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# Digital Technologies and Personalised Learning in Higher Education Institutions, a Case of Uganda Institute of Information and Communications Technology (UICT)

**Twesigye Leonard Biho[1], Dr Patience Tugume[2], Kamugisha Obadia[3], Bakashaba Edmund[4]**

[1]Dean, Team University
[2]Director, Team University
[3,4]Lecturer, Team University

**ABSTRACT**

The main hurdle in personal learning system deployment and success, which most of the institutions face is the challenge of outdated and lack of access to technology infrastructure. As a result, teachers, and more importantly learner's experience via personal learning is impacted. This study sought to examine the relationship between Digital technologies and personalised learning at UICT in Uganda. The target population was 210 from where a sample of 136 including 91 and 45 for students and lecturers respectively was determined using the Krejcie and Morgan table and the study employed stratified random sampling to select students and lecturers as the unit of inquiry with the use of semi-structured questionnaires.Analysis was done using Statistical Package for Social Scientists (SPSS) computer programme version 25. Descriptive statistics of mean and standard deviation was used to present data and correlation coefficient used to establish the relationship between the variables. Results revealed a statistically significant positive relationship between digital technologiesand Personalised learning in HIEs in Uganda.Findings indicatedthat digital technologies had a significant influence on differentiated instruction at UICT (r =0.954, p=0.000) and Adjusted R2 of 87.88%.Alsodigital technologies contribute significantly to individualized instruction at UICT (r =0.9605, p=0.000)and Adjusted R2 of 89.53%. Results further indicated that digital technologies had a significant relationship on knowledge construction at UICT (r =0.956, p=0.000) and Adjusted R2 of88.40%.These findings are evident that digital technologies have an impact on the personalised learningat higher education institutions in Uganda. In order to improve personalised learning, digital technologies should be enhanced. These study results are useful in decision making and improving current teaching practices to realise personalised learning in HEIs in Uganda.

**KEY WORDS**

Digital Technologies
Personalised Learning
Differentiated Instruction

Individualized Instruction
Knowledge Construction

**1.1 Background of the Study**

Today's students are generally quite tech savvy. Most learners own a smartphone or other digital devices and spend several hours a day using media or on the Internet. Teachers are becoming more tech savvy as well. Seven in ten teachers report that educational technologies allow them to do "more than ever before" for their students (American Psychological Association, 2016). Student-centered approaches, such as the inquiry model, constructivist model, and experiential learning, are the groundwork that created our current concept of personalization in the classroom. Personalization can encompass all of these ideas and more, with students' passions transforming education from teacher-centered to learner-driven (Bray & McClaskey, 2014).

Personalised learning, or personalisation, refers to a variety of educational programs, learning experiences, instructional approaches, and academic-support strategies that are intended to address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students (Stevens, 2017). According to Stevens, personalised learning refers to instruction in which the pace of learning and the instructional approach are optimised for the needs of each learner and technology is used to facilitate personalised learning environments.

Providing personalised learning experiences that allow all students equal access to quality education according to their needs and interests is an ideal all educators embrace (Lynch, 2017). Historically, student performance was viewed through a "rear-view mirror," such as summative test data that provided information about the outcomes of prior teaching (Kurshan & Woolley-Wilson, 2016). It is possible for personalised learning to take place in traditional face-to-face settings as well as technology enhanced learning environments. When face-to-face teaching takes place, personal learning often takes place when there is a low student to teacher ratio (Nandigam, Tiramala, & Baghei, 2015). An important element of personalised learning is however its link to the use of technology. Feldstein and Hill (2015) contend that a more accurate term for personalised learning would be "technology-assisted differentiated instruction".

The U.S. Department of education encourages a culture of learning powered by technology (U.S. Department of Education, Office of Educational Technology, 2010), calling for the use of advanced technologies to improve student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement.

Digital technologies denote a wide range of technologies, tools, services and applications using various types of hardware and software (Rice, 2003). They facilitate services or activities by electronic means to create, store, process, transmit and display information. Broadly, digital technologies include the use of personal computers, digital television, radio, mobile phones, systems such as software apps and virtual reality, and less tangible forms of technology such as the Internet (Vuorikari et al. 2016;Rice 2003). Digital technology has increasingly played a critical role to learners in terms of their cognitive, metacognitive and affective processes. With its unique features that support a wide range of learning experiences including interactive engagement (e.g., multimedia), immersive learning (e.g., virtual

reality), ubiquitous information access (e.g., mobile learning), data driven individualized learning (e.g, learning analytics), digital technology is poised to redefine the educational landscape with tremendous opportunities for personalized learning and development of skills and abilities necessary to meet the challenges in 21st century (Arnab et al., 2012; Echeverri & Sadler, 2011). According to Halyna Tkachuk (2018),personalised learning improves the educational process, as the student can build their own educational trajectory according to their individual needs, interests, preferences, and abilities. The proposed pedagogical model reveals the structure and content of personalized education of higher education institutions, the central figure of which is the student, his educational needs, interests, and abilities.

The use of digital technology in education has led to the investigation of how it may influence and change learners' behavior in personalized learning. Hacker, (2017); Zhou & Winne, (2009) examined the relationship between self-regulated learning and digital technology in support of self-paced, goal-oriented, reflective learning. Lee & Liu, (2017); Liu, Toprac, & Yuen, (2009) focused on the impact of digital technology on learners' motivation in learning such as intrinsic and extrinsic motivation and the locus of control. Still others are focused on the influence of digital technology on learners' social behavior such as collaboration, participation, and collective knowledge sharing and creation (Agosto, Copeland, & Zach, 2013; Vickers, Field, & Melakoski, 2015).

In spite of the advances in the knowledge of the role of digital technology and its relation to self-regulated learning, motivation, and social learning, much remains unknown in terms of how digital technology is contributing to personalized learning in the context of differentiated instruction, individualized instruction and knowledge construction and transfer.

**1.2 Statement of the Problem**

In the present world, where information is just one mouse click away, speedy and compatible hardware is vital for personal learning success (Kolchenko, 2018; Reich, 2020). The main hurdle in personal learning system deployment and success, which most of the institutions face, is the problem of outdated and lack of access to technology infrastructure (Alshwaier, Youssef & Emam, 2012). As a result, teachers, and more importantly learner's experience via personal learning is impacted (Kolchenko, 2018; Reich, 2020).

In Uganda, the education system is under increasing pressure to integrate digital technologies. This is intended to impart students' knowledge, skills, and attitudes to survive the fast-evolving digital era under the Fourth Industrial Revolution (4IR[1]). The use of digital technologies in education is vital for providing learners and trainers opportunities to operate with ease in a highly digitalized economy and fast-evolving world of work; a need that the COVID-19 pandemic outrightly showed (ACET, 2020).
In this regard, the government of Uganda has put in place policies and initiatives to facilitate the implementation of digital technology in schools to improve the quality of education especially through personalised learning. This journey of digital transformation is enshrined in the Digital Uganda Vision (DUV), Uganda's National 4IR Strategy, the Ministryof Information and Communications Technology and National Guidance (**ICT**& NG)Strategic Plan, the Uganda Communications Commission(UCC) Strategic Plan (2020/21 – 2024/25), and the Uganda Institute Of Information And Communication

Technology (UICT) Masterplan, all intended to ensure uptake of digital technologies and enhance personalised learning.

Despite all these efforts, realization of personalised learning in Uganda's secondary and tertiary institutions is still very low (ACET 2020), leaving the majority of the students to lag behind in a changing world. An assessment report on teaching and learning (2022) by the academic registrar to the UICT Governing Council indicates that; teaching based on student's individual interests, needs, strengths, scaffolding,self-paced and one-to-one learning remained low with only 30% success registered. Therefore this study seeks to determine the extent to which digital technologies influence the personalised learning in higher education institutions in Uganda.

### 1.3 Objectives of the study

#### 1.3.1 General Objective

The main of objective of the study was to examine the relationship between Digital technologies and personalised learning at UICT.

#### 1.3.2 Specific objectives

1. To establish the relationship between digital technologies and differentiated instruction at UICT
2. To examine the relationship between digital technologies and individualized instruction at UICT
3. To find out the relationship between digital technologies and knowledge construction and transfer at UICT

#### 1.3.3 Research Questions

1. What is the relationship between digital technologies and differentiated instruction at UICT?
2. What is the relationship between digital technologies and individualized instruction at UICT?
3. What is the relationship between digital technologies and knowledge construction at UICT?

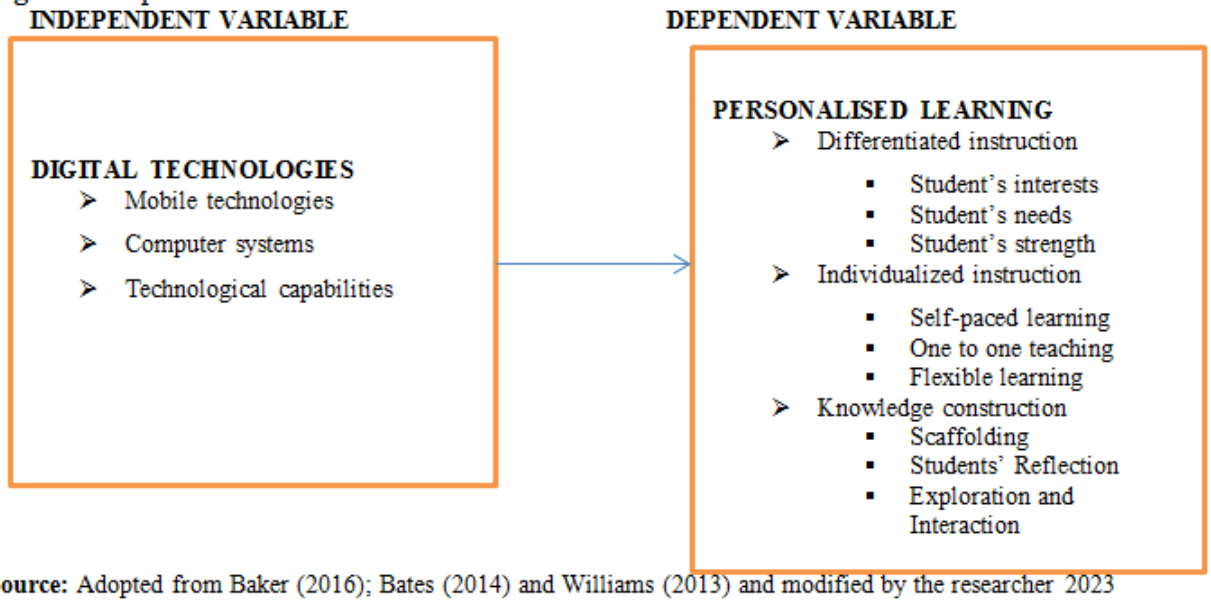
### 1.4 Significance of the study

1. The results of the study will add to the already existing literature on digital technologies and personalised learning.
2. The findings of the study shall provide an opportunity to enhance application of the concept of personalised learning in higher institutions of learning.
3. The study findings shall enhance further research in digital technologies and the education sector for the country's economic development.
4. The education institution used as case study shall benefit from this study by providing alternative methods of teaching and learning that augments personalised learning.
5. It enhances the institution's reputation as one that values and supports individualized learning

### 1.6 Conceptual Framework

The research model demonstrates the relationship between digital technologies as independent variable and personalised learning as a dependent variable. It is conceptualized that digital technologies influence personalised learning and this improves a student's performance. Digital technologies were measured in terms of mobile technologies, computer systems and technological capabilities (Baker 2016). Personalised learning shall be measured in terms of differentiation, individualisation and knowledge construction (Bates 2014 & Williams 2013).

**Fig 1** Conceptual Framework




**Source:** Adopted from Baker (2016); Bates (2014) and Williams (2013) and modified by the researcher 2023

## METHODOLOGY

### 3.1 Introduction

This section presents the strategy that was used in conducting the study. It covers the research design, study population, sampling method, data collection, and data analysis; measurement of study variables and limitations of the study.

### 3.2 Research Design

A cross sectional survey design which involves collection and analysis of data at one point in time was used. Both analytical and descriptive techniques were used to analyze the data collected.

### 3.3 Study population

The study targeted a population of 210 participants including; 140 registered students at UICT (Academic Registrar's Report, academic year 2021/2022) and 70 lecturers (Human Resource Staff Development Extract Report, 2021).

### 3.4 Sample selection and sample Size

Out of a population of 210 students and lecturers, a sample of 136including 91and 45 for students and lecturers respectively was determined using the Krejcie and Morgan table (1970). Stratified random sampling was used to select students and lecturers as units of inquiry.

### 3.5 Data Sources and collection instrument

Primarydata that was collected from carefully selected respondents especially students and lecturers. This was done through administering a structured questionnaire with the help of one research assistant. Additionally, respondents were guided through the questionnaire to ensure high level of accuracy in the data collection process.

A semi structured questionnaire contained questions relating to each study variable in question. The questions were related to digital technologies and personalised learning in higher education institutions in Uganda.

### 3.6 Measurement of variables

Digital technologies were explained using mobile technologies, computer systems and technological capabilities (Baker, 2016).

Personalised learning was measured by considering differentiated instruction, individualized instruction and knowledge construction;Bates (2014) and Williams (2013).

A 4-Point Likert Scale provided four possible answers to a statement or question that allows respondents to indicate their positive-to-negative strength of agreement or strength of feeling regarding the question or statement. It assumed that the strength/intensity of an attitude is linear, i.e., on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. For example, each of the four responses had a numerical value that was used to measure the attitude under investigation as indicated; Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4). Likert Scale can measure other variations such as frequency, quality, importance and likelihood etc.

### 3.7 Validity and reliability of research instruments

Assessment instruments must be both reliable and valid for study results to be credible. In the present study, reliability of the assessment tool was estimated using Cronbach alpha test of internal consistency. This test is frequently used to calculate the correlation values among the answers in the assessment tool. Cronbach alpha calculates correlation among all the variables, in every combination; a high reliability estimate should be as close to 1 as possible. The following formula was used in SPSS as follows.

$$\alpha = \frac{Nc}{v+(N-1)c}$$

Where;

c is the average inter-response covariance

v is the average variance and

N is the number of items in the questionnaire

**Table 1: showing reliability of Research Instrument**

| | | R1 | R2 | R3 | R4 |
|---|---|---|---|---|---|
| R1 | Covariance | **1.403** | 0.673 | 0.689 | 0.732 |
| R2 | Covariance | 0.673 | **1.678** | 0.723 | 0.727 |
| R3 | Covariance | 0.689 | 0.723 | **1.921** | 0.803 |
| R4 | Covariance | 0.732 | 0.727 | 0.803 | **1.736** |

V= (1.403+1.678+1.921+1.736)/4= 1.685

C=(0.673+0.689+0.732+0.723+0.727+0.803)/6= 0.7245

$\alpha = \frac{4(0.7245)}{1.685+(4-1)0.7245} = 0.751$

According to Amin (2005) if Cronbach Alpha is greater than 0.7, then it is a good measure for reliability.

**Validity** refers to how well the assessment tool actually measures the underlying outcome of interest. The instrument was discussed with content experts suggested by the supervisor in the field of digitalized learning. The experts were specifically requested to indicate whether the items in particular sections of the questionnaire adequately measure the respective constructs and whether the instrument was appropriate for this kind of study. The final instrument was developed upon incorporating all comments from the experts.Content validity index(CVI) is the most widely reported approach for content validity in instrument development and can be computed using the Item-CVI (I-CVI) and the Scale-level-CVI (S-CVI). I-CVI is computed as the number of experts giving a rating of relevant for each item divided by the total number of experts.

CVI = No of items declared relevant by judges=20
Total No of items on the Questionnaires 24

=0.833

Values range from 0 to 1 where I-CVI > 0.79, the item is relevant, between 0.70 and 0.79; the item needs revisions, and if the value is below 0.70 the item is eliminated.A score of 0.7 and above was accepted as Amin (2005) suggested.

### 3.8 Data processing and analysis

The collected data was edited for incompleteness and inconsistence. Statistical package for social scientists (SPSS) version 25 was used for data entry and analysis. Data was presented using diagrams, tables, charts and other forms of presentations. Pearson's correlation coefficient was used to establish the relationships between digital technologies and personalised learning. Regression Analysis was used to determine the power of the explanatory variables.

## PRESENTATION, INTERPRETATION AND ANALYSIS OF FINDINGS

### 4.1 Relationship between digital technologies and differentiated instruction

During the study, six statements on digital technologies and differentiated instruction were presented to lecturers and students at UICT who wereasked to provide their opinion, a 4-Point Likert Scale that provides four possible answers (Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4)) to a statement that allows respondents to indicate their positive-to-negative strength of agreement regarding the statement was used; results are presented in the table.

**Descriptive Statistics**

**Table 2Relationship between digital technologies and differentiated instruction at UICT**

| S/N | Item | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| 1 | Digital technologies like zoom and goggle meet help me in my specific learning preferences and actions at UICT | 121 | 1 | 4 | 2.57 | .898 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | Blended computer teaching systems are essential in meeting my learning needs at UICT | 121 | 2 | 3 | 3.10 | .790 |
| 3 | Mobile technologies enable me to learn from long distance while off campus hence meeting learning interests at UICT | 121 | 2 | 3 | 3.45 | .888 |
| 4 | There is a relationship between digital technologies and differentiated instruction at UICT | 121 | 1 | 4 | 2.97 | .809 |
| 5 | I use mobile technologies to download lectures and re-listen to them which helps to build my listening abilities | 121 | 2 | 4 | 3.13 | .991 |
| 6 | Effective digitalized instruction accommodates differences in learners' readiness levels, interests and learning profiles. | 121 | 2 | 4 | 2.97 | .836 |
| | **Average** | | | | **3.03** | **0.096** |

**Source: Primary data**

Results indicate that digital technologies like zoom and goggle meet help students in their specific learning preferences and actions at UICT. This is described by a high mean value of2.57 and a normal standard deviation of0.898 (Table 2).

These findings affirm that blended computer teaching systems are essential in meeting students' learning needs at UICT. The mean value of 3.10 indicate that majority of the respondents agreed and a normally distributed standard deviation of 0.790 shows that the dispersion of a dataset closer to the mean.

Findings further indicate that mobile technologies enable students to learn from long distance while off campus hence meeting learning interests at UICT. The mean value of 3.45and a low standard deviation of 0.888 affirm this finding.

The study also found that, use of mobile technologies to download lectures and re-listening to them helpslearnersto build their listening abilities. This is explained by a high mean value of 3.130 and standard deviation of 0.991.

The study further reveals that, effective digitalized instruction accommodates differences in learners' readiness levels, interests and learning profiles as shown by a mean value of 2.97 and standard deviation of 0.836.

The standarddeviationranged from0.790 to0.991 whichwasrelatively lowsuggestingthatmostmeansdidnotdeviatefromthe centralmean by abig margin.
Toestablish whether there is or no relation between Digital Technologies and Differentiated Instruction, correlation coefficient was determined (Table 2).

**Inferential statistics**

**Table 3: Correlation coefficient for digital technologies and differentiated instruction**

| | | **Digital Technologies** | **Differentiated Instruction** |
|---|---|---|---|
| **Digital Technologies** | Pearson correlation<br>Significant ( 2 tailed)<br><br>N | 1<br><br><br>121 | 0.954**<br>0.000<br><br>121 |
| **Differentiated Instruction** | Pearson correlation<br>Significant ( 2 tailed)<br>N | 0.954**<br>0.000<br>121 | 1<br><br><br>121 |

** Correlation is significant at 0.05 level (2 tailed)

**Source: Primary data 2023**

There was a significant positive relationship betweenDigital Technologies and Differentiated Instruction(r=0.954**,P=0.000) (Table3). This implies that the Digital Technologies significantly affect Differentiated Instruction and therefore,digital technologies like zoom and goggle meet help in delivering lectures specific to learner's preferences and actions at UICT.
Regression analysis was further done to determine the strength of the relationship between digital technologies and differentiated instruction.( Table 4)

**Table 4: Regression analysis for digital technologies and differentiated instruction**

| Model | R | R square | Adjusted R square | Standard error of estimate |
|---|---|---|---|---|
| 1 | 0.9542** | 0.9104 | 0.8788 | 0.0392 |

Predictors (constant), digital technologies

**Source: Primary data 2023**

Table 4 indicates that the coefficient of determination (Adjusted R2) value is 0.8788; this implies that digital technologies explain 87.88% variation in differentiated instruction.

### 4.2Relationship between Digital technologies and Individualized instruction

During the study, six statements on digital technologies and Individualized instruction were presented to lecturers and students at UICT who were asked to provide their opinion;a 4-Point Likert Scale that provides four possible answers (Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4)) to a statement that allows respondents to indicate their positive-to-negative strength of agreement regarding the statement was used; results are presented in the table 5.

**Descriptive Statistics**

**Table 5:Relationship between Digital Technologies and Individualized Instruction at UICT**

| S/N | Item | | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|---|
| 1 | Mobile learning technologies enable me to have self-paced learning at UICT | | 121 | 2 | 4 | 3.48 | .570 |
| 2 | Computer based learning systems enable me to have a one to one learning experience at UICT | | 121 | 1 | 4 | 3.06 | .892 |
| 3 | Mobile teaching technologies enable students to have flexible learning experiences at UICT | | 121 | 1 | 3 | 3.23 | .717 |
| 4 | Digital computers enable me to do flexible scheduling of lectures for individualized learning | | 121 | 1 | 4 | 2.93 | 1.015 |
| 5 | Mobile technologies enable interaction with a lecturer individually, with instruction tailored to my own personal pace and learning needs | | 121 | 2 | 3 | 2.93 | .842 |
| 6 | The is a relationship between Digital Technologies and Individualized Instruction at UICT | | 121 | 1 | 4 | 3.03 | .615 |
| | **Average** | | | | | **3.11** | **0.11** |

**Source: primary data 2023**

Table 5 showsa positive insight on the relationship between Digital Technologies and Individualized Instruction at UICT.

Resultsreveal that mobile learning technologies enable students to have self-paced learning at UICT. This is supported by a mean value of 3.48 indicating that most respondents strongly agreed and a normally distributed standard deviation of 0.570 which indicates that data are clustered tightly around the mean.

On whether computer based learning systems enable students to have a one to one learning experience at UICT, the results indicate a positive insight with a high mean value of 3.06 and a low standard deviation of 0.892.It was further revealed that mobile teaching technologies enable students to have flexible learning experiences at UICT as shown by a bigger mean value of 3.23 and a small standard deviation of 0.717Findings further indicate that digital computers enable lecturers and students to do flexible scheduling of lectures for individualized learning. This was illustrated with high mean value of 2.93 and a slightly high standard deviation of 1.015 which indicate that data is spread far away from the mean.

The study further reveal that,respondents agreed that mobile technologies enable interaction with a lecturer individually, with instruction tailored to students own personal pace and learning needs as reflected with a mean value of 0.93 and a normal standard deviation of 0.842.The results further indicate a positive relationship between Digital Technologies and Individualized Instruction at UICT. Findings reveal a mean value of 3.03 and standard deviation of 0.615 depict that a significant number of respondents agreed with the statement.

**Inferential statistics**

To establish whether there is or no relationship between Digital Technologies and Individualized Instruction, correlation coefficient was determined (Table 6).

Table 6: Correlation coefficient for digital technologies and Individualized Instruction

| | | **Digital Technologies** | **Individualized Instruction** |
|---|---|---|---|
| **Digital Technologies** | Pearson correlation<br>Significant ( 2 tailed)<br><br>N | 1<br><br><br>121 | 0.961**<br>0.000<br>121 |
| **Individualized Instruction** | Pearson correlation<br>Significant ( 2 tailed)<br>N | 0.9605**<br>0.000<br>121 | 1<br><br>121 |

** Correlation is significant at 0.05 level (2 tailed)

**Source: Primary data 2023**

Results show the correlation (r=0.9605**, P=0.000) (Table 6). This implies that Digital Technologies significantly affect Individualized Instruction. Digital technologies enable interaction with a student individually, with instruction tailored to learner's own personal pace and learning needs.

Regression analysis was further done to determine the strength of the relationship between digital technologies and individualized instruction(Table7).

**Table 7 Regression analysis for digital technologies and individualized instruction.**

| Model | R | R square | Adjusted R square | Standard error of estimate |
|---|---|---|---|---|
| 1 | 0.9605** | 0.9226 | 0.8953 | 0.0449 |

Predictors (constant), digital technologies

**Source: Primary data 2023**

Table 7indicates that the coefficient of determination (Adjusted $R^2$) value is 0.8953; this implies that digital technologies explain 89.53% variation in individualized instruction.

### 4.3 Relationship between digital technologies and knowledge construction

During the study, six statements on digital technologies and knowledge constructionwere presented to lecturers and students at UICT who were asked to provide their opinion, a 4-Point Likert Scale that provides four possible answers (Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4)) to a statement that allows respondents to indicate their positive-to-negative strength of agreement regarding the statement was used; results are presented in the table 8**.**

**Descriptive Statistics**

**Table 8:Relationship between digital technologies and knowledge construction at UICT**

| S/N | Item | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| 1 | Computer based teaching systems enable students to have personal reflections UICT | 121 | 1 | 4 | 3.12 | .806 |
| 2 | There is a relationship between digital technologies and knowledge construction at UICT | 121 | 2 | 3 | 3.19 | .655 |
| 3 | Mobile technologies enable scaffolding with students | 121 | 2 | 4 | 2.46 | .877 |
| 4 | Technology enables me to develop learner's cognitive, affective, intuitive and psychomotor domains through engaging ways | 121 | 2 | 4 | 3.06 | .680 |
| 5 | I use technology to foster creativity, like creating digital artwork or making a short movie for student's reflection. | 121 | 1 | 3 | 2.62 | 1.088 |
| 6 | Digital programs connect learning to real-world experiences and also promote equity, access and opportunity for all students | 121 | 2 | 4 | 3.37 | .719 |
| | **Average** | | | | **2.97** | **0.085** |

**Source: primary data 2023**

Table 8 showsthat computer based teaching systems enable students to have personal reflections at UICT. This is explained by the mean value of 3.12 and a normally distributed standard deviation of 0.806. The study also indicates that most respondents agreed that, there is a relationship between digital technologies and knowledge construction at UICT as depicted by a mean value of 3.19 and a low standard deviation of 0.655.Results further reveal that most respondents disagreed that, mobile technologies enable scaffolding with students. This is elaborated by a mean value of 2.46 and standard deviation of 0. On whether technology enables learner's cognitive, affective, intuitive and psychomotor domains through engaging ways, results indicate a positive response with mean value of 3.06 and a low standard deviation of 0.680. On whether lecturers use technology to foster creativity, like creating digital artwork or making a short movie for student's reflection, findings indicate a positive trend with mean value of 2.62 and a slightly high standard deviation of 1.088 which indicates data are more spread out.Item 6 had the highest mean value of 3.37 and standard deviation of 0.719 indicating that digital programs connect learning to real-world experiences and also promote equity, access and opportunity for all students.

**Inferential statistics**

To establish whether there is or no relation between Digital Technologies and Knowledge Construction, correlation coefficient was determined (Table 9).

**Table 9: Correlation coefficient for digital technologies and Knowledge Construction**

| | | **Digital Technologies** | **Knowledge Construction** |
|---|---|---|---|
| **Digital Technologies** | Pearson correlation<br>Significant ( 2 tailed)<br><br>N | 1<br><br><br>121 | 0.956**<br>0.000<br>121 |
| **Knowledge Construction** | Pearson correlation<br>Significant ( 2 tailed)<br>N | 0.956**<br>0.000<br>121 | 1<br><br>121 |

**Source: Primary data 2023**

There was a significant positive relationship between Digital Technologies and Knowledge Construction correlation (r=0.956**,P=0.000) Table9 This implies that the Digital Technologiessignificantly affect Knowledge Constructionand therefore the finding show that improvement in digital technologies positively and significantly relate to knowledge construction.

Regression analysis was further done to determine the strength of the relationship between digital technologies and knowledge construction(Table 10)

**Table 10: Regression analysis for digital technologies and knowledge construction**

| Model | R | R square | Adjusted R square | Standard error of estimate |
|---|---|---|---|---|
| 1 | 0.9562** | 0.9143 | 0.8840 | 0.3469 |

Predictors (constant), digital technologies

**Source: Primary data 2023**

Thecoefficient of determination (Adjusted $R^2$) value is 0.8953; this implies that digital technologies explain 88.40% variation in knowledge construction.

## DISCUSSION OF FINDINGS

### 5.1 Relationship between digital technologies and differentiated instruction at UICT

There was a significant positive relationship between digital technologies and differentiated instruction at UICT. This implies that effective digitalized instruction will improve on the Student's interests, Student's needs, and Student's strength while traditional technologies limitlearning especially learner's abilities. This is in agreement with the studies of Conrad et al., (2014); Beggrow et al., (2014); Nakamura et al., 2016; Zheng, (2007) who stated that digital technology had the potential to facilitate information retrieval and retention, assist in mental representation, and support knowledge transfer in complex learning. This finding is also supported by Butcher & Aleven, (2013); Chen & Huang, (2014); Tucker et al., (2014) who emphasized that digital technology with cognitive support can significantly improve students' deep learning.

It was also revealed that digital technologies like zoom and goggle meet help in delivering lectures specific to learner's preferences and actions at UICT. This is in line with Conati et al., (2013); Moos & Bonde, (2016); Zheng et al., 2009 who stated that Digital Technology with Enhanced Cognitive Support **(**DTECSs) have the potential to personalize learning for learners with different cognitive styles and abilities.

Blendedcomputer teaching systems and mobile technologies werereported as essential in meeting learner's needs and enablelearning from long distance while off campus respectively hence meeting learner's interests at UICT. This was affirmed by Springer, Stanne and Donovan, (1999) who argued that it is vital to know how students learn and that most of them learn through collaborative, active working inside and outside the classroom; as collaborative programs and courses help to boost student's engagement and learning.

The study also found that effective digitalized instruction accommodates differences in learners' readiness levels, interests and learning profiles at UICT. This is emphasized by Dabbagh (2005) who stated that for personalised learning to be effective, it must be grounded in epistemological theories, based on different views of cognition and knowledge. Teachers need to design their courses by considering theories that emphasize collaboration among learners and active knowledge creation. Mor, Craft, and Maina (2015) also stressed that, Teachers need to change and become designers for learning so that learners are actively engaged in the learning process.

This further supported by Zmuda etal. (2015) who advocated for "a balanced approach through which the teacher and student collaborate in the design of the learning experience

### 5.2Relationship between Digital Technologies and Individualized Instruction at UICT

Results revealed a significant positive relationship between Digital Technologies and Individualized Instruction. This means that an improvement in Digital Technologies enhance Individualized Instruction. Findings revealed that mobile learning technologies and computer based learning systems enable lecturers to apply self-paced learning styles and one to one interaction respectively with learners at UICT. This is in agreement with Bates (2014); Williams (2013) who stated that, the ultimate aim of a personalised learning environment is to create an educational system that responds directly to the diverse needs of individuals rather than imposing a 'one size fits all' model on students. They emphasize that,

personalised learning shifts the role of students from being simply a 'consumer' of education to a 'co-producer and collaborator' of their learning pathway.

Bentley & Miller (2004) also confirmed that, for a student, personalised learning actively engages students in the process of learning, leading to improved learning outcomes and learning experiences. For institutions, it enhances their reputation as one that values and supports individual student's learning.

The findings also indicated that mobile technologies enable interaction with a student individually, with instruction tailored to learner's own personal pace and learning needs.Truong (2016) stated that providing the same content to students with different qualifications and personal traits and having different interests and needs is not considered adequate anymore when learning can now be personalized. This is further supported by Miliband (2006) as cited in Lee, Huh, Lin and Reigeluth (2018) who promoted personalized learning to be the solution to tailoring the learning according to individuals' needs and prior experience so as to allow everyone to reach their maximum potential through customized instruction. Furthermore Brusilovsky and Peylo, (2003); Liu and Yu, (2011), state that, the customized instruction that includes what is taught, how it is taught, and the pace at which it is taught allows learning to meet individual needs, interests and circumstances which can be quite diverse.

Mobile teaching technologies enable students to have flexible learning experiences at UICT. The same view is held by John Dewey's (1915, 1998) who emphasized experiential, learner-centered learning, social learning, extension of the curriculum, and fitting for a changing world. McCombs & Whisler (1997); as cited in Lee et al., (2018) claimed that a learner-centered environment develops as it considers learners' unique characteristics using the best knowledge of teaching and learning which are available.Furthermore, Lockspeiser & Kaul (2016) claimed that individualized learning is a tool to facilitate learner-centered education.

Prior studies indicate that moving toward a personalized learning approach does not eliminate or even diminish the need for the classroom teacher; it merely shifts the role of the teacher from the lead resource and deliverer of information to a "curriculum planner, classroom facilitator and coach, assessor, advisor, communicator, and connector" to form a learning partnership between the teacher and the student (Zmuda et al., 2015, p. 20).In a study conducted by Saeed, Yang and Suku (2009) they observe "a major obstacle in the practice of web-based instruction is the limited understanding of learners' characteristics and perceptions about technology use" (Saeed et al., 2009, p. 98).

### 5.3 Relationship between digital technologies and knowledge construction at UICT

There was a positive significant relationship between digital technologies and knowledge construction at UICT. This means that suitabledigital technologies encourage knowledge construction while traditional technologies limit knowledge construction. This relationship is linear and significant which is in conformity with the scholars like; Twyman (2018), who pointed out that active student responses increases student engagement and learning outcomes, and decreases disruptive behavior. Hardware tools such as classroom response systems ("clickers") and even students' own digital devices, coupled with software applications, allow all students to respond individually and simultaneously, often with immediate individualized feedback and data on each learner for the teacher.

Findings indicate that, digital programs connect learning to real-world experiences and also promote equity, access and opportunity for all students touse technology to foster creativity, like creating digital artwork or making a short movie for student's reflection. Naresh & Reddy (2015) Stated that digital

technologies use has been growing in the education sector, and has been disruptive to the future of education planning; catalysed by the widening availability to low-cost devices and network services
The result again concurs with the findings of Alonso, López, Manrique & Viñes, (2005); who stated that digital technologies is defined by many authors in literature: for example, "the use of new multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration.
Findings further indicate that technology enables lecturers to develop learner's cognitive, affective, intuitive and psychomotor domains through engaging ways at UICT. This is agreement with Hammet & Collins (2002), who stated that knowledge construction occurs when students engage in meaningful activities that are authentic in real situations.
The study results further revealed that mobile technologies and computer-based teaching systems enable scaffolding with studentsand to have personal reflections respectively at UICT. This is in agreement with Chatti (2010); Miliband (2006) who stated that, personalized learning is a complex activity approach that is the product of self-organization or learning and customized instruction that considers individual needs and goals. Pontual Falcão, e Peres, Sales de Morais and da Silva Oliveira (2018) further explained that personalized learning can be an efficient approach that can increase motivation, engagement and understanding, maximizing learner satisfaction, learning efficiency, and learning effectiveness (Gómez, Zervas, Sampson and Fabregat, 2014).

## CONCLUSION

Based on discussion of the findings, the following are the conclusions:

### 6.1 Digital Technologies and Differentiated Instruction

Digitaltechnologies contribute to better differentiated instruction through building learner's listening abilities, accommodating differences in learners' readiness levels, interests and learning profiles.

### 6.2 Digital Technologies and Individualized Instruction

Digital Technologies have a significant effect on Individualized Instruction. They enable interaction with a student individually, with instruction tailored to learner's own personal pace and learning needs.

### 6.3. Digital Technologies and Knowledge Construction

Digitalprograms connect learning to real-world experiences and also promote equity, access and opportunity for all students enabling them to have personal reflections at UICT.
It was observed that there was a significant positive relationship between the study variables. It is therefore evident that digital technologies have an impact on the personalised learningat higher education institutions in Uganda.

## RECOMMENDATIONS

On the basis of study objectives, findings and the conclusion made:
The study recommends that in order to improve personalised learning, digital technologies should be enhanced.
Digital technologies must be availed to create conducive environment to access Mobile technologies, Computer systems, Technological capabilities and later positively impact on personalised learning in HEIs.

The government should come up with incentives that encourage Higher Education Institutions to stimulatepersonalised learning.

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**LIST OF ABBREVIATIONS**

ACET: African Center for Economic Transformation
DTECSs: Digital Technology with Enhanced Cognitive Support
DTGEPS: Digital Technology for General Educational Purposes
HEIs: Higher Education Institutions
SPSS: Statistical package for social scientists
UBOS: Uganda Bureau of Statistics
UICT: Uganda Institute of Communication and Information Technology

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**Conflict of interest**

I Twesigye Biho Leonard, declare to the best of my knowledge thatI have no any competing financial, personal, or professional connections or personal values and stand with this journal that may compromise professional objectivity.

**Author Biography**

**Twesigye Leonard Biho** is a Lecturer and Dean of Faculty of Business and Management at Team University with vast experience in Transformational Leadership and Management, Curriculum development and review, Teaching and Research at micro and macro levels. He is an Educator, mentor, trainer and researcher in Practicum Entrepreneurship, Business modeling and sustainability.

Biho Holds a Master of Business Administration from Makerere University, Bachelor Vocational Studies in Education from Kyambogo University. He is currently pursuing an Integrated Skills Development PhD at Makerere University, a Master of Educational Planning and Management at Team University, a Certified Public Accountant Certification at the Institute of Certified Public Accountants of Uganda. Biho has several years of experience in both private and public sectors including Centenary Bank, Salama Shield Foundation, Uganda Institute of Information and Communications Technology and Ministry of Education and Sports Uganda Government. He is a principal farmer and loves gardening.

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