alpha. Similarly, the researchers used the same alpha to test questions in the student self-administered questionnaire. The outcome variable of the adoption of TSL was

operationalized as intention to use, innovative use and acceptance of TSL with Cronbach alphas of 0.64, 0.67, 0.70 respectively. The organizational factors had a Cronbach alpha of 0.73. The researchers followed ethics guidelines to accomplish the study.

RESULTS AND ANALYSIS

Background Information

The majority (82.1%) of the students were aged between 21 and 30 years old. This is in line with Bhardwaj and Goundar (2018) who indicated that the majority of the student respondents were between 21 to 30 years old. The majority (64.1%) of the student respondents were male while 35.9% were female respondents. This is in line with Zuvic-Butorac et al. (2011), who found that female students concentrated on art subjects, while their male counterparts were in engineering, natural science and ICT. Most (41.0%) of the students were in their second year of study, followed by first year students (i.e. 32.0%). The majority of the students (i.e. 94.0%) had access to email. Few (38.6%) students had laptops. This is because these students may not be in position to afford such devices. Most (59.2%) of the respondents revealed that there are functional TSL laboratories in their universities. Most of the students (57.1%) were affiliated to Gulu University. For descriptive analysis of means and standard deviations for selected research variables see Tables 2 and 3. All the data simulations were based on a Likert scale of 5. Descriptive analysis of the individual (student) presenting modal age, gender and level of education of the whole population of students (i.e. $N = 184$) is shown in Table 3.

Descriptive Statistics

Table 2

Descriptive Statistics for Selected Research Variables (N =184)

Variable	Brief Description of Variables	M [a]	Min	Max	SD
Adoption of TSL					
Intention to Use					
ITU1	Computers	4.45	1	5	0.979
ITU2	CD-ROMs	2.83	1	5	1.468
ITU3	Web-based learning	3.84	1	5	1.344
ITU4	Video conferencing	3.59	1	5	1.449
ITU5	University TSL environments e.g. Black-Board	3.66	1	5	1.425
Innovative Use					
INU1	I am able to expound on what lecturers have provided to me in class using the Internet	3.79	1	5	1.334
INU2	I am able to make presentations in text, audio and visual	3.80	1	5	1.424
INU3	I am able to communicate with other students through online discussions, emails, wikis, and WhatsApp	3.71	1	5	1.496
Acceptance					
ACC1	Computers	4.52	1	5	0.941
ACC2	CD-ROMs	2.96	1	5	1.536

Variable	Brief Description of Variables	M [a]	Min	Max	SD
ACC3	Web-based learning	3.75	1	5	1.388
ACC4	Video conferencing	3.59	1	5	1.376
ACC5	University TSL environments e.g. Black-Board	3.61	1	5	1.536
Organizational Factors					
GUELP1	Goal of university TSL policy	2.97	1	5	1.408
ATIEXICT1	Availability of time to experiment with ICT	3.22	1	5	1.366
AFS1	Availability of financial support	2.73	1	5	1.544
COMAN1	Commitment of management	3.04	1	5	1.362

[a] A score of 3.50 indicates that: the person has and there was "e.g. intention to use TSL, encouragement

on use of TSL facilities and "hindrance to the progress of TSL ISs" on the five-point Likert scale of

1(Very little or no: intention to use TSL, encouragement on use of TSL facilities, and hindrance to the

progress of TSL ISs) and 5(Very much: intention to use TSL, greatest encouragement on use of TSL

facilities and very much hindrance to the progress of TSL ISs).

Students had 'much' intention to use TSL facilities. For instance, they had 'much' intention to use computers (ITU1). The students had 'much' innovative use of TSL (for instance, they were able to make presentations in text, audio and video, INU2). They also indicated very much acceptance of TSL. For instance, they had very much acceptance of computers (ACC1).

See Table 3 for most frequent characteristics of each individual in the whole student population (i.e. *N* =184).

Table 3

Individual Factors (N = 184)

Individual Factors	Rate of Occurrence	Most Frequent Individual Factors
AGE	Most frequent age of students	25 Years
GEN	Most frequent gender of students	Male
LEDUC	Most frequent year of study of students	Year 2

Cluster Analyses

The researchers used the *k*-means clustering algorithm with the help of Statistica Software version 13.3 to generate six clusters. The data were standardized. Whereas several simulations were carried out (i.e.1, 2, 3, 4, 5 and 6), only the sixth simulation showed acceptable results. All 6 simulations yielded *p* values less than 0.05 (see Table 4). Table 4 indicates the measurement of the organizational factors and

adoption of TSL in universities in Uganda across the six student clusters. Table 5 shows the measurement of the individual factors across the said clusters.

Table 4

Cluster Analysis and Analysis of Variance for Students

| Variable | Cluster | | | | | | ANOVA | |
	1 (*n* = 37)	2 (*n* = 38)	3 (*n* = 19)	4 (*n* = 42)	5 (*n* = 24)	6 (*n* = 24)	F	p
Adoption of TSL								
Intention to Use TSL								
ITU1	0.11	0.24	0.02	0.32	0.48	-1.61	24.4	.00
ITU2	-0.07	-0.74	0.33	0.69	-0.14	-0.05	11.09	.00
ITU3	-1.01	0.37	0.35	0.58	0.39	-0.72	25.02	.00
ITU4	-0.84	0.31	0.31	0.59	0.31	-0.79	18.93	.00
ITU5	-0.56	0.22	-0.06	0.59	0.29	-0.78	11.59	.00
Innovative Use of TSL								
INU1	-0.25	0.51	-0.24	0.65	-0.13	-1.22	20.75	.00
INU2	0.14	0.29	-1.42	0.49	0.52	-0.92	26.71	.00
INU3	-0.51	0.44	-1.28	0.61	0.49	-0.45	24.49	.00
Acceptance of TSL								
ACC1	0.23	0.23	0.07	0.39	0.34	-1.79	34.39	.00
ACC2	-0.21	-0.85	0.50	0.92	0.18	-0.52	25.79	.00
ACC3	-0.87	0.41	0.07	0.64	0.33	-0.81	22.19	.00
ACC4	-1.00	0.27	0.29	0.67	0.57	-0.86	31.69	.00
ACC5	-0.65	0.01	-0.13	0.64	0.66	-0.69	15.29	.00
Organizational Factors								
GUELP1	0.04	0.32	-0.24	0.78	-0.99	-0.75	20.78	.00
ATIEXICT1	0.19	-0.51	-0.69	0.89	-0.09	-0.40	16.36	.00
AFS1	0.12	-0.51	-0.44	1.05	-0.53	-0.36	22.28	.00
COMAN1	0.01	-0.17	-0.57	0.74	-0.18	-0.39	8.35	.00

Note. Positive values are indicated in bold while negative ones are not in bold.

Table 5

Individual Factors per Cluster

Individual Factors	Rate of Occurrence	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	ANOVA F	p
AGE	Most frequent age of students	26 Years	25 Years	25 Years	25 Years	26 Years	24 Years	3.56	.00
GEN	Most frequent gender of students	Male	Equal number of male and female	Female	Male	Male	Male	4.26	.00

Individual Factors	Rate of Occurrence	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	ANOVA F	p
LEDUC	Most frequent year of study of students	Year 2	Year 2	Year 1	Year 2	Year 4	Year 1	40.9	.00

Qualitative Analysis

Thematic analysis was used in analyzing qualitative data. We used Braun and Clarke (2006)'s six thematic analysis steps of familiarization, generating initial codes, searching, reviewing, defining and naming themes and producing a report. Students' data comprised student interview data items from which initial extracts were made. Familiarization was carried out by reading and re-reading the said data items. Generating initial codes was achieved through capturing features of interest from the student data set. Searching was achieved through grouping student data relevant to potential themes. Defining and naming was achieved by categorizing the themes. Finally, a report about the student data was produced. The researchers used the most significant interview data that could support the quantitative results presented in this paper in the discussion of findings section. Thus, the discussion of findings is integrative.

DISCUSSION OF FINDINGS

In this section, qualitative findings have been integrated with the quantitative ones. The letter 'S' denotes student. Cluster 1 students were ranked third as far as the adoption of TSL is concerned because of the quite weak alignment between the configurational factors. For instance, the students had no intention to use web-based technology. This was confirmed by student S5, who revealed that she did not understand web-based learning. These students could not interact with their colleagues using TSL facilities. Students in this cluster never embraced video conferencing technology because it is limited as reflected in the main themes by the students, S1, S3 and S5. However, these students had the intention to use computer technology. This is consistent with student S1, who commented that *"I have the intention to use computers for academic purposes"*. They also had innovative use of TSL shown through their ability to incorporate text, audio and visual technology. Furthermore, these students accepted computer technology. This is supported by students, S1, S2 and S6, who revealed that they use computers because of the current education trend which demands them to be computer literate, for academic purposes and they are easy to work with.

Further analysis of this cluster indicates that the organizational factors encourage these students to use TSL facilities (see Table 4). Qualitative results from students, S1, S4, and S3 respectively had the following implications on the organizational factors:

• the goal of the TSL learning policy encourages the use of TSL facilities at a minimal level,

• students practise with ICT and also believe that the university indirectly supports them financially by providing limited wireless fidelity,

• the university management is supportive by designing sessions on how to use computers.

A typical student in this cluster was 26 years old, male by gender and in his second year of study (see Table 5). While these students have similar characteristics with those of Cluster 6, they have tried to adopt TSL facilities compared Cluster 6 students because of their experience with such facilities.

Cluster 2 students ranked second as far as adoption of TSL is concerned. For example, students in this cluster revealed 'much' intention to use TSL. For instance, student S1, confirmed that *"Web-based learning offers more information"*. Students in this cluster were 'very much' capable of expounding on what lecturers had provided to them in class using the Internet. This was through "surfing" the Internet, using the Google search engine as revealed by student S1. Students in this cluster had 'much' acceptance of TSL facilities such as web-based facilities. This is because web-based learning can be used for research work and expounding on what is taught in class by lecturers as revealed by student S1. This is confirmed by a recent study by Chopra et al. (2019) that indicates that students are satisfied by web-based technology.

In relation to the organizational factors, students in Cluster 2 agreed that the goal of university TSL policy encourages their use of TSL facilities. The qualitative results suggest that e-discussions can compel students to use TSL facilities, as revealed by Student S3. On average, students in this cluster were aged 25 years, the number of male students was equivalent to that of female ones and they were in their second year of study (see Table 5). These students could be better adopters than those of Cluster 1 because they seemed to have an equal gender distribution. Such distribution may account for an unequal educational technology use among Cluster 1 and 2 students who enjoyed a similar learning experience (see Tables 4 and 5). Students of this cluster seemed to be better adopters than those of Clusters 1, 3, 5 and 6 because of their ability to make use of the TSL policy to their advantage (see Tables 4 and 5).

Cluster 3 students were low adopters of TSL because of low alignment between the configurational factors thus ranked fifth as far as adoption of TSL is concerned. These students lacked innovative use of TSL facilities implying that these students cannot use such facilities to improve their learning capabilities. The same students however, registered 'very much' acceptance of CD-ROMs (see Table 4). This could be because this medium is a dependable way of accessing content by students (Kisanga & Ireson, 2015).

Students in Cluster 3 perceived that the organizational factors never contributed to their use of TSL facilities in any way (see Table 4). For example, students had no time to experiment with ICT. This could be because students never practise with ICT due to the fact that the course is "hectic" and the IT laboratories are usually closed over the weekend, as revealed by student S1. The average age, gender and level of education of a student in this cluster is 25 years, female and first-year respectively (see Table 5). These could be lower adopters of TSL than members of Clusters 2 and 5 because of their gender. Female respondents are disadvantaged when it comes to the use of information technology (Odewumi, 2018). Another plausible reason for the low adoption levels in Cluster 3 compared to those in Clusters 2 and 1 could be the lack of innovative use of TSL (see Table 4).

Cluster 4 students were the greatest adopters of TSL among the six clusters. This is because they had the 'greatest' alignment between the configurational factors. These students are eager to use ICT, innovative and embraced TSL. They are eager to use CD-ROM technology because such technology is cheap and stores information as confirmed by students, S1 and S6. They can innovatively expound on what lectures have provided to them in class using the Internet with the help of search engines (such as Google), as indicated by student S1. They have embraced video conference technology. Students S1, S3 and S5 confirmed that they were able to imitate the limited video conferencing learning using the WhatsApp facility.

Students in Cluster 4 perceived that the organizational factors encouraged their use of TSL facilities. High scores were registered on the goal of the university TSL policy, time to experiment with ICT, financial support and commitment of university management. For instance, during the interview process,

student S3 revealed that *"a discussion policy, for example, may improve adoption of [TSL] because once e-discussions are made they can compel one to use the [TSL] facilities".* The result from the interview process on time to experiment with TSL conflicts with the cluster one, whereby the majority of the students never found time to practise with TSL facilities. Shah and Cheng (2019) however, indicate that time influences the adoption of TSL facilities. Quantitative findings in this cluster on financial support could be related to those of student S3, who indicated that there was indirect financial support by their university through the provision of wireless technology. On the issue of management commitment, findings are in line with those of student S4, who felt that university management was committed because they designed computer literacy sessions for them. A typical student in this cluster was 25 years old, male by gender and in year 2 of study (see Table 5). This cluster ($n = 42$) had the majority of the student respondents among the six clusters.

The alignment of the configurational factors in Cluster 5 seemed to be 'weaker' than that of Cluster 1, thus, this cluster was ranked fourth. Whereas the students in this cluster indicated 'very much' adoption of TSL in some instances, the configurational variables registered low scores. For instance, they had very much acceptance of TSL environments, yet they seemed not to be familiar with the TSL policy. The result on acceptance of TSL environments is parallel to that of Bond et al. (2018) who indicated that such environments are commonly used by students in higher education institutions in Germany. The result on the TSL policy was confirmed by student, S4 who revealed that the TSL policy is not effectively implemented in the university. A normal student in this cluster was 26 years old, male by gender and in year 4 of the study (see Table 5). These students could be better adopters of TSL than those of Clusters 3 and 6 because of their long-time experience with TSL, as reflected in their year of study compared to the said clusters (see Tables 4 and 5). It is not surprising this cluster had the best distributions of ICTs among students.

Similar to Cluster 5, Cluster 6 had 24 respondents (see Table 4). However, students in this cluster are coincidentally ranked as non-adopters of TSL among the six clusters (see Tables 4 and 5). This is because there is no alignment between the configurational factors, resulting in no adoption of TSL. These students were not willing to use IT, could not modify their learning capabilities using IT, and had not realised the value of IT tools. All 24 respondents in this cluster 'concurred' that the organization never encouraged their use of TSL facilities. This could imply that students were not involved at all during the adoption of TSL. Shah and Cheng (2019) reveal that students perceive that juggling work and study, caring for children, financial difficulty and academic writing among other factors affect their ability to adopt TSL. On average, students in this cluster were 26 years old, male by gender and in year 1 of their study. Being in their first year of study could imply that they had little experience with TSL.

CONCLUSION

Identification of predictors of successful adoption of TSL among students was achieved using the Gestalts approach. Students perceived that organizational and individual factors predict successful adoption of TSL. Cluster 4 is the most coherent and as such adopted TSL most. This is because the organizational and individual factors were most aligned. For example, when students in this cluster are financially supported and are in their second year of study, they are eager to use, to be innovative with and embrace TSL. And because of their eagerness, innovativeness and ability to embrace TSL they have accumulated more experience than others. Cluster 6 students are non-adopters because they are more inexperienced with TSL than the rest of the students.

There seems to be a gap in the use of the non-linear techniques (e.g. clustering technique) in studies on students' perceptions. Most studies, for instance Chopra et al. (2019); Gerasimova et al. (2018) and Shah

and Cheng (2019), who have measured student perceptions have used linear techniques. Thus, this study has closed this gap. This study is a benchmark for universities in developing economies to integrate TSL at university level. For instance, it should be noted that in order to achieve successful adoption of TSL among students in universities, management must be involved Nabushawo et al. (2018) suggest that the commitment of management can be achieved by collaborating with and training the users of TSL ISs. Since the world is challenged by Corona Virus Disease (COVID), this study can be used as model to avail learning materials to students without spreading this disease.

It should be noted that the rate of adoption of TSL among students is still low, yet they have advanced in age. This contradicts Pereira et al. (2018) who indicated that adoption of TSL usually takes place at an early age. It is therefore recommended that students should be supported to adopt TSL during their earlier career years so that universities in Uganda can benefit from this innovation. This can be done by introducing TSL at primary level. Universities need to strengthen their management capabilities such as increasing the time students' have to experiment with ICTs. Further research is required to develop strategies that can be adopted to enhance adoption of TSL among students at earlier ages. Although this study was carried out at a particular point in time, it can also be carried out longitudinally. There are many indicators of the organization, individual (student) and adoption of TSL besides those presented in the conceptual framework. Further research can be carried out on those. Besides organization and individual factors, there is need to know the role of other factors in the adoption of TSL among students. While students from only two public universities were considered for this study, students from other universities can be considered as well.

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REFERENCES

Acosta, M. L., Sisley, A., Ross, J., Brailsford, I., Bhargava, A., Jacobs, R., & Anstice, N. (2018). Student acceptance of e-learning methods in the laboratory class in optometry. *PLOS ONE, 13*(12), 1-15. https://doi.org/10.1371/journal.pone.0209004

Adewole-Odeshi, E. (2014). Attitude of students towards e-learning in South-West Nigerian universities: An application of technology acceptance model. *Library Philosophy and Practice*. Article 1035.

Angolia, M. G., & Pagliari, L. R. (2016). Factors for successful evolution and sustainability of quality distance education. *Online Journal of Distance Learning Administration, 19*(3).

Ayele, B. A., & Birhanie, W. K. (2018). Acceptance and use of e-learning systems: The case of teachers in technology institutes of Ethiopian universities. *Applied Informatics, 5*(1), 1-11. https://doi.org/10.1186/s40535-018-0048-7

Back, D. A., von Malotky, J., Sostmann, K., Peters, H., Hube, R., & Hoff, E. (2019). Experiences with using e-learning tools in orthopedics in an uncontrolled field study application. *Orthopaedics & Traumatology: Surgery & Research, 105*(2), 389-393. https://doi.org/10.1016/j.otsr.2019.01.002

Bhardwaj, A., & Goundar, S. (2018). Student's perspective of elearning and the future of education with MOOCs. *International Journal of Computer Engineering*, 7(5), 248-260.

Bhattacherjee, A. (2012). *Social science research: Principles, methods, and practices*. Textbooks Collection. http://scholarcommons.usf.edu/oa_textbooks/3

Bond, M., Marín, V. I., Dolch, C., Bedenlier, S., & Zawacki-Ritcher, O. (2018). Digital transformation in German higher education: Student and teacher perceptions and usage of digital media. *International Journal of Educational Technology in Higher Education, 15*(48). https://doi.org/10.1186/s41239-018-0130-1

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 33,* 77-101.

Chopra, G., Madan, P., Jaisingh, P., & Bhaskar, P. (2019). Effectiveness of e-learning portal from students' perspective: A structural equation model (SEM) approach. *Interactive Technology and Smart Education, 16*(2), 94-116. https://doi.org/10.1108/ITSE-05-2018-0027

Creswell, J. W. (2014). *Research Design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage Publications.

Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organisations: Effects of environment, organisation and top managers. *British Journal of Management, 17,* 215–236. https://doi.org/10.1111/j.1467-8551.2006.00498.x

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Drazin, R., & Van de Ven, A. H. (1985). Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, *30*(4), 514-539. https://doi.org/10.2307/2392695

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education, 51*, 187–199. https://doi.org/10.1016/j.compedu.2007.05.001

Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilisation of e-learning facilities in the educational delivery system of Nigeria: A study of M-University. *International Journal of Educational Technology in Higher Education, 15* (34), 1-20. https://doi.org/10.1186/s41239-018-0116-z

Ferreira, A., Teixeira, A. L., & Dantas, A. R. (2015). Non-technological innovation activities mediate the impacts of the intra- and extra-organisational contexts on technological innovation outputs. *Enterprise and Work Innovation Studies, 11,* 9-43.

Gerasimova, V. G., Melamud, M. R., Tutaeva, D. R., Romanova, Y. D., & Zhenova, N. A. (2018). The adoption of e-learning technology at the Faculty of Distance Learning of Plekhanov Russian University of Economics. *Journal of Social Studies Education Research, 9*(2), 172-188.

Glazier, R. A., Hamann, K., Pollock, P. H., & B Wilson, B. M. (2019). Age, gender, and student success: Mixing face-to-face and online courses in political science. *Journal of Political Science Education, 16*(2), 142-157. https://doi.org/10.1080/15512169.2018.1515636

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed method evaluation designs. *Educational Evaluation and Policy Analysis, 11*(3), 255-274. https://doi.org/10.2307/1163620

Gwamba, G., Renken, J., Nampijja, J., Mayende, G., & Muyinda, P. B. (2018). Contextualisation of e-learning systems in higher education institutions. In M. Auer & T. Tsiatsos (Eds.), *Interactive mobile communication technologies and learning: Proceedings of the 11th IMCL conference* (pp. 44-55). Springer.

Hardaker, G., & Singh, G. (2011). The adoption and diffusion of eLearning in UK universities: A comparative case study using Giddens's theory of structuration. *Campus-Wide Information Systems, 28*(4), 221–233. https://doi.org/10.1108/10650741111162707

Kim, H. J., Hong, A. J., & Song, H. (2019). The roles of academic engagement and digital readiness in students' achievements in university e-learning environments. *International Journal of Educational Technology in Higher Education, 16*(21), 1-18. https://doi.org/10.1186/s41239-019-0152-3

Kimiloglu, H., Ozturan, M., & Kutlu, B. (2017). Perceptions about and attitude toward the usage of e-learning in corporate training. *Computers in Human Behavior, 72,* 339-349. https://doi.org/10.1016/j.chb.2017.02.062

Kisanga, D., & Ireson, G. (2015). Barriers and strategies on adoption of e-learning in Tanzanian higher learning institutions: Lessons for adopters. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 11*(2), 126-137.

Lee, Y-K., & Pituch, K. (2002, December 10–13*). Moderators in the adoption of e-learning: An investigation of the role of gender* [Article]. The Second International Conference on Electronic Business, Taipei, Taiwan.

Lippman, P. C. (2010). Can the physical environment have an impact on the learning environment? *CELE Exchange.* https://doi.org/10.1787/5km4g21wpwr1-en

Maina, M. K., & Nzuki, D. M. (2015). Adoption determinants of e-learning management system in institutions of higher learning in Kenya: A case of selected universities in Nairobi metropolitan. *International Journal of Business and Social Science, 6*(2), 233–248.

Martin, M. (1991). The culture of the telephone. In P.D. Hopkins (Ed.), *Sex/machine: Readings in culture, gender, and technology* (pp. 50-74). Indiana University Press.

Moakofhi, M., Leteane, O., Phiri, T., Pholele, T., & Sebalatlheng, P. (2017). Challenges of introducing e-learning at Botswana University of Agriculture and Natural Resources: Lecturers' perspective. *International Journal of Education and Development using ICT, 13*(2), 4-20.

Nabushawo, H. M., Muyinda, P. B., Isabwe, G. M. N., Prinz, A., & Mayende, G. (2018). Improving online interaction among blended distance learners at Makerere University. In M. E. Auer, D. Guralnick, & I. Simonics (Eds.), *Advances in Intelligent Systems and Computing* (pp. 63-69). Springer. https://doi.org/10.1007/978-3-319-73210-7_8

Odewumi, M. O., Yusuf, M. O., & Oputa, G. O. (2018). UTAUT model: Intention to use social media for learning interactive effect of postgraduate gender in South-West Nigeria. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 14*(3), 239-251.

Okai-Ugbaje, S., Ardzejewska, K., & Imran, A. (2020). Readiness, roles, and responsibilities of stakeholders for sustainable mobile learning adoption in higher education. *Education Sciences*, *10*(3), 49-69. https://doi.org/10.3390/educsci10030049

Ozkan, S., & Koseler, R. (2009). Multi-dimensional students' evaluation of e-learning systems in the higher education context: An empirical investigation. *Computers & Education, 53*(4), 1285–1296. https://doi.org/10.1016/j.compedu.2009.06.011

Parlakkılıç, A. (2014). Change management in transition to e-learning system. *Qualitative and Quantitative Methods in Libraries, 3*(3), 637–651.

Pereira, A., Martins, P., Morgado, L., & Fonseca, B. (2018). Technological proposal using virtual worlds to support entrepreneurship education for primary school children. In M. E. Auer, D. Guralnick, & I. Simonics (Eds.), *Advances in Intelligent Systems and Computing* (pp. 124-132). Springer.

Ramírez-Correa, P. E., Arenas-Gaitán, J., & Rondán-Cataluña, F. J. (2015). Gender and acceptance of e-learning: A multi-group analysis based on a structural equation model among college students in Chile and Spain. *PLOS ONE, 10*(10*),* 1-17. https://doi.org/10.1371/journal.pone.0140460

Rhema, A., & Miliszewska, I. (2014). Analysis of student attitudes towards e-learning: The case of engineering students in Libya. *Issues in Informing Science and Information Technology, 11*, 169-190. https://doi.org/10.28945/1987

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Salinas, J. (2004). Cambios metodológicos con las TIC. Estrategias didácticas y entornos virtuales de enseñanza-aprendizaje. *Bordón. 56*(3-4), 469-481.

Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education, 49*(2), 396–413. https://doi:10.1016/j.compedu.2005.09.004

Shah, M., & Cheng, M. (2019). Exploring factors impacting student engagement in open access courses: Open learning. *The Journal of Open, Distance and E-Learning, 34*(2), 187-202. https://doi.org/10.1080/02680513.2018.1508337

Singh, G., O'Donoghue, J., & Worton, H. (2005). A study into the effects of elearning on higher education. *Journal of University Teaching and Learning Practice, 2*(1), 13-24.

Tchamyou, V. S. (2017). The role of knowledge economy in African business. *Journal of the Knowledge Economy, 8*(4), 1189–1228. https://doi.org/10.1007/s13132-016-0417-1

The, M. M., & Usagawa, T. (2018). A comparative study of students' readiness on e-learning education between Indonesia and Myanmar. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS), 40*(1), 113-124.

Venkatraman, N. (1989). The concept of fit in strategy research: Toward verbal and statistical correspondence. *Academy of Management Review,* 9*(3*), 513-525. https://doi.org/10.2307/258177

Zuvic-Butorac, M., Nebic, Z., & Nemcanin, D. (2011). Establishing an institutional framework for an e-learning implementation: Experiences from the University of Rijeka, Croatia. *Journal of Information Technology Education: Innovations in Practice, 10,* 43-56. https://doi.org/10.28945/1364