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Article · March 2023

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Critical factors affecting ICT adoption in Higher Education – A Systematic Review

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Abstract

In this digital era, integration of information and communication technology (ICT) in teaching and learning is gaining more importance than ever before. Education sectors in developing countries are being challenged to adapt the changes in a digital era. However, there is a widespread concern arises across the education sector in integrating the ICT infrastructure due to various factors. This research study is to identify the major challenges, factors and guidelines for the evaluation and adoption of ICT for Higher Education Institution intending to adopt. The findings indicated that the most highly identified critical factors were such as a lack of technology, restricted Internet access, and a lack of administrative and technical support. ICT policy, cost, attitude, resistance to change. This paper has articulated the critical factors related to the adoption of ICT in higher education and pointed out the challenges to be addressed in the efforts to harness advantages of digital technology in education processes.

Keywords:- Digital Technology, Higher Education, Information Technology, Teaching and Learning.

I. INTRODUCTION

The primary role of information and communication technology (ICT) in the education system presents opportunities for academicians to upgrade their knowledge and teaching skills and to increase the students' overall performance significantly. The application of ICT in education is not only limited to transferring knowledge from dedicated teachers to their students; it also allows for the real-time exchange of experience across a network of peers (Qazi et al., 2021). On the other hand, Industry 4.0 has incredible and rapid penetration in all technological fields including high speed communication, the Internet of Things (IoT), artificial intelligence, smart city, agriculture, health care and robotics. It changes our concept

regarding factors such as communication, digital literacy, leadership, collaboration, emotional intelligence, learning skills, cross-cultural understanding, and education (Urmi & Taher, 2021).

The IR 4.0 not only affects the business, governance and the people, it also affects education as well, thus the name Education 4.0 came into existence. Education 4.0 is a response to the needs of IR4.0 where humans and technology are aligned to enable new possibilities. According to Nindito et al., (2020), the adoption of ICT is suitable for sharing messages, exchanging knowledge and able to access wide range of information from various fields and to keep up-to-date information. Moreover, technology has changed frequently, and Fisk (2017) had explained that the new vision of learning promotes learners to learn not only skills and knowledge that are needed but also to identify the source to learn these skills and knowledge.

The new technologies, being called disruptive technologies, evolve at exponential pace and there is no historical precedent that marked the beginning of the evolution. The impact of ICT in education can be seen to improve both teachers' and learners' capabilities, restructure the curriculum, create opportunities for more significant and comprehensive learning, and enhance teaching and learning skills in general. (Qazi et al., 2021).

This increasing interest for integrating ICT into teaching practices is principally associated with modern educational systems' striving for providing students with more enhanced learning opportunities (Kalolo, 2018; Pérez-Sanagustín, et al. 2017). Another reason for this growing interest is students' demand for availability and accessibility of information technologies as part of their daily lives, along with connectivity and share of e-learning contents within school learning environment (Islam, & Grönlund, 2016, Aydin & Gürol, 2019). Due to ICT's importance in society as well as in the future of education, identifying the possible challenges to integrating these technologies in higher education would be an important step in improving the quality of teaching and learning. (Ghavifekr, S., Kunjappan, T., Ramasamy, L., & Anthony, A. 2016)

The scope of this research paper includes all information and communication technologies that are or can be used in education. Critical factors can be viewed as those activities and constituents that must be addressed to ensure its successful accomplishment and acceptance by the various stakeholders. This study helps to find the critical factors that affects the adoption of ICT in higher education (Aydin & Gürol, 2019). Despite the benefits provided by the ICT in general, a limited number of studies explore and assess the critical factors that are affecting the adoption of this ICT in higher education. In this sense, the following research question has evolved and guides this study:

RQ. What are the critical factors that affects the ICT adoption in Higher Education?

A systematic literature review approach has chosen for answering the above research question by selecting the research papers to the identify the impact of ICT, combined with an examination of relevant texts to obtain the meaning of the critical factors affecting the adoption ICT in the education sector.

II. BACKGROUND STUDY

ICT in Higher Education

The information metaphor has given rise to a wide range of irrational theories about the need for educational reforms that will enable future citizens to live in an information society. According to current thinking, ICT serves as both the foundation of the information society and a crucial catalyst and tool for bringing about educational reforms that turn our students into knowledgeable workers (Kalolo, 2010; Urmi & Taher, 2021). Unprecedented technological advancements have significantly altered both the needs of society and how people live. ICT alternatives are expanding, giving decision-makers a wider range from which to choose when incorporating ICT into education and training. In recognizing the impact of recent technologies at the workplace and daily life, today's education institutions must try to redesign their education programs and facilities inside the classroom to reduce the teaching and learning technology gap between today and the future (Tongkaw, 2013).

From the earlier literature reviews, it has been frequently asserted that staff development is a very important aspect of the adoption and implementation of ICT in education. Since the majority of respondents stated that it was their intention to provide all instructors with ICT training, it would appear that universities are well aware of the importance of this issue. It is also noticeable that there is a significant disconnect between the ideal and reality in the majority of emerging nations (Hassan et al., 2021). According to the previous research, having technical support staff who are skilled at using computers may be a crucial requirement for promoting staff development in universities. Instructors often believe that technology usage is very important for teaching (Elangovan et al., 2021), however, during the integration process, knowledge, confidence and deep understanding is also very much needed. Furthermore, preceptors should possess the competencies skill that are essential to design, deliver and evaluate instructions and successful integration of technology that requires not only the knowledge of the technology but also the skill to plan and execute a good lesson. (Tongkaw, A. 2013; Urmi, & Taher, 2021).

III. RESEARCH METHOD AND PROCEDURES

A systematic review is a valuable tool in collecting the critical scientific evidence necessary for developing evidence-based guidelines, making programmatic decisions, and guiding future research (Gough, & Thomas, 2016). In other words, a systematic review is an essential tool for researchers, practitioners and policy makers who want to remain current with the evidence in the field. In this regard, a systematic review must adhere to strict standards, as its results can provide a more objective appraisal of evidence for making scientific decisions (Gough, & Thomas, 2016; Aydin & Gürol, 2019).

Another major advantage of systematic reviews is that they follow strict guidelines to reduce bias. These guidelines provide essential elements to include in the review process and report in the final publication for complete transparency (Gough, & Thomas, 2016; Aydin, M. K., & Gürol, M. 2019). In this research work, we adopted the systematic literature review guidelines proposed by Kitchenham (2004), with view to make detailed the review methodology and to determine documents that stated on ICT adoption in Higher Education (M'rhaouarh et al., 2018). Therefore, the guidelines suggested by Kitchenham (2004) will be

followed in three stages: search, selection and analysis. Based on these criteria, this research was conducted in several stages, namely by searching the research paper using keywords pattern, starting with inclusion and exclusion criteria, extracting the content and then analyzing the content to satisfy the research questions as stated above.

3.1. Search Process

The search process is carried out after defining the research question and the data source to build an SLR by using the digital library or online database. Table 1. shows the various online digital database used to search the relevant research paper to address the research question.

The search was conducted based on the research question using various combinations of the keyword like “Critical factors” OR “Barriers” OR “Challenges” AND “Information Technology” AND “Higher Education” or Information Communication Technology” AND “Higher Education” OR “Education Sector” with the journal listed stated in the above table. The article search was conducted using these different combinations of keywords in the article title, abstract and full text.

Table 1. Electronic data Sources

Electronic Data Sources	URL address
IEEE Explore	http://ieeexplore.ieee.org/
Science Direct	http://www.sciencedirect.com/
ACM Digital Library	http://dl.acm.org/
SAGE Journals	https://journals.sagepub.com

The search results returned 11 articles from science direct, 27 papers from the IEEE Xplore, 14 from ACM digital library and 3 from Sage journals. All the databases were restricted to the year ranges between 2010 and 2022. Then each title is analyzed manually and checked to determine its relevance to the topic related to the research questions.

3.2. Inclusion and Exclusion Criteria

To ensure the quality of the texts, the articles were selected only published in the journals and conference proceedings. Articles that only cited Information and Communication Technology as a context but did not discuss the adoption of ICT in Higher Education or Education Sector were excluded. Articles which address the issues at school level or secondary education were not included in the selection process. Also, the studies that dealt with the application of the concept outside the Higher Education were also removed from the selection process.

3.3. Data Extraction

The result is 22 articles met the criteria to be reviewed which is shown in the Table 2. The articles were selected based on the content related to the research question extracted from the abstract and conclusion part.

Table 2. Articles in Selected Sources

Source	Articles found	Selected Articles
IEEE Explore	27	16
Science Direct	11	3
ACM Digital Library	14	3
SAGE Journals	3	0
Total	55	22

IV. RESULTS AND ANALYSIS

The efficient use of ICT in education is hampered by a variety of problems. Based on the evaluation of the literature that was chosen for this research study, these factors have been categorized into the following groups.

4.1. Learning Difficulties

Lack of resources, lack of training opportunities, lack of support from school administration, inability to obtain personal ICT equipment, lack of ICT equipment at the workplace, poor electricity supply, lack of ICT knowledge, time constraints due to workload, lack of interest in learning, and lack of practise time are just a few of the barriers to ICT usage among academic staff (Oye, et al., 2011).

Teaching and learning are the primary uses of cutting-edge technology during the epidemic. Online education is, however, thought to be ineffective because learning the tools and understanding the material might be difficult for students. Online classes lack interaction, making it difficult to rapidly resolve questions. Because they are not educated in the pedagogy for online education, teachers find it challenging to manage the classes well and to clarify. Traditional teaching and learning processes have decreased (Elangovan et al., 2021). Additionally, due to time zones, international students may not feel comfortable participating in online classes. Sometimes, the students need to attend the classes during midnight, and it will be even worse when they take the final examination during the odd hours which could severely affect their performance.

4.2. Lack of Knowledge and skills

Lack of expertise and confidence were frequently cited in research as major obstacles (Alkhaldeh & Menchaca, 2014). A speedier adaptation to new technologies requires prior digital expertise and understanding. It would be difficult to use digital tools effectively if you don't have a fundamental understanding of how to operate a computer system, use spreadsheets, word processing, the Internet, and other browsing tools, as well as how to install and remove software programmes and customise settings.

Tarman et al.,(2019) discuss innovative approaches or tactics for integrating technology into teaching. In other words, for instructors to ensure successful outcomes, they must first be

adept at using the particular technology (such as a computer) and only then should they integrate it into their lessons using the right techniques.

4.3. Lack of Motivations

Movement has been restricted during the lockdown, making it impossible to carry out normal activities. The availability of necessities and financial concerns are occupying our attention. People are demotivated and discouraged from participating in the training and learning process or experimenting with new technology because of the confusion. In its early phases, idleness has also resulted in laziness, lethargy, complacency, and disorderliness. Procrastination and a lack of accountability keep individuals from embracing new technology. There is also a lack of pressure and discipline to use technology. Peer pressure to complete the job on time and fulfil deadlines, which typically occurs in a physical, academic setting, is absent. Additionally, there is a bad attitude toward using technology, and academic reasons also prevent acceptance (Elangovan et al., 2021). Some teachers are motivated and compelled to use ICT in the classroom, but the absence of support from top management prevents and deters them from doing so (Ghavifekr & Rosdy, 2015).

4.4. Attitude

To effectively integrate their technological expertise into their subject matter teaching, teachers must have a positive attitude. In other words, the effectiveness of instructors integrating technology may not be dependent on their technical expertise and equipment (Kilinc et al., 2016). Additionally, educators must think that incorporating technology into their lessons will improve students' learning (Tarman, Baytak, and Duman, 2015) and look for innovative ways to approach their subject matter (Tarman et al., 2019).

This category includes obstacles that can be connected to unfavourable opinions and sentiments regarding the use of ICT in education. There were two obstacles in this category: scepticism about the advantages of ICT and a lack of confidence. It was crucial to stress that these obstacles affected administrators and teachers rather than students. One school's principal stated that "some teachers are afraid to use ICT in the classroom, while some others refuse to use it because they don't believe it will be good for their teaching style." Lack of confidence was widely identified in the literature as the main and most prevalent barrier to the integration of technology (Kim et al., 2013). Teachers were afraid of losing their professional status because they believed that the growing use of computers in the classroom was removing or downgrading their traditional pedagogical methods, according to research. These fears included being unable to perform computer-related tasks efficiently or exposing themselves to social embarrassment when working with computers (Alkhaldeh & Menchaca, 2014).

4.5. Technological Challenges

Complexity, portability, compatibility with current devices, technological failures, and a thorough grasp of the technology are some of the most important elements that can hinder a technology's speedy acceptance (Elangovan et al., 2021). Not all academic assignments can be accomplished online, despite the fact that technology solutions exist for many of them. It is difficult to spread skill-based training that requires the use of physical equipment and has a practical component. Due to compatibility issues, some operating systems may not support digital content like video files or websites with multimedia elements. Additionally, some of the

software programmes used to create digital content could not be supported by all platforms, particularly mobile devices with low specifications. The applications can be complicated and incompatible with conventional systems. In addition to that, access to internet resources is not entirely free. Accessing out-of-print and expensive books might be challenging. Numerous physical resources are also inaccessible due to the non-delivery of e-commerce platforms (Elangovan et al., 2021). Other technological challenges such as poor quality of network connection with low bandwidth, were cited by different researchers.

4.6. Resistance to Change

The adoption and integration of computers into education are significantly influenced by teachers' attitudes toward technology. It is further said that due to a lack of enthusiasm, acceptance, and preparedness for ICT integration and adoption in the teaching and learning process, teachers choose to use the traditional approach to teaching English in their classrooms. (K. Raman, Yamat, & 2014). Many have responded that they miss the work environment, personal meetings and lively workplace interactions. They feel that the experience of a virtual environment leaves out the human touch. They hope to return to normal soon. Emerging from the conventional method is a challenge. The feeling of comfort with the traditional method and its more productive and effective attitude creates resistance towards new technology. (Elangovan et al., 2021)

4.6. ICT infrastructure and Policy

The majority of the study articles found that one of the biggest obstacles to technology integration is a lack of technical and administrative support. Many members of the teaching staff have held senior management responsible for the lack of administrative support for technological integration. According to Wachira and Keengwe's (2011) argument, a higher education institution needs a compelling technology policy to which top management has committed in order to achieve successful technology integration. Administrators should also assist and encourage teaching personnel in their successful use of technology in the teaching-learning process (Tarman et al., 2019).

Technical support specialists are crucial to the ongoing viability of ICT use in a particular school, whether they are offered by internal personnel, external service providers, or both. Although the technical support needs of an institution ultimately depend on the technology deployed and used, there are some general competencies that are needed, including network administration, network security, and the installation, operation, and maintenance of technical equipment (including software). Due to technical failures, a significant amount of time and money could be lost without on-site technical help (Ogbomo, 2011). According to Tarman et al. (2019), a slow Internet connection was another significant obstacle to integrating technology.

Teachers are deterred from implementing technology in the classroom by a lack of technical support. They also concurred that the biggest issue with incorporating ICT in classrooms is the lack of technical help available in schools and technical upkeep (Raman, K., & Yamat, 2014). According to a number of studies, the major obstacle to utilising technologies in teaching is a lack of technical support. ICT integration in teaching requires a technician, and if one is not accessible, a barrier may arise due to a lack of technical support, claims Gomes

(2005). According to Toprakci (2006), one of two important and potentially "severe" obstacles to ICT integration in Turkey is a lack of technical support (Ghavifekr et al., 2016).

War-related hardships caused a crisis in higher education in Iraq, which in turn caused a general delay in the process of creating and advancing information systems and technologies in Iraqi institutions. The use of ICT in education is a systematic and structured process to improve its quality. It helps to visualize, implement, and evaluate the educational process and helps to implement a modern educational system. It also includes educational materials that govern the work, relationships, and behavior of all participants in this process (Montazer & Al-Rikabi, 2021).

In Iraq, higher education has seen numerous crises that have affected all of its stakeholders, including teachers, students, the educational system, curriculum, academic requirements, administrative systems, etc. The country's prolonged period of difficult political and economic conditions, along with the ongoing war, worsened the country's once-healthy state and had devastating repercussions on the higher education industry. Deep-seated issues, including the policies, politics, culture, and general lack of government backing, will require tenacious and persistent activism to bring about educational reform (Tongkaw, 2013).

4.6. Cost

One of the biggest difficulties in using ICT in education is striking a balance between instructional objectives and economic realities. ICTs in educational programmes demand large financial inputs, and developing nations must exercise caution when deciding which ICT models to deploy and keep in mind sustaining economies of scale. In the end, it comes down to weighing the cost of using ICTs against the cost of alternatives to determine whether the value added justifies the expense. Alternately, the question might be examined in terms of whether ICT-based learning is the most effective approach for accomplishing the required educational goals and, if so, what mode and scope of implementation can be supported given the available financial, human, and other resources (Ogbomo 2011).

Other issues that restrict the use of ICT in educational institutions include a lack of ICT infrastructure and access, excessive student enrollment, insufficient funding, and a lack of funding allocated to technology, among others. Due to the challenging economic climate, access to high-quality equipment, the Internet, and training programmes are all challenges to implementing ICT in the educational system (Montazer, & Al-Rikabi, 2021).

V. CONCLUSION

The aim of this research is to provide information on encouraging the desired improvement in teaching and learning activities by integrating ICT in the higher education. The findings of this study indicate that higher education institutions have a strong desire for the integration of ICT, however, they encounter many challenges and issues due to various factors. In this research paper, the major factors identified are technology challenges, ICT infrastructure and policy, learning difficulties, knowledge and skills, motivation, attitude, resistance to change and cost. The paper has articulated the critical factors related to the adoption of ICT in higher education and pointed out the challenges to be addressed in the efforts

to harness advantages of digital technology in education processes. The decision to either use a particular strategy in addressing the ICT challenges or not, it needs to be done carefully so that the use of ICT is not blindly adopted, rather guided by research evidence that demonstrates productive approaches.

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