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A systematic review of information and communication technologies (ICTs) on student motivation: researchers' reflections on a selected higher education institution (HEIs)

Nhlanhla Mzameleni Nhleko
Department of Information Systems, Durban University of Technology, Durban, South Africa

Oluwasegun Julius Aroba
Department of Information Systems/Department of Operations and Quality Management, Durban University of Technology, Durban, South Africa and Centre for Ecological Intelligence, Faculty of Engineering and the Built Environment, University of Johannesburg, Johannesburg, South Africa, and

Collence Takaingenhamo Chisita
Department of Information Science, University of South Africa – Muckleneuk Campus, Pretoria, South Africa

Abstract

Purpose – Through the review of several journal articles on the adoption of information and communication technologies (ICTs) and how it impacts students' motivation to continue with their studies or to drop out of their academic program, this study aims to review the literature on the impact of ICTs on student motivation at a university.

Design/methodology/approach – This paper is based on a systematic literature review steered by the PRISMA guidelines. This paper uses both Durban University of Technology subscription-based and publicly available papers. The research articles examined were published between 2018 and 2023 in Scopus, Web of Science and ScienceDirect.

Findings – Reviewed literature bespeaks that ICTs can increase student motivation by enhancing interactive, engaging and individualized learning. Digital technologies that engage students and offer a more engaging

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learning environment include instructional apps, online simulations and multimedia content. Using ICTs may be useful in lowering university dropout rates.

Originality/value – The systematic review yielded valuable insights for both academic research and real-world applications in education regarding the Durban University of Technology. The study offers a comprehensive analysis of the nexus between ICTs and student motivation.

Keywords Information and communication technology (ICT), Student motivation, Technology acceptance, Digital skills, Learning management system (LMS)

Paper type Literature review

Introduction

Research reveals that information and communication technologies (ICTs) play a significant role in the lives of individuals and organizations alike. ICTs consist of a variety of communication technologies such as mobile applications, computers, software and other media applications that deliver information to users in a digital form (Koh *et al.*, 2022). Studies conducted by Belagra and Draoui (2018) have shown that teachers have a direct effect on students' motivation, and numerous studies have shown that teachers can inspire or demotivate them.

Okoye *et al.* (2021) stated that ICTs have become integral components of modern education, revolutionizing teaching and learning practices in higher education institutions (HEIs) worldwide. In recent years, there has been a growing interest in comprehending the impact of ICTs on student motivation, engagement and learning outcomes within the higher education context. This systematic review aims to provide a comprehensive examination of the existing literature regarding the influence of ICTs on student motivation, drawing insights from selected HEIs.

Motivation is a critical factor in determining students' academic success and persistence in higher education (Bin Abdulrahman *et al.*, 2023). As such, understanding how ICTs can enhance or hinder student motivation is essential for educators, administrators and policymakers seeking to optimize the use of technology in higher education settings. By conducting a systematic review, this study seeks to synthesize and analyze the findings of previous research on this topic, identify key trends, gaps and areas for future investigation, and offer researcher reflections based on insights gleaned from selected HEIs.

The usage of information and communication technologies in the institution of higher learning

A university that uses ICTs is an ideal scenario, regardless of whether it is situated in Africa or not. Ahmad and Sheikh (2022) suggest that humans are now heavily reliant on ICTs on a daily basis. With these technologies, users are able to access information through a variety of communication devices, including cellphones, desktops, laptops, the internet, Wi-Fi devices and multi-media tools.

It has been contended by Abdullayev (2020) that one method of enhancing motivation for learning is through the use of ICT in the educational process. Both students and lecturers are able to develop their creative personalities through the use of ICTs. Learning management systems (LMSs) are among the many ICTs used by the university and can be defined as online learning technologies used to create, manage and deliver course content (Turnbull *et al.*, 2019).

Ghanaian researcher Adarkwah (2021) argued that in addition to the benefits of social upliftment, ICT facilitates teaching and e-learning activities, which benefit teaching, learning and research. The study conducted in Zimbabwe by Rudhumbu (2022) highlighted the need for universities to increase investment in ICT infrastructure as well as in capacitating students with the necessary ICT skills for the optimum use of institutional ICT infrastructure

to enhance the blended learning mode. The study further argued that without appropriate ICT infrastructure and necessary skill this could lead to low motivation among students apropos accepting digital technologies. This is a clear indication that all universities should embrace this innovation.

Problem statement

Ahmad and Sheikh (2022) asserted that students today already have access to information technology gadgets like laptops, computers, mobile phones, etc.; therefore, it is equally important to also investigate the impact these tools have on students' motivation. Several students in South Africa come from rural areas where digital infrastructure and electricity are limited; therefore, access to these devices varies. If technology resource-starved students are enrolled in technology endowed universities or colleges, they are likely to experience challenges because of the lack of necessary knowledge and skill sets (such as digital and metaliteracy models, among many) to navigate the wide range of the ICT resources, for example, LMSs. A metaliteracy approach is ideal for fostering a spirit of active learning, critical involvement and reflection in higher education, according to Durodolu *et al.* (2021). Therefore, the introduction of ICT technologically challenged students could impair their morale and their exuberance to continue with their studies. Unfortunately, the failure to address this issue could jeopardize university retention tactics and lead to a rise in the dropout rate. The sad reality is that the dissemination ICTs in tribal communities remains a challenging endeavor, especially given their socioeconomic circumstances, ethnocultural contexts and a host of infrastructure and access-related challenges *vis-a vis* the digital divide (Nayak *et al.*, 2020).

Research questions

RQ1. What is the perceived effectiveness of LMSs?

RQ2. How do various ICTs, including learning management systems, online platforms and educational software, influence student motivation?

RQ3. How can insights from existing studies guide the effective use of ICTs to enhance student motivation in higher education?

Literature review

There is a plethora of information available worldwide regarding ICT adoption, application, merits and demerits advantages and effects on people and businesses. This review examined 29 empirical studies published in peer-reviewed journals from 2018 to 2023 that investigated the impact of ICTs on students' motivation at the university, the use of computers and ICTs for learning, including academic writing. Table 1 provides an overview of the sources reviewed for the study.

Chisita (2020) and Haleem *et al.* (2022) postulated that the COVID-19 pandemic compelled educational institutions to switch to an online learning environment to maintain the system. Developed countries were well-prepared to handle this disaster. Although there has been progress in the world regarding increasing the usage of the internet and ICT, the digital divide between developed and underdeveloped nations still exists (United Nations, 2019). However, Afawubo and Noglo (2022) asserted that developing nations have little choice but to leapfrog to more advanced technologies when it comes to adopting emerging technologies. The development of ICT abilities among university students seem to be a

Table 1. Extensive research on the impact of ICT on student motivation across the continents

Author	Year	Country	Title	Method	Limitation
Parul Kumara, Neha Kumarb	2020	India	A study of learner's satisfaction from MOOCs through a mediation model	The structured questionnaire was modified based on previous research on students' satisfaction with online instruction	The current study's goal has been to examine the variables influencing MOOC participants' satisfaction *(ScienceDirect)*
Lilach Alon, SeoYoon Sung, JiYong Cho, Ren´e F. Kizilcec	2023	USA	From emergency to sustainable online learning: Changes and disparities in undergraduate course grades and experiences in the context of COVID-19. Computers and Education, 203: 104870	Four course instructors participated in semi-structured interviews for the study. Six leading questions concerning modifications made to the course throughout the shift to online learning (both emergency and sustainable) were included in each 45–60-min interview	The study investigated changes in student grades and experiences during emergency online learning (spring 2020) and sustainable online learning a year later (spring 2021) *(ScienceDirect and Scopus)*
Ahmad, T. and Sheikh, A.	2022	Pakistan	Impact of information and communication technologies (ICT) on student's learning: a case from university of the Punjab, Pakistan. *Digital Library Perspectives*, 38 (2): 205–221	The study used questionnaire. A convenience sample technique was used to pick 275 students who were enrolled in different degree programs at the University of the Punjab, Pakistan	The study examined how ICTs affect students' learning, with a focus on accessibility, availability, and ease of use of ICT resources *(Web of Science)*
Foster, G. and Stagl, S.	2018	Austria	Design, implementation, and evaluation of an inverted (flipped) classroom model economics for sustainable education course. *Journal of Cleaner Production*, 183: 1323–1336	The study used instructions for the students to complete the survey, the grades of the students as the secondary assessment method and the anonymous perception survey as the primary evaluation method	This study supplements the scant literature on ICM in sustainable education and advances the field of post-graduate research on ICM. This work also contributes to the growing body of research on ICM in the German-speaking world *(ScienceDirect)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Asad, M.M., Khan, S., Sherwani, F. and Banerjee, J. S.	2022	Pakistan	Impact of asynchronous Web-based learning environment on students' interest and motivation in mathematics: a quantitative research study. *International Journal of Information and Learning Technology*, 39 (4): 340–359	This study employed a quantitative methodology and a survey research design. Thus, information regarding students' motivation and interest in learning mathematics through asynchronous WBLE was gathered via a questionnaire	The purpose of the study was to determine how much Shah Abdul Latif university (SALU), Khairpur, students' interest and motivation in learning mathematics are impacted by the asynchronous WBLE *(Web of Science)*
Belagra, M. and Draoui, B.	2018	Algeria	Project-based learning and information and communication technology's integration: Impacts on motivation. *International Journal of Electrical Engineering Education*, 55 (4): 293–312	A questionnaire about motivation was used to collect data within an experimental research plan	The aim of this study was to investigate how students' motivation is affected by project-based learning and ICT *(Web of Science)*
G´eraldine Heilporn and Sawsen Lakhal	2021	Canada	Fostering student engagement in blended courses: a qualitative study at the graduate level in a business faculty	This qualitative case study explores the instructional strategies that foster student engagement in graduate level blended courses in a business faculty. Semi-structured interviews of eight instructors were conducted, and information gathered was complemented by content analysis of the course plans and web portals	The study focuses on general ICT in the context of pupils at home and school setup; however, no emphasis on university students *(ScienceDirect)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Murillo-Zamorano, L. R., López Sánchez, J. Á. and Godoy-Caballero, A. L. 2019	2019	Spain	How the flipped classroom affects knowledge, skills, and engagement in higher education: Effects on students' satisfaction. *Computers and Education*, 141: 103608	The online questionnaire, uploaded to Google Drive and accessible to the students through the VLE, contained information related to the students, the devices that they had used to complete the questionnaire and it was the result of a combination of face-to-face work with students in the classroom and online work combining the internet and digital media	The provides an effective flipped classroom plan for higher education so that its impact on knowledge, skills and engagement may be better understood *(WoS and ScienceDirect)*
Xiang Hua, Yang Gongb, Chun Laib and Frederick K.S. Leunga	2018	China	The relationship between ICT and student literacy in mathematics, reading, and science across 44 countries: A multilevel analysis	Three-level hierarchical linear models (HLM) were used to analyze the Programme for International student Assessment (PISA) 2015 data of 305,414 15-year-old students from 11,075 schools across 44 countries	In this study, ICT was viewed as multi-level (national, educational and student) components, and their connections to students' reading, arithmetic and scientific literacy were investigated *(ScienceDirect)*
Ibrahim Youssef Alyoussef	2023	Saudi Arabia	Acceptance of a flipped classroom to improve university students' learning: an empirical study on the TAM model and the UTAUT	The proposed model and survey were created, validated and assessed using a multistage testing technique	The purpose of the study was to find out why students used flipped classrooms, what they thought of the underlying pedagogy and expectations of the approach and what benefits and challenges they saw *(ScienceDirect)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Shahida Mariam, Kausar Fiaz Khawaja, Muhammad Nawaz Qaisar, Farooq Ahmad	2023	Pakistan	Blended learning sustainability in business schools: Role of quality of online teaching and immersive learning experience	The information was gathered from 589 students enrolled in various degree programs at 22 of Pakistan's top business schools	This study looked at how and when blended learning is first used to encourage students in Pakistani business and management schools to use it in the future *(Scopus)*
Marcos Fernandez-Gutierrez a, Gregorio Gimenez b, Jorge Calero c	2020	Spain	Is the use of ICT in education leading to higher student outcomes? Analysis from the Spanish autonomous communities	The PISA survey, conducted every three years, provides standardized data to assess the competencies of a representative sample of 15-year-old students in math, reading and science	This paper analyzes the impact of the use of ICT at school on students' outcomes in compulsory secondary education in math, reading and science *(ScienceDirect)*
Brian A. Swanson and Ahneka Valdois	2022	China	Acceptance of online education in China: A reassessment in light of changed circumstances due to the COVID-19 pandemic	This study uses a phenomenological approach. The basis of phenomenology is two main presumptions. The first is that perceptions give us information about the outside world. The second is that it is interesting and worthwhile for humans to live	This study examines Chinese students' online learning experiences during the COVID-19 pandemic to determine whether or whether it has become more acceptable for degree candidates to pursue their education online *(Scopus)*
Jalal Rajeh Hanaysha, Fayez Bassam Shriedeh, Mohammad in'Airat	2023	United Arab Emirates	Impact of classroom environment, teacher competency, information and communication technology resources, and university facilities on student engagement and academic performance	The information from 314 students in the United Arab Emirates was gathered using a survey tool. AMOS Version 21 was used in the data analysis phase to verify the research instrument and evaluate the suggested hypotheses	The purpose of the study was to ascertain how academic performance and student involvement at HEIs are affected by the classroom environment *(ScienceDirect and Scopus)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Rosa Estrieganaa, José-Amelio Medina-Merodiob and Roberto Barchinob	2019	Spain	Student acceptance of virtual laboratory and practical work: an extension of the technology acceptance model	Experimental study used to examine students' acceptance of technology and the process of adopting an online learning environment incorporating Web-based resources, an online questionnaire was designed to assess hypotheses	This paper presents insight into students' acceptance of technology and the process involved in their adoption of an OLE incorporating virtual laboratories *(ScienceDirect)*
John Komar, Jia Yi Chow, Masato Kawabata, Corliss Zhi Yi Choo	2022	Singapore	Information and communication technology as an enabler for implementing nonlinear pedagogy in Physical Education: Effects on students' exploration and motivation	The study used three distinct experimental conditions: all three conditions were performed by the participants, and at the conclusion of each, they answered a survey on their experiences with the climbing instruction	This study looked at the impact of integrating ICT in PE together with a pedagogical innovation to increase student motivation *(Scopus)*
Yuki Higuchi, Miyuki Sasaki and Makiko Nakamuro	2020	Japan	Impacts of an information and communication Technology-Assisted program on attitudes and English communication abilities: an Experiment in a Japanese High School	Over the course of five months, the treated students were given the option to participate in an extracurricular activity where they interacted via Skype for 25 min a week with Filipino professors who spoke English	Experimental study to assess the usefulness of the home use of ICT in complementing current education programs at high schools' level *(Scopus and WoS)*
Yan Cao, Zenah M. Alkubaisy, Jelena Stojanović, Nebojša Denić, Dalibor Petković, Dragan Zlatković, Aleksandar Zakić	2022	China	Appraisal of information and communications technologies on the teaching process by neuro fuzzy logic	A questionnaire study was applied to obtain training and testing data for statistical evaluation. The statistical analysis was based on an adaptive neuro fuzzy inference system (ANFIS)	The study observes the effects of math software on motivation, interest and confidence of the course's participants *(Scopus)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Youssra EL JANOUS, Hassan EL-HASSOUNY, Mohamed LAAFOU, Mourad Madrane	2022	Morocco	Effect of ICT on students' achievements and motivation in life and earth sciences subject	Questionnaires were administered to 30 students over 8 weeks as an experimental study. Statistical analysis was performed using SPSS	The study examined the impact of ICT integration on student learning and motivational outcomes in science education in high school context *(Scopus and WoS)*
Idorenyin Thomas Ukut And Donyaprueth Krairit	2019	Nigeria	Justifying students' performance: a comparative study of both ICT students' and instructors' perspective	A three-pronged methodology was used to conduct the study: a review of the literature, expert interviews and a self-administered survey of 430 students and 55 teachers of ICT from tertiary institutions in Nigeria's Akwa Ibom State	This study was limited to tertiary institutions in Akwa Ibom state, Nigeria. Consequently, the findings of this study are limited to Akwa Ibom state, Nigeria, and may not be generalized to cover other countries *(Scopus and WoS)*
Koon Teck Koh, Li Quan Warrick Tan, Martin Camir´E, Maria Agnes Alcantara Paculdar and Wei Guang Andy Chua	2022	Singapore	Teachers' and students' perceptions of factors influencing the adoption of information and communications technology in physical education in Singapore schools	The study is qualitative research placed within the framework of epistemological constructionism and driven by ontological relativism	The study set out to identify the critical variables that impact how instructors and students in Singaporean schools evaluate the use of ICT in PE *(Scopus and WoS)*
Arzouma Hermann Pilabré, Patrice Ngangue, Abibata Barro and Yacouba Pafadnam	2021	Burkina Faso	An Imperative for the National Public Health School in Burkina Faso to Promote the Use of Information and Communication Technologies in Education During the COVID-19 Pandemic: Critical Analysis	PRISMA-P (preferred reporting items for systematic review and meta-analysis protocols) was the approach adopted, and critical analysis and systematic reviews were conducted	The study examined the shortcomings and difficulties associated with the use of ICT in education at the NPHS and offered workable alternatives to encourage its adoption (*WoS)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Ferreira, A. P. F., Ferreira, P. And Marques, C. G. 2021	2021	Portugal	Motivating for Reading through Transmedia Storytelling: A Case Study with students from a Middle School in the Medio Tejo Region. *Education in the Knowledge Society*, 22	Questionnaires were used for learners and teachers. Physical and digital materials were developed with the purpose of supporting the activities facilitated in the classroom	The goal of this research project is to provide a detailed explanation of how transmedia might enhance instructional strategies and boost student enthusiasm *(WoS and Scopus)*
Gómez-Tejedor, J. A., Vidaurre, A., Tort-Ausina, I., Molina-Mateo, J., Serrano, M.-A., Meseguer-Dueñas, J. M., Martínez Sala, R. M., Quiles, S. and Riera, J.	2020	Spain	Effectiveness of flip teaching on engineering students' performance in the physics lab. *Computers and Education*, 144: 103708.	When using a traditional model, the grades that pupils received in years prior to the implementation of the flip teaching approach are contrasted with those from those years	This study examines the impact of the FT approach on students' academic performance in the laboratory settings of two technical degree subjects: electricity and physics *(ScienceDirect)*
Stecuła, K. And Wolniak, R.	2022	Poland	Advantages and Disadvantages of E-Learning Innovations during COVID-19 Pandemic in Higher Education in Poland. Journal of Open Innovation: Technology, Market, and Complexity, 8 (3): 159	The study used a Google questionnaire that was accessible online. Not only can you create a form with questions on it, but Google Forms also allows you to administer surveys	This study reports on the investigation on the benefits and drawbacks of creative e-learning in higher education during the COVID-19 epidemic *(ScienceDirect)*
Swanson, B. A. And Valdois, A.	2022	China	Acceptance of online education in China: A reassessment in light of changed circumstances due to the COVID-19 pandemic. *International Journal of Educational Research Open*, 3: 100214	This study uses a phenomenological approach	This study investigated if using online education for degree seekers has become more acceptable by examining the experiences of Chinese students who studied during the COVID-19 pandemic *(ScienceDirect)*

(*continued*)

Table 1. Continued

Author	Year	Country	Title	Method	Limitation
Rudhumbu, N.	2022	Zimbabwe	Applying the UTAUT2 to predict the acceptance of blended learning by university students. *Asian Association of Open Universities Journal*, 17 (1): 15–36	A structured questionnaire was used in a quantitative manner to gather data from a sample of 432 postgraduate students. Confirmatory factor analysis (CFA) was used for data validation	The UTAUT2 was used in the study to forecast students' adoption of blended learning in Zimbabwean colleges *(Scopus)*
Wu, Ycj, Wu, Th, Li, Yb	2019	China	Impact of using classroom response systems on students' entrepreneurship learning experience	Twenty-two graduate students enrolled in an 18-week course on entrepreneurship management are included in this study	The purpose of this study was to assess how students felt about using mobile-based CRS technology in an entrepreneurship course *(WoS)*
Mohammad A. Tashtoush1 Rommel Alali Yousef Wardat Nedal Alshraifin Hasan Toubat	2023	Saudi Arabia	The impact of information and communication technologies (ICT)-based education on the Mathematics Academic Enthusiasm	The study used the MAE questionnaire, which included three subscales: cognitive, behavioral and emotional	The study investigated the impact of ICT-based education on the academic enthusiasm of 11th-grade female students in mathematics *(Scopus)*
Abu Elnasr E. Sobaih, Ishfaq Ahmad Palla and Abdul Baquee	2022	India	Social Media Use in E-Learning amid COVID 19 Pandemic: Indian students' Perspective	The study used an online questionnaire, which was directed to a sample of higher education students in India via a personal network	This research explores perspectives of higher education students in India regarding the use of social media for e-learning amid the COVID-19 pandemic *(Scopus)*

Note: The table below is shown in a landscape view
Source: Developed by Nhleko, Aroba and Chisita (2024)

peripheral issue due to economic challenges. Overall, the interruption had a persistent negative impact on historically disadvantaged students. Hence, over extended periods of online learning, student experiences and learning outcomes should be closely watched and encouraged to prevent aggravating educational disparities (Alon *et al.*, 2023).

Researchers and policy officials alike are continuing to show more interest in the contentious topic of how ICT affects academic performance. The beneficial effects of ICTs on education have enthralled policymakers, who have made significant investments in this field. The evidence from science, however, is not entirely in favor of this endeavor (Fernández-Gutiérrez *et al.*, 2020). Additionally, ICTs promotes student participation through increased teacher–student and peer relationships (Asad *et al.*, 2022).

According to a Singaporean study, ICTs can benefit students even in physical education (PE). The findings of this investigation suggest that ICTs can benefit students when they are used and underpinned by a clear pedagogical goal (Komar *et al.*, 2022). Similarly, the Spanish study done by Murillo-Zamorano *et al.* (2019) reveals that students' knowledge is directly and favorably impacted by flipped classrooms and the study found out that students in flipped classrooms gained skill acquisition and development, according to earlier research.

In the context of secondary education, which is not foreign to this study, the study conducted in Portugal asserted that because technology is more akin to what students like and use in their everyday lives, it can significantly increase students' motivation. Additionally, integrating technology into the classroom can support student-centered learning, which advances the growth of abilities like independence, critical thinking, self-directed learning and self-esteem (Ferreira *et al.*, 2021). Given that Portugal has made early educational investments in its youth development programs confirms that the country has the potential to overcome difficulties amongst students who lack digital literacy.

According to Asad *et al.* (2022), a Pakistan study found that students' intrinsic, extrinsic and interest levels are significantly impacted by asynchronous Web-based learning environment (WBLE). Based on the degree of mean range of asynchronous WBLE, the results showed that mathematics students benefit. Similarly, in Poland, Stecuła and Wolniak (2022) posit that the more proficient a student is with information technology, the higher their assessment of the benefits of innovative e-learning; the more resources available to students to engage in e-learning activities, the higher their assessment of the benefits of e-learning; and the more frequently innovative e-learning solutions are implemented in a particular university, the higher their assessment of the benefits of e-learning.

The study primarily focuses on student capacity building as a domain that will provide favorable outcomes for optimum ICT usage. The research conducted by Gómez-Tejedor *et al.* (2020) in Europe demonstrated the considerable benefits of ICT use in the field of higher education. According to the statistical study conducted by Gómez-Tejedor *et al.* (2020), it was asserted that there was a statistically significant difference between the students' academic performance in both subjects under the flipped teaching method (FT) and the traditional method (TM) also known as legacy method. Additionally, Murillo-Zamorano *et al.* (2019) research supports the beneficial effects of the flipped classroom on students' engagement in discourse, knowledge and skills acquisition. This study offers academics insightful conclusions and helpful recommendations regarding ICT adaptation to enhance learning activities.

The study by Alon *et al.* (2023) conducted in the USA asserted that the disruptions that arose from the lasting negative impact of the COVID-19 pandemic on the historically disadvantaged students. Hence, over extended periods of online learning, student experiences and learning outcomes should be closely examined and encouraged to prevent aggravating educational disparities. Despite higher assessment marks during emergency

online learning, Alon *et al.* (2023) found that achievement gaps for students from ethnic minorities worsened when the shift from emergency to sustained online learning occurred. While switching from emergency to sustainable online learning increased the overall quality of the course (Alon *et al.*, 2023), it also affected students with low ICT aptitude. The subsequent section contextualizes ICT capacity development with reference to Asia and Africa.

In the context of Asia, China acknowledged that ICTs were beneficial for learning and research studies as evidenced by the integration of ICTs into their educational systems via a gradual and intricate process (Cao *et al.*, 2022). China's swift advancement of ICT has resulted in a remarkable digital transformation as evidenced by the adaptation of digital technologies in its educational system. Cao *et al.* (2022) further argued that ICT usage in the classroom changes traditional instruction into new instruction that is geared to fulfil the needs, demands and expectations of a techno-savvy modern learner. This raises the quality of education by enhancing student motivation, using a variety of knowledge sources and helping students develop their functional skills. All this is done with the ultimate goal of improving learning outcomes.

According to a study conducted by Hu *et al.* (2018), which assessed and monitored how ICT-related factors affected student academic performance, the preceding study examined how ICTs affected student motivation at a selected South African university. In spite of significant attempts to comprehend the connection between ICTs and student learning, further research in this area is required (Hu *et al.*, 2018). Another study conducted in China found that mobile-based customer requirement technologies (CRS) as a helpful and efficient tool for encouraging learners to interact with the material, raising students' motivation levels and increasing their engagement with acquiring entrepreneurial information (Wu *et al.*, 2019).

The Japanese took a different approach to ascertain the efficacy of how ICT can enhance existing educational programs. Higuchi *et al.* (2020) conducted a randomized controlled trial (RCT) in which they probed Japanese high school students pursuing English resources through ICTs to determine their level of motivation. This shows how, in contrast to the African context, they are looking at diverse ways to integrate ICTs into all areas of human endeavor, rather than concentrating on adoption and infrastructure challenges. The study's conclusions suggest further research into the effective strategies for motivating students, particularly those who tend to procrastinate in using ICT apps, for example, mobile technologies and LMSs that is the focus of this study. Another study conducted in Japan examined Skype as their communication tool with their professor and highlighted the importance of maintaining students' motivation to continue using ICT assisted learning programs, even if they were not already incorporated into the existing curriculum (Higuchi *et al.*, 2020).

The increasing usage of ICTs in the 21st century has caused a paradigm shift in education because it has a high degree of transformative power. With the development of ICT, open, online and flexible learning has moved from being an afterthought in mainstream education to an everyday experience for those institutions that are technologically resource endowed (Kumar and Kumar, 2020).

Capacity development on ICT skill remains the subject matter in African continent [African Union Continental Education Strategy for Africa (CESA), 2016]. African countries are obliged to use ICT to improve education and training access, quality and management under the strategic objective of the African Union (AU). A study conducted in Austria by Foster and Stagl (2018) noted the paucity of research focusing on equipping students with the requisite digital skills. This study argued that education should provide students with the

knowledge, abilities, values and mindset necessary to become change agents for sustainability.

With reference to Africa, the adoption of ICTs in Africa differs from nation to nation due to varying degrees of economic stability. The use of ICTs and their advantages are acknowledged; nonetheless, concerns with digital skills and infrastructure deficiencies remain unaddressed. In most European countries, challenges related to IT infrastructure, affordability, digital skills and technology acceptance, adoption and implementation is key priority. These problems still exist in the African context. There is a dearth of research on ICTs and their effects on students' motivation in the African context. This confirms the study's potential to pursue further research to unpack the contentious issues apropos the topic.

According to the study conducted in Burkina Faso, the usage of ICTs in the classroom has also been linked to elevated levels of stress and anxiety among students. The use of the wrong tools and limited technical literacy were blamed for these elevated levels of stress and anxiety (Pilabré *et al.*, 2021).

This study, conducted in Nigeria by (Ukut and Krairit, 2019), focused on how instructors and students view students' performance according to the unified theory of acceptance and use of technology (UTAUT). Similarly, the purpose of the aforementioned study was to suggest other variables that may be added to the UTAUT model to expand it and make it more suitable for usage in educational settings (Ukut and Krairit, 2019). According to the study's findings, it is clear that Africa is still in the adoption and acceptance stage, if not the infrastructure development stage. This study, however, is pertinent to ongoing research endeavors as it attempted to assess the impact of ICTs on students' academic achievement.

According to a Moroccan study, El Janous *et al.* (2022), as technology advances, educational institutions are forced to adopt new approaches, suggesting that through this process, they discovered the value of incorporating ICT into the classroom as an active teaching strategy that enhances learning outcomes and increases student motivation in the earth and the biological sciences (El Janous *et al.*, 2022).

As technology develops, educational institutions are compelled to adopt new methods in sync with a Moroccan study on the integration of ICTs (El Janous *et al.*, 2022). The aforementioned study suggested that integrating ICT into the classroom served as an active teaching strategy that enhances learning outcomes and increases student motivation in the fields of earth and biological sciences (El Janous *et al.*, 2022).

El Janous *et al.* (2022) proclaimed that current technological revolutions are prompting secondary schools and university institutions to adopt creative approaches and replace traditional or legacy instruction models. This shift includes actively integrating ICT into the classroom via a teaching strategy proven to enhance learning outcomes and student motivation, particularly in the earth and life sciences. Using digital resources for the earth science and the life science courses positively impacts student achievement. This study, specifically focusing on third-year students, demonstrated the favorable effects of ICT, including digital tools provided by the minister, on academic performance (El Janous *et al.*, 2022). In the African context, specifically South Africa, the evaluation and identification of schools with ICT availability and students' home ICT use lag behind Morocco regarding technological advancements.

Overall, the systematic review underscores the need for further research and innovation in the integration of ICTs into higher education to enhance student motivation and learning outcomes. By addressing challenges, leveraging best practices and promoting digital inclusion, HEIs can harness the potential of ICTs to create engaging, dynamic and student-cantered learning environments that foster motivation, empowerment and academic success.

Methodology

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was used for the study since it is befitting for meta-analysis. Over the past decade, advances in systematic review methodology and terminology have necessitated an update to the guideline. The PRISMA systematic literature review was conducted in accordance with the PRISMA standards. PRISMA is a minimum set of evidence based elements for reporting in systematic reviews and meta-analyses (Khomo *et al.*, 2023). Through a qualitative meta-analysis (QMA), this study investigated the qualitative aspects of ICTs on student motivation at a selected South African university using a comprehensive analysis of findings from selected publications from scholarly databases.

Inclusion criteria

With regard to methodological transparency, the researchers selected 285 diverse types of documents for systematic review and the PRISMA framework was used in inclusion and exclusion criteria. The study includes papers that address the relationship between ICT and students' motivation, or studies that are related to it. Among the requirements for inclusion were the following:

- the publication dates from 2018 to 2023;
- relevance of the study;
- the African context of the study; and
- written in English language.

The researchers included the following: studies focusing on the impact of ICTs on student motivation in higher education settings. Research specifically addressing the use of ICTs to enhance student motivation, engagement and learning outcomes. Studies involving students enrolled in HEIs, including undergraduate, graduate and postgraduate levels.

The research focused on scholarly outputs conducted in diverse disciplinary fields and academic programs. Research studies investigating various ICT interventions, including, but not limited to, e-learning platforms, online courses, digital resources, educational software, mobile applications and virtual reality/augmented reality tools were used for the study. Furthermore, studies examining the use of ICTs for different educational purposes, such as course delivery, content delivery, collaborative learning, assessment and feedback were also used.

Exclusion criterion

- reviews excluded;
- erratum excluded;
- retracted works excluded; and
- one times article in press.

The researcher excluded the following: non-peer-reviewed articles, editorials, opinion pieces, book reviews and gray literature sources from the review. Studies published in languages other than English were excluded because of lack of translation services. Studies exclusively investigating the use of ICTs for administrative purposes, institutional management or non-academic functions. Research focusing on specific ICT tools or platforms without broader implications for student motivation and engagement. Studies that did not include student motivation, engagement, satisfaction or learning outcomes as primary

or secondary outcomes were excluded. Research lacking empirical data or methodological rigor in assessing the impact of ICTs on student motivation were also excluded.

Selection per database

- 12 × documents in Scopus.
- 9 × documents in Web of Science.
- 10 documents in ScienceDirect.

Scopus: Of the 25 documents retrieved from Scopus, one of these documents was retracted and two originated in Africa – Nigeria and Morocco. The remaining documents were selected from Europe and Asia. Of those documents, 11 were retained for the ultimate examination.

Web of Science: Nine of the 84 documents that were obtained from the Web of Science database were chosen were included in this review. And, one article came from Burkina Faso.

Search strategy

The research around the ICT has been vastly conducted but not much has been investigated on the impact of ICTs on students' motivation, with specific reference to the students coming from under-privileged rural areas.

As illustrated in Keyword Search on each database used, three databases were selected (Scopus, Science Direct and Web of Science) to conduct the systematic review. The selection of these databases was based on reputation these databases have on the research fraternity. Web of Science carries that weight, Science Direct on the basic of relevance and Scopus as an abstract and citation database of peer-reviewed literature that covers scientific journals, books and conference proceedings and covers a wide span of topics in the fields the life sciences, physical sciences, health sciences, social sciences and humanities.

impact of information communication technology on students' motivation (Topic) and **2023** or **2018** or **2019** or **2020** or **2021** or **2022** (Publication Years) and **English** (Languages) and **Review Article** (Exclude – Document Types)

Scopus:

TITLE-ABS-KEY (impact AND of "information and communication technology" on "students' motivation") AND PUBYEAR > 2017 AND PUBYEAR < 2024 AND (LIMIT-TO (LANGUAGE, "English"))

ScienceDirect:

[…] impact of "information and communication technology" on "students' motivation" AND 2018 OR 2019 OR 2020 OR 2021 0R 2022 OR 2023 (ENGLISH)

The bibliographic searches were conducted on the August 1, 2023, using exact terms impact of "Information and communication technology," "students' motivation" in ALL FIELDS because using Title, Keywords, Abstract option yielded very minimal results. The searches were restricted to 2018–2023 publication dates on all databases used, which were English-produced materials. Below is the table of keyword search used in navigating three databases, namely, Web of science, Scopus and ScienceDirect.

Keyword search used on each database

The results also excluded the following document type: erratum, retracted and reviews. Table 2 shows the results of all the databases used in the search strategy. Table 2 shows diverse types of documents found from three databases used in the search strategy.

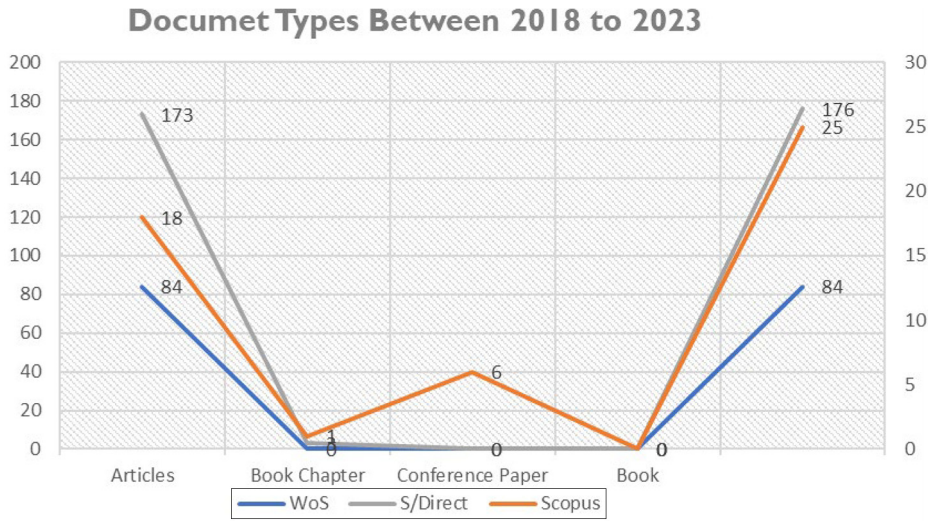
Table 2. Document types between 2018 and 2023

DOCUMENT TYPES BETWEEN 2018 AND 2023				
Types	WOS	Scopus	S/Direct	Total
Article	84	18	173	*274*
Book chapter	0	1	3	*4*
Conference paper	0	6	0	*6*
Book	0	0	0	*0*
Total	*84*	*25*	*176*	*285*

Source: Prepared by Nhleko *et al.*, 2024

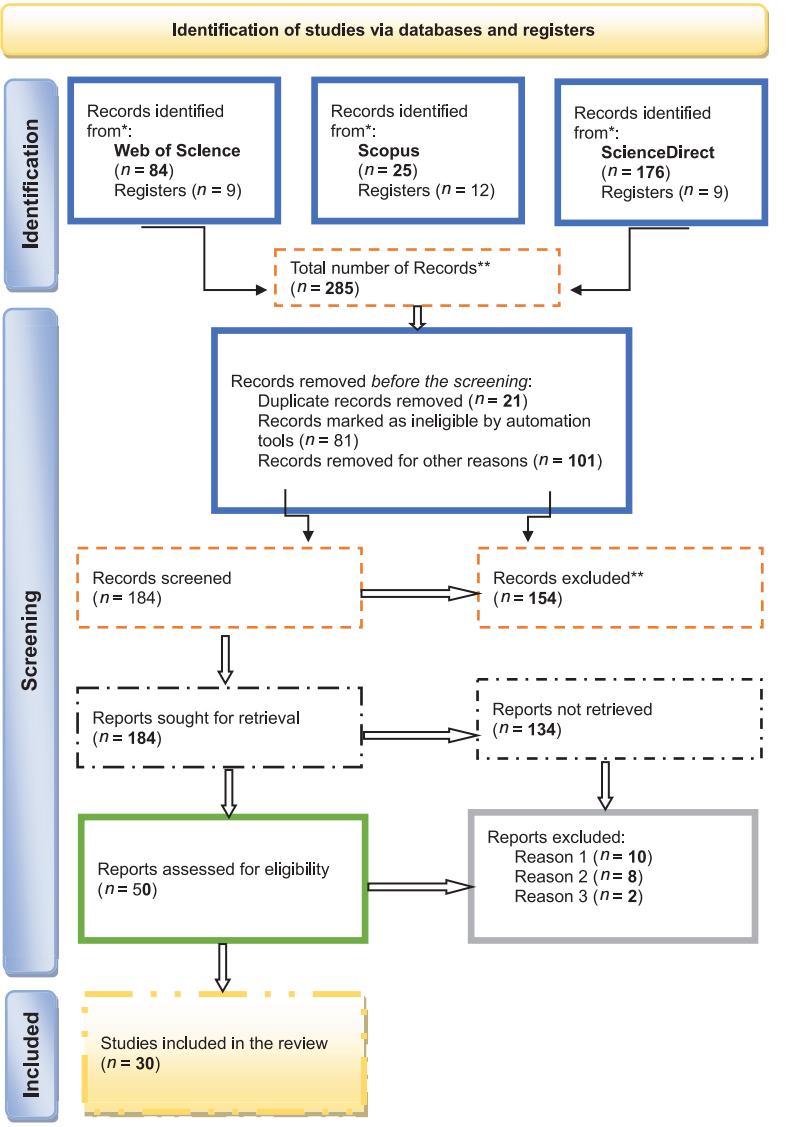
All the documents that were retrieved from Web of Science, ScienceDirect and Scopus are shown in Table 2. These were not yet carefully examined to determine which ones were most pertinent to be included in the study.

Out of 285 papers, all document kinds that were extracted from the three databases were carefully examined and rigorously examined to select the most pertinent documents, as highlight in Figure 1. It can be deduced from Figure 2 that all the documents obtained may have been included in the study depending on their relevancy to the study. The majority of the documents were articles, with the highest count in ScienceDirect (173), followed by Web of Science (84) and Scopus (17). Book chapters: a smaller representation compared to articles, with S/Direct accounting for the majority (three out of four) of the book chapters. There were a total of six conference papers, all indexed in Scopus. There were no books indexed by major search engines, namely, (WOS; ScienceDirect and Scopus). There was one retracted document indexed by Scopus. Journal articles were the most prevalent document type, with ScienceDirect having the highest count, indicating a focus on articles within that



Source: Developed by Nhleko, Aroba and Chisita, 2024

Figure 1. Document types on three databases between 2018 and 2023



Source: by Moher *et al*., 2009 and Anwana and Aroba, 2022, p. 4

Figure 2. Adapted from PRISMA flow diagram

source. Scopus accommodates conference papers, as all six documented were indexed in this source. There was a limited representation of books and retracted documents. These sources were minimal or not represented during this period across all sources. This data provides an overview of the distribution of document types in WOS, Scopus and ScienceDirect between

2018 and 2023, revealing their focus areas and the types of documents they indexed during this time frame (Figure 1).

Out of 285 papers, all document kinds that were taken from the three databases were carefully examined and rigorously questioned to select the most pertinent documents. This indicates that all the documents that were obtained may have been included in the study, but it all depended on how relevant they were. The PRISMA diagram (Figure 2) will help us in showing the inclusion and exclusion criteria.

Finding, discussions and recommendations

The information retrieved was limited to what Durban University subscribed to in terms of the Databases: Scopus, Web of Science and ScienceDirect, as illustrated in Figure 1. Although there are many databases available, the researcher chose the three listed above for this investigation because they contain materials that have undergone peer review. Only the years 2018–2023 were included in the searches. Duplicates from the previously evaluated literature were eliminated throughout the screening procedure. Research indicates that ICTs have a favorable effect on students' achievement both locally and internationally, and that well-integrated ICTs yield positive results. The literature on students' motivation, however, lacked sufficient details, leaving readers to surmise that these technological tools also affect students' motivation. According to the Saudi Arabian study Tashtoush *et al.* (2023), when compared to traditional education techniques, the ICT-based approach had a greater significant impact on students' mathematics academic enthusiasm (MAE) for the cognitive and behavioral subscales. It did, however, also highlight the need for more study on students' enthusiasm for other novel teaching strategies and the effects of ICT on other factors like motivation, arithmetic achievement and attitudes about the subject, which is the subject of this current study.

The literature review reveals that ICTs have a positive impact on students' achievement and well-integrated ICTs proved to yield good results among students (Anwana and Aroba, 2022; Aroba, 2022; Aroba *et al.*, 2023a, Aroba *et al.*, 2023b, Aroba, 2024a, Aroba, 2024b). It is left with the readers to assume that students' motivation is also impacted by these technological tools, research did not say much on this area of research. However, the African context comes in the study done by (Rudhumbu, 2022) where it was revealed that students may get unmotivated and have unfavorable attitudes about blended learning if there is insufficient and inappropriate ICT infrastructure and skills in place. This could ultimately have an impact on their acceptance of the learning style.

According to a study done in Pakistan, ICTs have the ability to keep students in universities. It was discovered that ICT has a beneficial impact on students' academic performance and is particularly important for chemistry retention (Ahmad and Sheikh, 2022). Regardless of the situation, ICT adoption and use are essential for decreasing poverty and granting citizens agency over their own development (Frans and Pather, 2022). Evidence also suggests that for rural people to properly use ICTs, they need to receive proper skill training (Frans and Pather, 2022). A Malaysian study argued that it was anticipated that this action will close the digital gap in technology use across all communities and give every student the chance to experiment with, use and hone a variety of ICT skills (Halili and Sulaiman, 2019). This study further suggested that financial challenges involve high costs for the purchase of hardware and software and social factors include the aspect of rural "technophobes" not wanting to use ICT resulting from rural communities not understanding the benefits and advantages of using ICT. Students coming from such communities are most likely to face challenges in when they face university life.

The adoption of ICTs in Africa differs greatly from that of developed nations. The disparity is apparent across the body of work. All countries can agree on the notion that ICTs are highly advantageous to individuals and groups. The impacts and implications of these tools on students in university settings are the subject of a specialized field that needs more research to be done. One topic that is rarely discussed is the use of ICTs in African contexts. African universities use LMSs and hope that students would use them; appropriate evaluation is lacking. According to Mwapwele *et al.* (2019) many ICT interventions meet with failure when the recipients of the intervention struggle to sustain the tools introduced and used during the project. In developing nations, ICTs are revolutionizing and improving many facets of higher education. There is a dearth of research on university capacity building for rural students to enable a seamless transfer and close the geographic gap caused by the digital divide. The study seeks to bridge that gap by proposing recommendations to universities.

The systematic review revealed a significant body of literature supporting the positive impact of ICTs on student motivation in higher education. Studies consistently reported that ICTs enhance student engagement, motivation and learning outcomes by providing access to digital resources, facilitating collaborative learning and offering personalized learning experiences. Despite the overall positive findings, the review also identified challenges and limitations associated with the use of ICTs in promoting student motivation. Digital inequality, technological barriers and concerns about the overreliance on technology were among the key challenges reported in the literature.

Conclusion

To sum up, this systematic analysis elaborates on how ICTs affect students' motivation in the setting of HEIs; conclusions and implications have been drawn from a thorough analysis of the corpus of research on selected HEIs as well as researcher views relating to the area of study. First, the review highlighted the significant impact of ICTs on student motivation, with several studies indicating a positive association between the use of technology and student engagement, motivation and learning outcomes. ICTs offer a wealth of tools and resources that enable them to take charge of their education, work together with classmates, access course materials and get feedback quickly. This increases students' motivation and achievement in the classroom.

In well-developed countries where ICTs are ubiquitous, the issue of infrastructure and the lack of digitals skills are not their main concerns, but these countries are looking at how they can enhance the uptake of ICTs to maximize the benefits. ICT skills training for students at the university level is not on their priority as their students seemed to be well versed with digital skills. In the African context, the adoption of ICTs varies from country to country. The adoption of ICTs and the benefits these tools have is not disputed; however, the lack of infrastructure and the issues of capacity development on digital skills is deemed high priority.

It is imperative to ensure that the necessary digital infrastructure and human capital are in place to ensure sustainability of ICT adaptation within academic institutions.

Recommendation for future research

This study recommends the following:

- ICTs should be effectively introduced to students at universities and their proficiency should be strengthened to enable them to make optimum use of LMSs.

- Students who were marginalized due to their rural geographical location should receive special attention to enhance their skills and knowledge in navigating LMs with ease;
- HEIs should strategize on how to sustain students ICTs literacy to empower them achieve academic success through effective use of the LMS.
- The adaptation of metaliteracy pedagogical models would be ideal in empowering students with the necessary skills to make optimum use of the available ICT infrastructure for learning and research.

The researched papers yielded limited information regarding the impact and influence of ICTs on the motivation of African students. It is crucial to investigate how these ICTs affect students' motivation, particularly for those from underprivileged backgrounds who were not exposed to technology due to a lack of ICT infrastructure. Further research is needed to explore innovative approaches to ICT integration, assess the long-term impact of technology on student motivation and learning outcomes and identify best practices for promoting digital inclusion and equitable access to technology in higher education.

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About the authors

Nhlanhla Mzameleni Nhleko is a Librarian/Information Specialist in the Department ICT and Society Research Group; Information Systems; Durban University of Technology; 4001, Durban South Africa. Currently Nhlanhla is studying for a PHD in LIS.

Oluwasegun Julius Aroba is a Research Fellow in the Department ICT and Society Research Group; Information Systems; Durban University of Technology; 4001, Durban South Africa. He is an Honorary Research Associate, Department of Operations and Quality Management, Faculty of Management Science, Durban University of Technology; 4001, Durban South Africa.

Collence Takaingenhamo Chisita is a Research Fellow at the University of South Africa (UNISA) He is the legatee of the National Research Foundation (NRF) of South Africa (C2) rating for research excellence. He has navigated the globe as a presenter and contributed to LIS through webinars. Collence Takaingenhamo Chisita is the corresponding author and can be contacted at: chisitacollence@gmail.com