Dr. Shankar Swarup Das[1]

Dr. Kirti Sanjay Dorshetwar[2]

Roopa U.[3]

Dr. Shouvik Sanyal[4]

Dr. Melanie Lourens[5]

A Study on ICT and Application of Computing Technology for Assessment of Educational Quality and Policies in Global Universities

Abstract: - The evaluation of ICT, computing technologies for assessing educational quality, and policies in global universities has been performed in this research paper to anticipate the recent approaches for increasing academic outcomes. Multiple reliable sources were chosen for a systematic review and thematic analysis to analyse the secondary qualitative data on the targeted topic. Additionally, the results demonstrate advancements in ICT, and computing technologies like Artificial Intelligence, the Internet of Things, Cloud-based Learning Management Systems, and Blockchain technology that improve personalise learning, and data accuracy. Challenges like integration costs, data privacy, and digital divide are identified in the research paper. Additionally, the study further demonstrated the crucial roles of the initiatives of equitable access, continuous training, and role of educational policies for facilitating standardisation in the aspect of higher education worldwide.

Keywords: ICT, Computing technology, Educational Quality, Global Universities, Artificial Intelligence, Blockchain, Internet of Things, Cloud-based LMS

1. Introduction

The use of ICT and computer technology in assessing educational quality and the policies of universities worldwide can be transformative. The application makes it possible to collect, analyse, and report on the information progressively so as to improve the accuracy and transparency of evaluations. Additionally, the AI and advanced analytics reveal trends, strengths or weaknesses that are crucial in evidence based policy making. Online assessment tools as well as e-portfolios offer a broad range of information to know about institutional effectiveness and student performance, learning management systems. Hence, high-quality education that is consistent is assured through ICT and computing technology by promoting standardisation in diversity. Hence, these technologies enhance global accountability for improved quality while fostering collaboration among regions that drive consistency with regional differences for higher education changes across the globe.

2. Background and Rationale

The transformation of higher education has been made possible by integrating information communication technology (ICT) and computational technology to evaluate the quality of education and policies in universities worldwide. Additionally, Stanford University, Massachusetts Institute of Technology (MIT), among others, in the United States uses artificial intelligence (AI) as well as big data analytics to assist them in institutional effectiveness appraisal and improvement, performance assessment and policy formulation making process. Moreover, In Australia, the University of Melbourne utilises digital assessment tools and e-portfolios for

[1] [1]Assistant Professor,(Mech. Engg.), Department of FMPE, CAEPHT

(Central Agricultural University), Ranipool, Gangtok -737135, Sikkim, India.

[2]Assistant Professor, Basic Science Department, Indian Institute of Information Technology, Nagpur, Maharashtra, India.

[3]Assistant Professor, Department of MBA, Dayananda Sagar College of Engineering, Kumaraswamy Layout, Bangalore-560111, India.

[4]Associate Professor, Department of Marketing and Entrepreneurship, Dhofar University, Sultanate of Oman.

[5]Deputy Dean Faculty of Management Sciences, Durban University of Technology South Africa. Orcid: 0000-0002-4288-8277

personalised learning experiences with real-time feedbacks given. Erasmus+, for instance, is a European Union based program that applies ICT to facilitate cross-border quality assurance and benchmarking aimed at promoting international collaboration. In addition, about 70 percent of universities including those from Asian countries such as National University of Singapore use cloud-based learning management systems (LMS) mostly for enhancing quality through continuous assessments (UNESCO) (Gupta et al. 2024). The University of Cape Town utilities mobile-based assessment platforms to easily reach remote areas that ensure equity, and inclusivity.

The International Association of Universities reported that around 85% of higher education institutions are investing in ICT to increase policy assessment, and educational quality in 2022 (Staring et al. 2022). AI is significantly used in institutions for analyzing large amounts of data on student performance that enable data-driven policy decisions, and tailored learning experiences. Some of the universities use deep learning algorithms for giving real-time feedback with the help of digital assessment tools that enhance educational quality. Henceforth, it positively contributes to a holistic assessment of educational quality. Besides this, blockchain technology is being incorporated by institutions such as the University of Nicosia in Cyprus for ensuring the transparency, and security of academic credentials, and records. Therefore, these technologies have significant contributions in fostering accountability and trust.

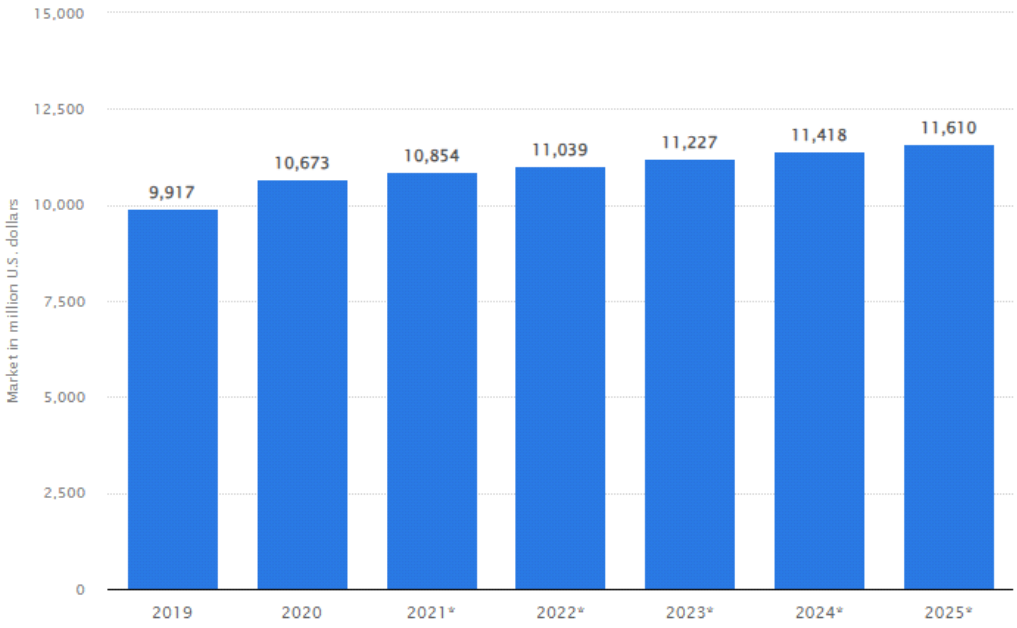

Figure 1: Market size of education software worldwide from 2019 to 2025 (Influenced by Lionel, 2023)

The education software market is projected to reach $10.85 billion in 2021 with a year-on-year growth of nearly $200 million and also expected to continue growing by reaching $11.6 billion by 2025 (Lionel, 2023). In addition, about 60% of the population of Japan, and Malaysia had basic ICT skills in 2020 with over 40% having standard-level skills (Leander, 2024). Learner's utilising voice communication aids in gaining the confidence of the students as well as social credibility.

The rationale of the research is to explore the application of ICT, and computing technology for the assessment of educational quality, and policies in global universities. A key issue is the concerns regarding data privacy with the applications of ICT, and computing technology (Alam, 2020). In logical order, it is required to ensure student data protection which is critical to prevent misuse. This problem can therefore be addressed through implementation strict access controls, comprehensive data privacy policies that are linked with strong encryption systems which provide protection to sensitive information.

3. Research Scope and Significance

This research scope discusses ICT's efficient use and computer science to evaluate policies and university rankings worldwide (Rodríguez-Abitia et al., 2020). Furthermore, the paper explored how such technologies as deep

learning, advanced analytics, blockchain, artificial intelligence and internet of things can be employed to enhance data collection, analysis and reporting.

This study also seeks to identify the best practices, opportunities and challenges facing these technologies in ensuring accuracy; efficiency and transparency in educational assessment. According to Owen, Watkins & Hughes (2022), universities need to more up-to-date and dependable evaluations meant for continuous improvement along with evidence-based policy-making in education. Additionally, standardized assessment processes are facilitated through these technologies that enable collaboration, and global benchmarking. Furthermore, the research highlighted the potential for applying ICT for addressing issues of accessibility, and inclusivity in education that directly ensure high-quality education is available to different populations. Henceforth, the study has significantly contributed to the ongoing initiatives for elevating educational standards, and policy effectiveness globally with the help of technological innovation.

4. Review of Literature

4.1 Role of ICT and computing technology in assessing educational quality and policies in global universities

ICT and more specifically computing technology enormously facilitates the objective evaluation of the quality and policies in universities of different countries. As commented by Jiang (2020), ICT and computing technology are used due to the increase in the accuracy of the results, the efficiency of the performed operations, and the openness of the provided data. These technologies help the universities to collect and analyse large volumes of performance data of the learners, organization performance data, and education performance data in real-time. For example, artificial intelligence algorithms can process information to recognise trends, predict outcomes, and give personalized learning experiences. Therefore, these technologies directly improve educational quality as well as also support evidence-based decision-making in formulating policy.

ICT offers the factors concerned with the actualization of the distinctive form of the assessment instrument and learning handling systems that help to reduce the evaluation disparities in different educational settings. As stated by Saleh, Ghazali & Rana (2020), a blockchain increases the security of the qualifying documents in academic practice and the credibility to reduce fraud instances. Moreover, the IoT influences students' learning settings and actual resources through the concept of engagement based on real learning scenarios of a University. On the other hand, as argued by Mian et al. (2020), universities at the global level can develop a solid structure geared towards improvement and quality assurance through the adoption of ICT and computing technologies. Additionally, these technologies enhance educational stakeholders' interactions that enable comparison and the sharing of effective practices across countries. Therefore, the adoption of ICT in education assessment contributes to the improvement of institutional effectiveness. Hence, these technologies also enhance accountability, quality education to all, and readiness to face the future job market that is increasingly driven by technology.

4.2 Potential risks to incorporating ICT and computing technology in the education system

The promotion of ICT and computing technology in global higher learning institutions also brings risks. As viewed by Saffady (2021), concerns relating to the management of data and its protection arise because the institution is involved in the processing and handling of very large data such as student records and assessments. Cyber terrorism and leakage of important data are potentially threatening to the learners' anonymity and organisation prestige. As argued by Lythreatis, Singh & El-Kassar (2022), an additional risk that has been identified is the potential for the digital divide in the type of technology access for some students and institutions compared to others. Thus, it can consequently result in a widening gap in education. Furthermore, dependence on technology also creates risks of technical failures or system downtime that disrupt the learning assessments and activities.

4.3 Risk assessment models in using ICT and computing technology to combat challenges on educational quality faced by global universities

Risk assessment models for ICT, and computing technology in global universities need to address security vulnerabilities, digital divide risks, and data privacy issues. As commented by Alexei & Alexei (2021), risk assessment models are required to be implemented to ensure the students and their institutions' data such as encrypted data and controlled options are secured. They also consider cyber security threat risks on their course

using regular check and response protocols. However, equitable access initiatives directly ensure all students benefit equally from technology. Therefore, risk assessment requires evaluating the effect of technological failures on educational continuity, and involves contingency plans. Therefore, continuous support, and training for staff in technology integration, and digital literacy are necessary to effectively solve the risks.

5. Research Method

The systematic review method has been utilized to collect secondary qualitative data on the application of ICT, and computing technology for assessing the educational quality, and policies in the aspect of global universities. Furthermore, the chosen databases for extracting the secondary data to potentially form the systematic literature review included Google Scholar, and PubMed (Van Dinter, Tekinerdogan & Catal, 2021). Besides this, these selected databases provided full-text, and peer-reviewed articles for collecting data on ICT, and computing technology applications to assess the educational policies, and quality in global universities. Boolean operators were used to searching the keywords based on research topics that positively contributed to organise the literature search method to make it easier to systematically conduct the research.

Table 1: Boolean table

Keywords	AND/OR	Keywords	AND/OR	Keywords
ICT	AND	Computing technology	AND	Educational quality
Policy assessment	OR	Global Universities	AND	Innovation

The exclusion, and inclusion criteria have been applied like gathering only full-text, peer-reviewed articles, excluding articles written in language other than English, and selecting articles that were published after 2020 for ensuring the research reliability (Ardern et al. 2022). Furthermore, the PRISMA tool was utilised for checking the quality of articles through databases. The screening process of the research papers maintained the addition and elimination of articles for effectively conducting the systematic literature review process.

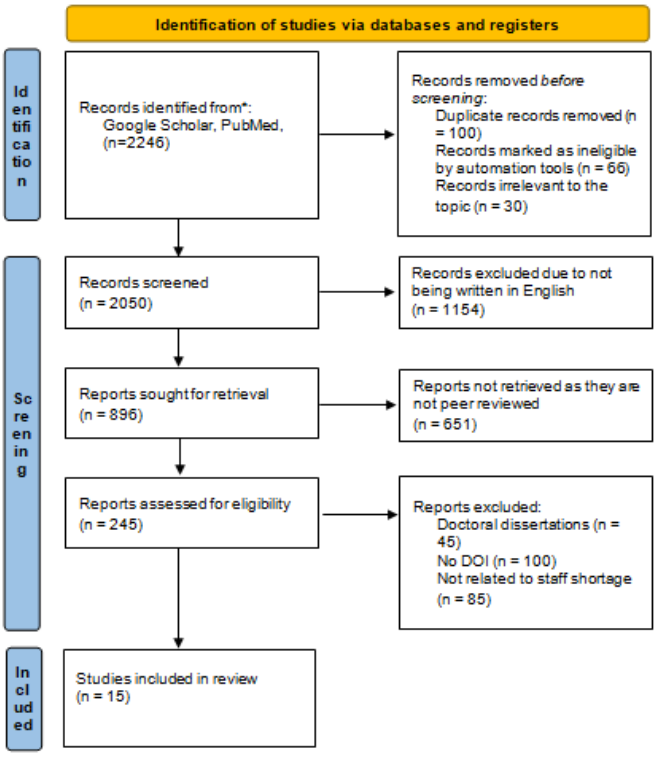

Figure 2: PRISMA

The systematic literature review was performed by selecting 15 articles, and the extracted secondary information was analysed through thematic analysis. The documentation of the identified themes was formulated through an axial coding board that assisted in step-wise thematic analysis along with systematically performing the whole research (Braun & Clarke, 2022).

6. Result and Analysis

Authors	Code	Themes
Hooda et al. (2022) Ouyang et al. (2023) Luan et al. (2020) Khan, Khojah & Vivek (2022)	Academic performance Prediction, AI prediction models, AI in education, online higher education, collaborative learning, teaching, learning, big data	***"Theme 1: AI and data analytics increase decision-making through real-time performance analysis and personalised learning insights of the university students."***
Cheriguene et al. (2022) Alkhatib, Albalawi & Saeed (2024) Alshahrani (2021) Alshareef (2022)	Distance learning, e-learning, blockchain, quality assurance, smart contracts, security, privacy, integrity, e-learning platforms, improved elliptic curve cryptography algorithm (IECCA), blockchain investment opportunity, blockchain in education	***"Theme 2: Blockchain and cloud-based LMS are useful for ensuring secure, transparent academic records, effective assessment systems, preventing fraud, and enhancing trust in global universities."***
Terzieva, Ilchev & Todorova (2022) Kamruzzaman et al. (2023) Badshah et al. (2023) Matthew et al. (2021)	Smart environments, Internet of Things, Intelligent education systems, smart education, sustainable education systems, cloud computing, e-learning, internet security, data warehouse, mobile learning, ubiquitous learning, pervasive learning	***"Theme 3: IoT in Learning Environments monitors engagement and optimises resources, improving educational quality."***
Cullinan et al. (2021) Mathrani, Sarvesh & Umer (2022) Lorente et al. (2020)	Blended delivery, Broadband, online learning, COVID-19, connectivity, digital divide, online learning, digital conclusion, developing world, ICTs in education, right to education	***"Theme 4: Data privacy, unequal access to technology, and internet connectivity among students are the challenges of using ICT and computing technology faced by global universities."***

Table 2: Axial coding table

Theme 1: AI and data analytics increase decision-making through real-time performance analysis and personalised learning insights of the university students

AI and data analytics significantly increase decision-making in universities by giving real-time performance analysis, and personalised learning insights for the students. Additionally, technologies such as natural language processing, machine learning algorithms and predictive analytics tools are utilised for analysing vast datasets (Hooda et al. 2022). These technologies help universities to recognise trends, predict student outcomes, and improve educational content based on the individual needs of the students. AI-driven insights are beneficial as these help educators recognise at-risk students early and allow for timely interventions (Ouyang et al. 2023). Personalised learning paths improve student achievement and engagement. Furthermore, data analytics also optimise administrative processes that enhance operational efficiency.

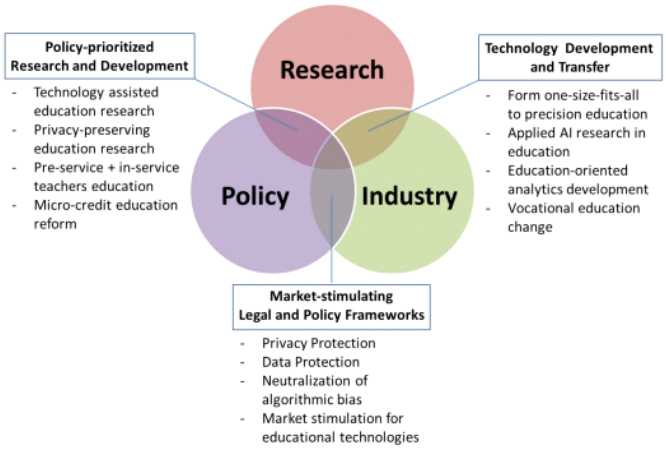

Figure 3: Technology-assisted education (Influenced by Khan, Khojah & Vivek, 2022)

Incorporating AI and data analytics raises privacy, and security concerns because sensitive information of the students must be protected (Luan et al. 2020). There is also a risk of bias in AI algorithms that can result in unfair outcomes. Incorporating these technologies into the existing educational frameworks needs proper investment and training. Universities should adopt data protection policies like access controls, and encryption to address these challenges. Policies are crucial for promoting the ethical use of AI like transparency in algorithmic decision-making, and bias mitigation strategies (Khan, Khojah & Vivek, 2022). Ongoing professional development for administrators and educators is crucial to effectively use these ICT, and computing technologies for maximising their benefits for students.

Theme 2: Blockchain and cloud-based LMS are useful for ensuring secure, transparent academic records, effective assessment systems, preventing fraud, and enhancing trust in global universities

Blockchain and Cloud-based Learning Management Systems (LMS) are crucial to ensure transparency, and secure academic records, and proper assessment systems in global universities. Additionally, blockchain technology is securely recording academic credentials that ensure transparency, and data integrity (Cheriguene et al. 2022). Cloud-based LMS facilitates effective management of assessments, student feedback, and grading systems. Additionally, blockchain prevents fraud by giving a tamper-proof record of academic achievements that also enhances trust among stakeholders. On the contrary, as argued by Alkhatib, Albalawi & Saeed (2024), cloud-based LMS streamlines administrative tasks and real-time access to educational awareness, and supports remote learning. Therefore, using this technology enhances convenience and accessibility for educators, and students.

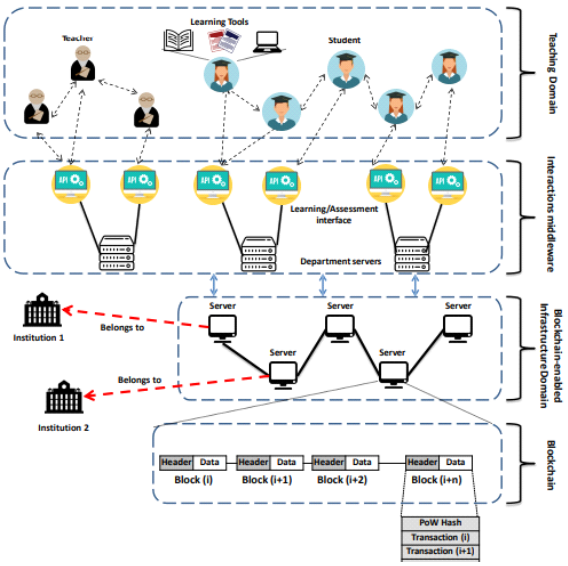

Figure 4: Blockchain in education (Influenced by Cheriguene et al. 2022)

Incorporating these technologies poses significant risks like the requirement for substantial IT infrastructure, and the high cost of integration (Alshahrani, 2021). Security concerns and data privacy issues are also prevalent due to the sensitive nature of the academic records. Furthermore, there is a learning curve for the students, and the staff to easily adapt to the new systems.

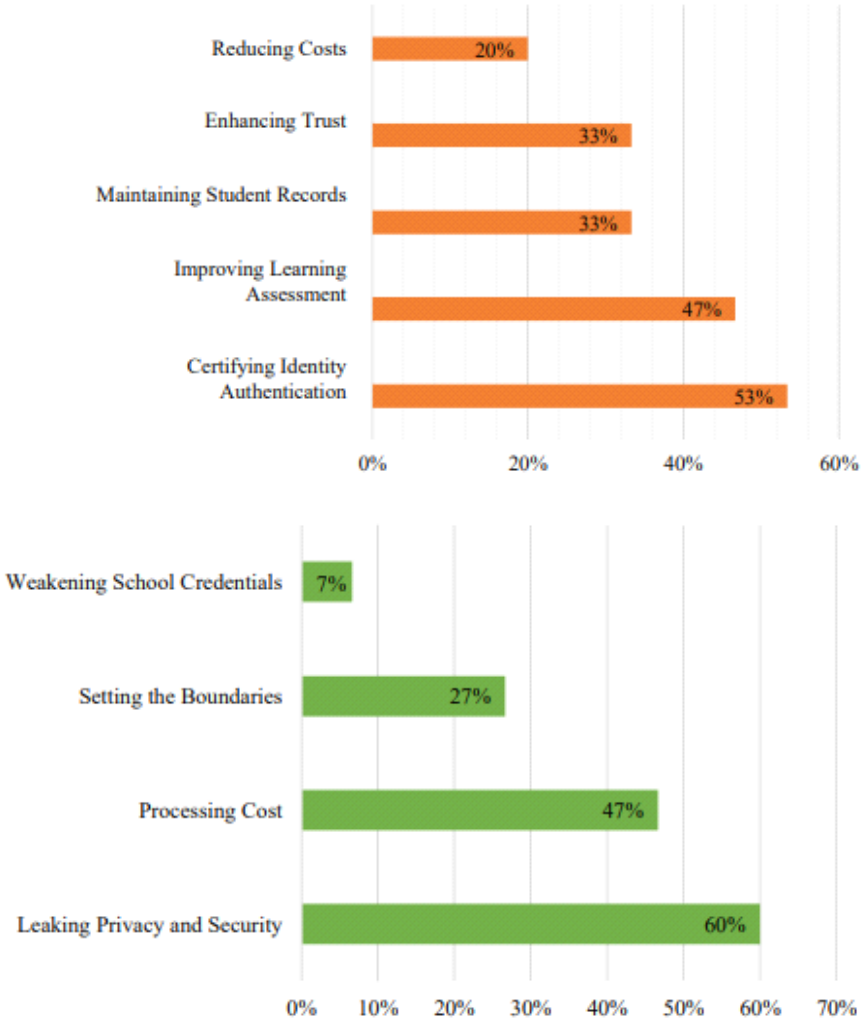

Figure 5: Benefits and challenges of adopting blockchain technology in education (Influenced by Cheriguene et al. 2022)

Universities must integrate comprehensive data protection policies that involve multi-factor authentication, and encryption to solve the challenges (Alshareef, 2022). Establishing protocols is for regular audits, and ethical use for ensuring compliance with the security standards that increase system efficacy, and trust.

Theme 3: IoT in Learning Environments monitors engagement and optimises resources, improving educational quality

The IoT in learning environments directly monitors the engagement of the students by managing classroom conditions and tracking attendance and smart devices. Additionally, IoT-enabled devices and sensors gather information for optimising the usage of resources like space utilization, HVAC, and lighting (Terzieva, Ilchev & Todorova, 2022). IoT increases educational quality by giving real-time data on learning habits, and student engagement that allows for personalised interventions.

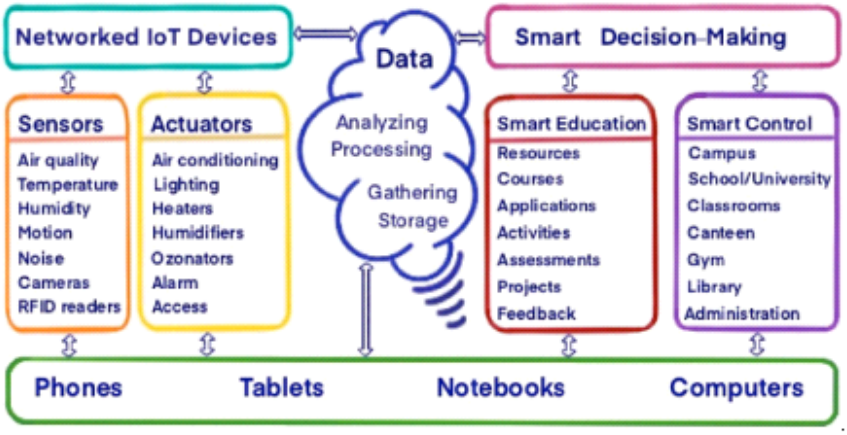

Figure 6: IoT in smart education (Influenced by Terzieva, Ilchev & Todorova, 2022)

IoT improves resource efficiency, creates more sustainable learning environments, and improves resource efficiency (Kamruzzaman, 2023). The Internet of Things (IoT) is transforming campus management in different universities like the National University of Singapore where interconnected devices directly monitor student engagement and classroom environments.

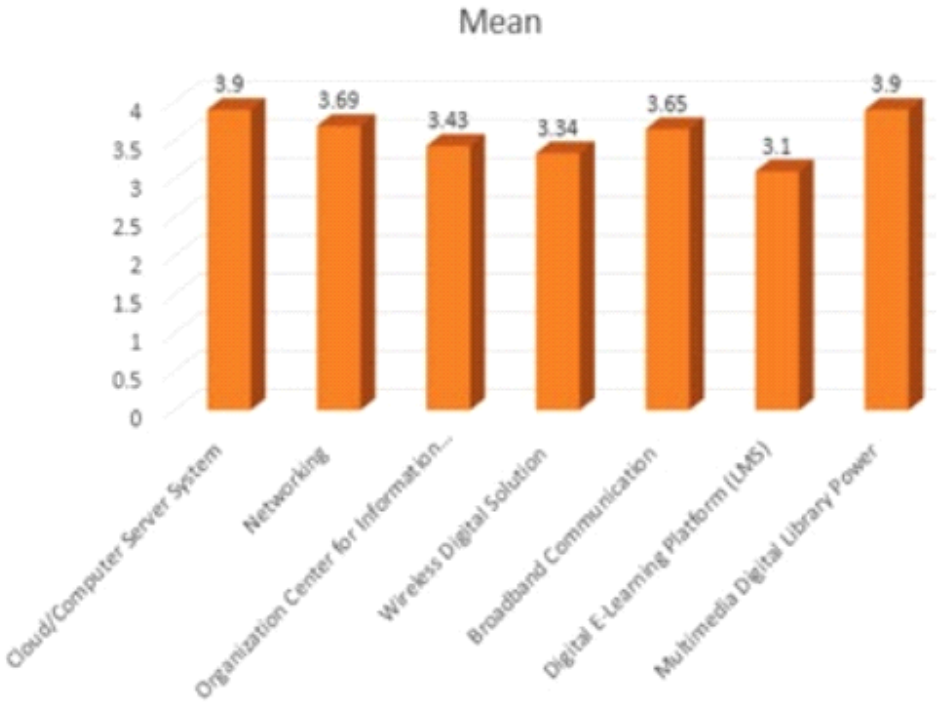

Figure 7: Institution ICT Infrastructure (Influenced by Matthew et al. 2021)

Global universities incorporate data protection policies like FERPA regulations, encryption protocols, GDPR compliance, multi-factor authentication, data access control measures, and regular cyber security audits to protect the information of the students (Badshah et al. 2023; Matthew, Kazaure & Okafor, 2021).

Theme 4: Data privacy, unequal access to technology, and internet connectivity among students are the challenges of using ICT and computing technology faced by global universities

Global universities experience prominent challenges in utilising ICT, and computing technology involving the risk of cyber attacks and data privacy issues. Moreover, unequal access to technology and internet connectivity accelerates educational disparities because some learners cannot fully benefit from digital resources (Cullinan et al. 2021; Mathrani, Sarvesh & Umer, 2022). Solving these challenges needs proper data protection measures,

improved infrastructure, and equitable technology access initiatives to ensure all students can effectively participate in the digital learning environment.

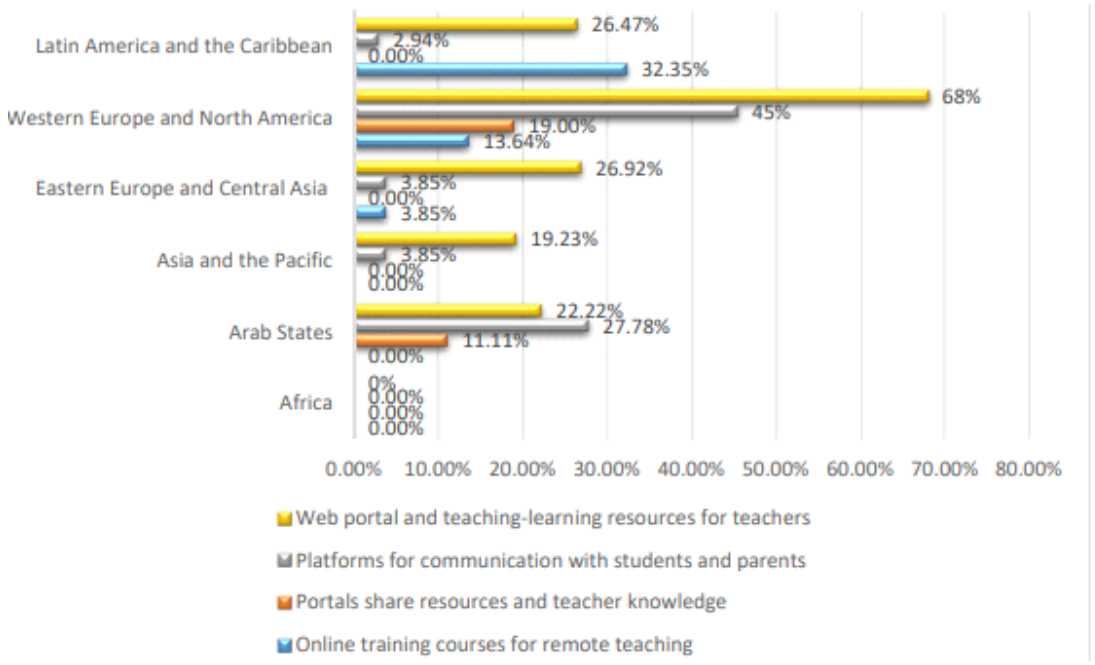

Figure 8: Percentage of countries that have employed learning tools and platforms for Teachers after pandemic (Influenced by Lorente et al. 2020)

There is a challenge of ensuring technology integration that supports the pedagogical goals effectively without replacing the critical human interaction in the learning process. As opined by Lorente, Arrabal & Pulido-Montes (2020), consistent technology advancement indicates that the educators' and administrators' competencies must be retrained frequently based on time. Managing these risks requires appropriate measures that protect data, justice programs, and backup options for ICT use. Henceforth, extensive education programs in the correct and effective utilisation of ICT in learning help to provide quality education to students.

7. Discussion

The discussed themes demonstrate the transformative effect of computing technologies and ICT on education. From the thematic analysis, it has been understood that data analytics and AI improve decision-making and personalised learning while blockchain assures transparent, and secure credentialing (El Koshiry et al. 2023). The third theme highlighted the uses of IoT in optimising resource allocation, and monitoring student engagement that ultimately improves educational quality. Contrastingly, issues like technology integration, data privacy, and the digital divide must be addressed to enhance benefits along with ensuring equitable access in global universities.

8. Conclusion

The integration of computing technologies and ICT to access educational policies and quality has a significant contribution to increasing efficiency, transparency, and data accuracy. IoT, cloud-based LMS, blockchain, and AI have the potential for revolutionizing education by securing credentialing and giving personalised learning. Therefore, these technologies if properly incorporated can significantly improve policy-making, and educational outcomes in global universities.

9. Future Scope and Research Limitation

The future scope of computing technology and ICT in assessing educational quality includes advancing blockchain, AI, and IoT applications for more secure and personalised experiences. Contrastingly, the research limitation involves an over-reliance on secondary data that can lead to biased or outdated conclusions (Christensen-Branum, 2022). Moreover, rapidly changing technologies can outpace recent research that needs

validation and continuous updates. Future research should focus on continuous updates, and primary data collection to stay updated with the technological advancements.

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