Asian Journal of Education and Social Studies

Volume 50, Issue 7, Page 272-285, 2024; Article no.AJESS.118835
ISSN: 2581-6268

A Systematic Review on Technology Resource Management in Education

Rosalie C. Baldezamo [a*], Diocyl Ann C. Requillo [a], Annaliza C. Lopez [a], Ivy D. Manguiob [a] and Charlo Bianci Guray [a]

[a] Davao del Norte State College, New Visayas, Panabo City, Davao del Norte, Philippines.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajess/2024/v50i71462

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/118835

Systematic Review Article

Received: 11/04/2024
Accepted: 15/06/2024
Published: 18/06/2024

ABSTRACT

Technology plays a pivotal role in modern education, revolutionizing teaching and learning processes. Effective management of technology resources in educational settings is crucial for maximizing their potential benefits. This systematic review aims to examine the challenges, impact, and best practices associated with technology resource management in education. Hence, this systematic review researched diverse literatures concerning resource management, particularly focusing on technology resource management, utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework as its guiding methodology. These studied a selection of literatures published in English and conducted between 2020 and 2024, were sourced from Google Scholar. Out of 293 records identified from database searching, 11 articles from eight countries revealed three themes for the challenges, namely: insufficient fund, teachers adaptability skills in new technology and lack of connectivity. In terms of the impact, the analysis showed two themes for namely: improve the quality of teaching and technology advancements.

**Corresponding author: Email: baldzeilasor@gmail.com;*

Cite as: Baldezamo, Rosalie C., Diocyl Ann C. Requillo, Annaliza C. Lopez, Ivy D. Manguiob, and Charlo Bianci Guray. 2024. "A Systematic Review on Technology Resource Management in Education". Asian Journal of Education and Social Studies 50 (7):272-85. https://doi.org/10.9734/ajess/2024/v50i71462.

Meanwhile, three themes appeared for the best practices such as routine evaluation and review, keep abreast of technological developments and flexibility and scalability of the plan. Finally, this systematic review highlights the significance of technology resource management in education and provides insights into the challenges, impact, and best practices associated with it. By synthesizing current literature, this review contributes to a deeper understanding of how educational institutions can effectively influence technology to support teaching and learning initiatives. Future research should continue to explore innovative strategies for overcoming challenges and maximizing the benefits of technology in education.

Keywords: Education; literature review; technology resource management.

1. INTRODUCTION

Technology is described as the application of science or knowledge to solve problems or develop practical tools. Furthermore, technology is essential to the inclusive advancement of contemporary human management systems. The main responsibilities of human resources management include recruiting, hiring, training, retention, workplace administration, and worker environment optimization. By implementing cutting-edge technology in the company, managers may gather and distribute information more efficiently and interact with staff members more successfully [1].

In the last few decades, technological advancements have happened at an alarming rate, and the number of digital products and services has grown. Furthermore, "frontier technologies" like artificial intelligence (AI), robotics, biotechnology, and nanotechnology look likely to quicken the rate of development [2,3,4,5]. Because of this, these technologies have already had a huge positive impact, which will be amply demonstrated in 2020 by the more rapid development of coronavirus vaccines. However, if quick advancements surpass civilizations' capacity for adaptation, there may be negative implications. For instance, there are worries that as economic activity becomes more automated, jobs will disappear and that social media will increase uncertainty, worry, and divisions. In general, there are worries that frontier technologies may either produce new or worsen existing inequities [6].

In addition, today's businesses are impacted by factors such as increased competition, the globalization of the market, technology breakthroughs, a varied workforce, and happy, knowledgeable customers. In the fiercely competitive business environment, the challenges previously mentioned are causing instability in consumer sentiments, which companies must be prepared for [7].

However, there is a role for information and communication technology. It is vital to continue developing and learning to have the knowledge and skills necessary to use information and communication technology in educational institution management to achieve reform and development in all sectors, especially in education. It enables management to organize tasks and establish objectives to maximize benefits [8].

As a result, government policies and plans for educational reform, particularly those that are urgently needed to prepare people for the twenty-first century, place a strong emphasis on quality and efficiency across all aspects for students, educators, civil servants, executives, and educational institutions of all stripes. Education at all levels is a lifelong study in this area. Determining how to use technology as a teaching tool to provide pupils with equal and standard education is one crucial challenge [9].

As educational institutions increasingly integrate technology into their teaching and administrative processes, the need to understand and navigate the challenges, impacts, and best practices of technology resource management becomes dominant. This systematic review aims to explore the complex realm of technology resource management in education, offering a comprehensive analysis of the existing literature. By synthesizing insights from scholarly research, expert perspectives, and stakeholder feedback, this review measures to provide valuable insights and guidance for educators, administrators, policymakers, and researchers alike. Through a systematic examination of the complexities and distinctions inherent in technology resource management, this review seeks to contribute to the ongoing dialogue surrounding the effective utilization of technology to enhance teaching, learning, and organizational effectiveness in educational settings.

1.1 Research Questions

This study tends to conduct a systematic review analysis of existing literature about technology resource management in education. It aims to focus on the following research questions:

1. What are the available works of literature about the challenges of technology resource management in educational institutions?
2. What proof in the literature is there for the impact of technology resource management in educational institutions?
3. What are existing pieces of literature about the best practices of technology resource management in educational institutions?

1.2 Inclusion and Exclusion Criteria

The primary tool employed by the study to locate relevant literature was Google Scholar. This choice was primarily stirred by Google Scholar's advanced search capabilities, allowing users to specify desired keywords, the section of the paper where they appear, and the publication year. Moreover, it provides statistics based on inclusion and exclusion criteria, including full-text availability.

To identify relevant reviews, the researchers accessed Google Scholar, utilized the "advanced search" option, and defined inclusion criteria to search "anywhere in the article" using keywords like "Technology Resource Management" within articles published between 2020 and 2024. This search yielded two hundred and ninety-three (293) results.
Additionally, the researchers observed several duplicates, which we promptly addressed by exporting the articles to Microsoft Excel and sorting them alphabetically. Consequently, two hundred and ninety-one (291) unique items remained. These were evaluated against the objectives of the systematic review, leading to the screening of 34 sources and the exclusion of 277 sources. Out of these, 14 eligible sources were retained for qualitative analysis, while 20 articles were disregarded. The PRISMA Flow Diagram in Fig. 1 illustrates the systematic review process.

The screening process focused primarily on the challenges, impact and best practices of technology resource management in education. The inclusion and exclusion criteria are presented in Table 1. Inclusions encompassed any research design, without limitations on the type of design. Studies conducted between 2020 and 2024 were considered for their quality, timeliness, and relevance to resource management in education. Furthermore, only English-language journals were included for ease of comprehension.

Conversely, the systematic review excluded studies conducted before 2020, non-English language journals, and sources beyond Google Scholar. Moreover, sources deemed irrelevant to the topic, despite containing the phrase "resource management" in the suggested Literature Search Database, were omitted. These rigorous inclusion and exclusion criteria ensured the relevance of the sources utilized in the systematic review.

1.3 Search Strategy

The research was done following established guidelines, inclusion and exclusion criteria throughout the analysis process. In finding relevant reviews, we utilized Google Scholar and navigated the "advance search" icon and set up the inclusion criteria like "anywhere in the article" and the year between 2020 and 2024. We searched relevant works by carefully filtering the searched articles by reading the abstracts, looking at the titles, and downloading the whole texts for in-depth analysis. All references were cited properly for easy searching.

Table 1. Inclusion and exclusion criteria of the systematic review

Eligibility Criteria	Inclusion	Exclusion
Time Frame/ Years	2020-2024	Below 2020
Relevance	Related to Education	Not Related to Education
Language	English	Other Languages
Methodology	Qualitative Methods	Quantitative Methods
Electronic Databases	Google Scholar	Other Sources/ Inaccessible Studies
Publication Status	Published in Journals/ Books	Unpublished

Table 2. Reviewed studies on technology resource management in education

ID	Author/s Year	Country	Discipline	Sample Size	Research Focus
1	Olaoye [10]	Nigeria	Education	N/A	Institutional Administration: A Review of Management Skills in Entrepreneurship Education
2	Bozak [11]	Turkey	Education	N/A	Instructional Reverse Mentoring: A Practice Proposal for Teachers' Understanding the" Z" and" Alpha" Generations' Learning Perspectives
3	Gayathri, Bella [12]	India	Education	N/A	Role Of Artificial Intelligence Technology and Its Impact on Transformation of Human Resources Management
4	Sibi, Miranda [13]	India	Education	7	School Leadership in the 21st Century: Shared Experiences of The Claretian Principals in Northeast India
5	Asadovna [14]	Uzbekistan	Education	N/A	Methods For Using Distance Education Technologies in Educational Management in The Era of Ict Development
6	Aron, Abraham [15]	Russia	Education	N/A	Resource Scheduling Methods for Cloud Computing Environment: The Role of Meta-Heuristics and Artificial Intelligence
7	Rita [16]	Uganda	Education	171	Teacher Efficiency and Program Implementation in Primary Schools Koboko District Uganda
8	Xu, Song [17]	China	Education	N/A	Optimization Of Innovation and Entrepreneurship Education and Training System in Colleges and Universities Based on Openstack Cloud Computing
9	Jiang, Huan [18]	China	Education	N/A	Check For Updates Construction of English Teaching Multimedia Resource Library Based on Cloud Computing Technology
10	Matayo, Abdulganiyu, Musa, Mohammed Ahmed, Aminu [19]	Nigeria	Education	N/A	Efficient Management of Information Communication Technology Resources in An Organisation
11	Serna [20]	Colombia	Education	N/A	Transdisciplinary Science

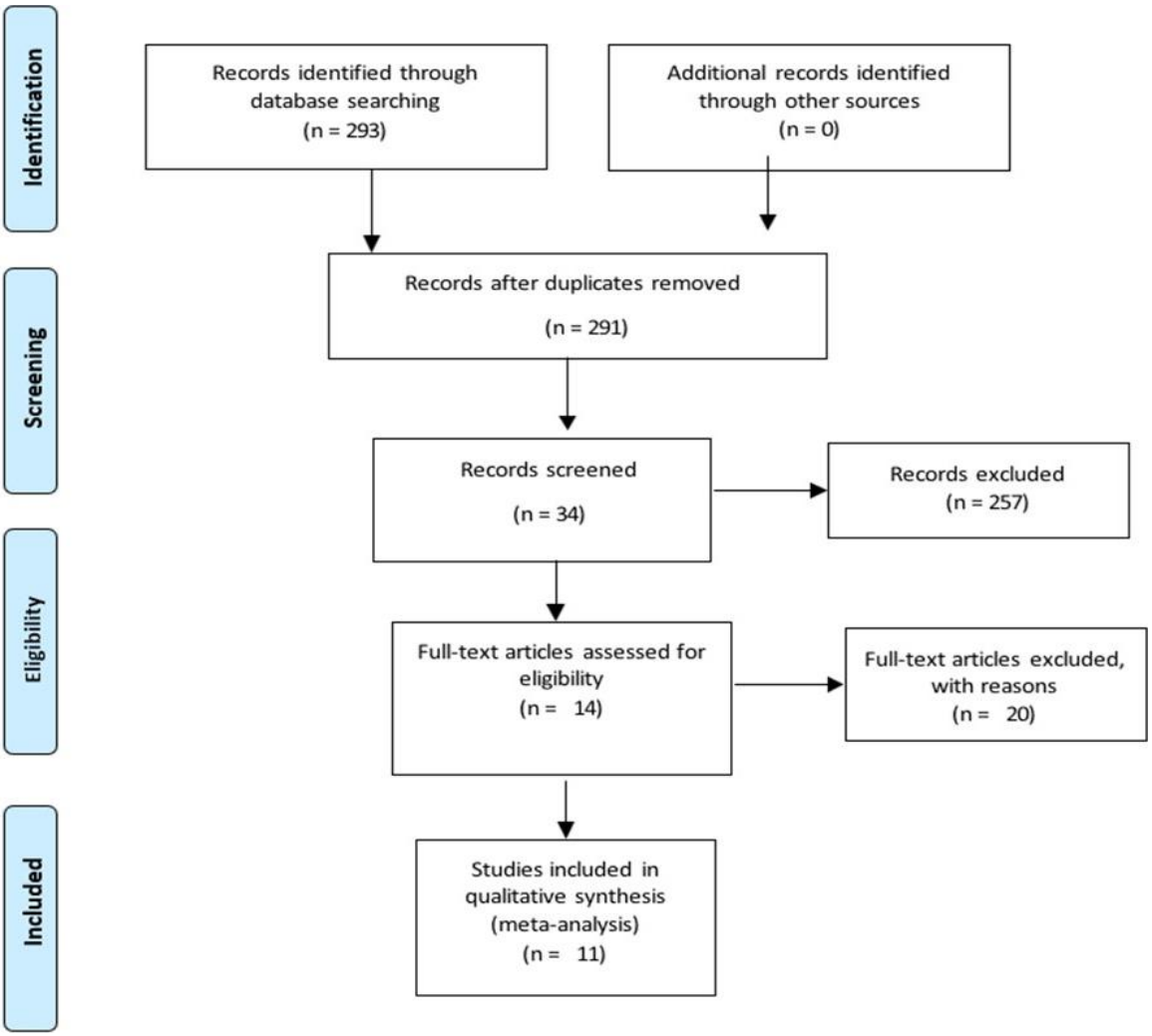

Fig. 1. PRISMA flow diagram of the systematic review

1.4 Data Extraction Procedures

The names of the authors, the year of publication, the country, the study design, participant characteristics, the study aims, results and discussion, conclusion and recommendations, and challenges, impact and best practices in technology resource management have all been extracted from the systematic review for easy navigation and citation. All related studies in Table 2 were attained through Google Scholar.

1.5 Data Analysis

Drawing upon insights obtained from various systematic reviews, this paper meticulously examined the data. Utilizing a table comprising systematic reviews with their respective focal points, information pertaining to technology resource management within educational institutions underwent thematic analysis. Consequently, themes were formulated to explain the challenges, impacts and best practices associated with technology resource management in education.

2. RESULTS AND DISCUSSION

The 11 articles reviewed in this paper came from eight countries. These were distributed properly according to the following: Nigeria (2), Turkey (1), India (2), Uzbekistan (1), Russia (1), Uganda (1), China (2), and Colombia (1). Two studies (18.18%) concentrated on basic education while 5 studies (45.45%) focused on higher education. On the other hand, four study (36.36%) was not identified (see Table 3).

Table 3. Distribution of the reviewed studies by country and by educational level

Place of Publication	Educational		Total
Basic Education	Higher Education	Not Identified	
Nigeria	1	1	2
Turkey	1		1
India 1		1	2
Uzbekistan	1		1
Russia		1	1
Uganda 1			1
China	2		2
Colombia		1	1
Total 2	5	4	11

Technology resource management challenges in education: In examining the themes regarding technology resource management challenges in education, several critical insights emerged from the data. Based on the analysis of 11 articles, the effects of resource management are outlined in three key areas: insufficient funds, teacher's adaptability skills in new technology, and lack of connectivity.

Insufficient fund: The theme of Insufficient Fund was prominent, highlighting the challenge of inadequate funding for purchasing and maintaining ICT tools. This finding aligns with the common understanding that ICT resources are costly to acquire and upkeep, presenting a significant barrier for educational institutions in enhancing their technological infrastructure. This theme has produced two characteristics: lack of funding for the purchase of ICT tools and ICT resources can be expensive to acquire and maintain.

Lack of funding for the purchase of ICT tools in education has the significant impact that greatly affects educational institutions. According to Aron and Abraham [15], the advancement of scientific applications has required the development of effective resource management systems. Also, a low-quality resource management system can potentially result in a long processing time and high cost. Therefore, technology is a key in helping students reach their learning goals, especially as they engage more in online learning environments. The university needs to offer top-notch assistive technology that includes the latest and most relevant translation resources for online courses [14]. Older technology, because of limited funds, can slow things down and make it tough to use newer educational stuff. This digital divide can worsen inequalities in educational opportunities among students.

ICT resources can be expensive to acquire and maintain that can often pose a significant financial burden for institutions. Conversely, Serna [20] stated that the presence of social and economic disparities in numerous countries, coupled with the ongoing exclusion of marginalized groups, poses challenges to creating fair social and political structures necessary for companies to effectively navigate their digital transformation journey. However, Access and Navigation (UI Design) refers to the technical assistance provided to make communication and learning easier in an online course. It involves creating a virtual structure or navigation system that helps students quickly locate programs and content. An effective online course design should feature a consistent on-screen navigation system that is easy to use. This aspect of design is crucial for the overall look and feel of online learning and requires user-friendly interface elements like pointers or labels that guide users to relevant information [14]. This only means that ICT resources can indeed be costly to obtain and upkeep, prioritizing Access and Navigation (UI Design) remains crucial for improving communication and learning in online courses.

Teacher's adaptability skills in new technology: This theme shed light on educators' struggles with technological proficiency, worsened by limited access to materials for practice. This theme underscores the importance of addressing educators' technological knowledge gaps through targeted training and support programs. Three characteristics emerged from this theme: lack of technological knowledge and skills, lack of access to technological materials for teachers to practice with, and lack of training for ICT integration.

Lack of technological knowledge and skills emphasized a need for comprehensive

professional development initiatives aimed at enhancing proficiency in navigating new technology to integrate effectively into teaching practices. Rita [16] highlighted those teachers faced technical challenges, including audio and visual glitches, during remote teaching. They emphasized that the global pandemic underscored a significant lack of preparedness and training among educators for emergency remote teaching, particularly in utilizing technology to ensure continuous learning for students outside the classroom. This crisis served as a valuable lesson for educators to anticipate and address any situation to maintain uninterrupted teaching. Moreover, Sibi and Miranda [13] emphasized that in terms of leading with technology, principals felt a common mix of personal doubts alongside the professional necessity. Principals recognized that even if they felt lacking in tech leadership skills, the demands of the 21st century made it essential to address this aspect in their leadership roles. They saw dealing with evolving technology and adapting to it as both a challenge and a crucial aspect of their work.

Lack of access to technological materials for teachers to practice with is often a result of budget constraints. According to Olaoye [10], over the past couple of decades, there has been a huge leap forward in Information and Communication Technology (ICT). Pricey mainframe or mini-computers have been replaced by personal computers (PCs). Nowadays, we not only have desktop computers but also laptops and notebooks. However, the significant challenge of teachers having limited access to technological materials for practice remains. This is mainly due to financial limitations, as not all departments or schools can afford to supply every teacher with the necessary gadgets to seamlessly incorporate technology into their lessons. As a result, teachers are driven to innovate their teaching methods without relying on gadgets, as long as they ensure successful learning transfer. Moreover, Xu and Song [17] highlighted that with economic globalization and the rapid advancements in science and technology, colleges and universities are increasingly focusing on fostering students' innovative thinking and creativity. Consequently, innovation and entrepreneurship education has become an integral component of the education system. This is another reason why teachers still lack access to technological materials for practice. The focus tends to prioritize enhancing students' skills without adequately considering the teachers' role in the process.

Lack of trainings for ICT integration can result in teachers feeling less confident and skilled in using technology effectively during lessons, which can negatively impact students' learning experiences and restrict their access to digital tools and resources. Asadovna [14] highlights that educational institutions employ various strategies to aid teaching and learning. Notably, teachers play a crucial role in ensuring the success of distance learning courses aligned with the "student-centered" principle. For instance, students act as users who navigate information on the screen and input data during learning tasks. Consequently, systems should offer diverse training methods for teachers to effectively conduct online courses. Moreover, according to Serna [20], it's crucial to prioritize enabling inclusive and sustainable digitization. This means not only setting the stage for economic recovery but also enhancing quality and productivity within institutions. Hence, prioritizing training for ICT integration is essential, as the absence of such opportunities for teachers can obstruct students' learning progress and restrict their access to digital tools and resources. Top of Form

Lack of connectivity: highlighted issues related to internet speed and availability, essential for leveraging online resources and digital platforms in education. Addressing these themes requires a holistic approach that includes strategic budget allocation, professional development opportunities, and infrastructure enhancements to overcome technology resource management challenges and foster effective integration of ICT in education. Two characteristics emerged from this theme: Speed of the internet and availability of the internet.

Speed of the internet ICT challenges can cause disruptions and frustrations in online activities, hindering productivity and communication. Serna [20] stressed that many people justify their choice not to adopt this trend because technological advancements tend to exclude a significant portion of society who lack access to its benefits, particularly due to inequitable income distribution. This discrepancy has widened the disparity between the availability and actual usage of digital technology, despite widespread coverage in many countries. It's undeniable that the balance between the advantages and drawbacks of digital transformation remains

uneven. Furthermore, geopolitical conflicts surrounding patents, standards, and digital production, along with concerns about digital security, undermine the decision-making process of companies. Aside from that, Asadovna [14] explores how information technology is becoming increasingly important to be integrated into distance education systems, highlighting the crucial roles of the Internet and online courses in enhancing the effectiveness of distance learning. These advancements are essential for the success of educational institutions at every level and should be prioritized accordingly.

Availability of the internet in regions with limited infrastructure or unstable network coverage, accessing online resources, and conducting digital activities becomes inconsistent and unreliable. According to Serna [20], to effectively incorporate new technologies reliably and sustainably, it is essential to implement policy reforms while addressing institutional resistance. Success requires the coordination of various government ministries and the involvement of all stakeholders. Internal oversight mechanisms must be established to prevent failures, and priority should be given to societal benefits over individual interests. Additionally, adopting a global perspective is crucial for understanding the full impacts of digital transformation. So, policy reforms are needed to address institutional resistance and it's crucial to coordinate efforts among government ministries and stakeholders, the lack of internet access poses a major obstacle. Asadovna [14] also pointed out that implementing online learning in course development includes computer skills, technical knowledge, and curriculum design. Additionally, teachers are encouraged to inspire students, enhance their computer literacy, and cultivate practical skills such as email communication, presentations, and creative thinking to facilitate effective online learning experiences. Hence, without internet access, understanding the full effects of digital transformation on a global scale becomes difficult, making it harder to advance technology integration efforts.

Themes on the technology resource management impact in education: After carefully examining 11 articles, we uncovered some key points about how managing technology resources affects education. Two main themes stood out: improve the quality of teaching and technology advancements.

Improve the quality of teaching: This theme highlighted the diverse strategies that can be implemented to enhance teaching effectiveness. This theme also emphasized the positive outcomes these strategies yield for learners, underscoring the importance of leveraging technology to improve the overall quality of education delivery. This theme has produced two characteristics: diverse strategies can be applied and gives positive outcome for the learners.

Diverse strategies can be applied and can be implemented to enhance teaching effectiveness. This theme also emphasized the positive outcomes these strategies yield for learners, underscoring the importance of leveraging technology to improve the overall quality of education delivery. Sibi and Miranda [13] highlight technological breakthroughs across different domains like artificial intelligence, robotics, the Internet of Things, nanotechnology, biotechnology, and quantum computing are revolutionizing various sectors, including government, education, healthcare, and commerce, by boosting efficiency and productivity. Consequently, the education sector is evolving, prompting a reevaluation of traditional teaching methods and the adoption of new approaches with technology at the forefront. There's a growing buzz about an "education revolution" that promises to fundamentally transform schools and universities. Also, in entrepreneurship education, Olaoye [10] stated that Information and Communication Technology (ICT) has made remarkable strides in the past two decades. From costly mainframe computers to personal computers (PCs), and now laptops and notebooks, technology has become more accessible. Today, being computer literate is practically a prerequisite for entrepreneurs. In the 21st century, having computer skills is essential to leverage the vast array of software applications available across all business sectors. Computers have largely replaced typewriters in offices, and various industries such as accounting, payroll, libraries, hotel management, banking, insurance, engineering, medicine, and agriculture have undergone computerization. This shift has often led to a reduction in the workforce as computers streamline tasks that were once labor-intensive and mentally taxing.

Gives positive outcome for the learners develop digital literacy skills preparing them for the demands of the modern workforce. Based on the study of Bozak [11], the impact of teachers using

Table 4. Themes on the technology resource management challenges in education

Themes on the Technology Resource Management in Education	Characteristics	Study ID	Number of Studies
Insufficient Fund	Lack of funding for the purchase of ICT tools.	[6] [5]	2
	ICT resources can be expensive to acquire and maintain.	[11] [5]	2
Teacher's adaptability skills in new technology	Lack of technological knowledge and skills.	[7] [4]	2
	Lack of access to technological materials for teachers to practice with.	[1] [8]	2
Lack of Connectivity	Lack of trainings for ICT integration	[5] [11]	2
	Speed of the internet Availability of the internet	[11] [5]	2
		[11] [5]	2

technology improve learning experience and create better learning opportunities for learners with the use of technology. According to Serna [20], the effects of the digital revolution on businesses became more apparent and pronounced during the Covid-19 pandemic, exposing their vulnerabilities in adapting to the realities of the New World Order. Across many countries, there was a surge in remote service delivery in education, healthcare, commerce, telecommuting, and social interactions, although to differing extents depending on the level of technological adoption in each country. Consequently, the rise in remote service delivery globally also benefits learners by enhancing their digital skills, crucial for succeeding in today's job market. Moreover, according to Asadovna [14], online learning involves various elements such as teaching and learning assignments, interactive courses, multimedia tools, and technologies. For instructors, the course student responsibilities manual includes tasks like clarifying objectives, which are essential for achieving learning goals. Just like any other educational approach, online learning aims to meet specific learning objectives, so it's crucial to establish clear goals at the beginning of the course. Accordingly, online learning strives to fulfill specific learning objectives, emphasizing the importance of setting clear goals from the outset of the course. This ensures that learners have a structured framework to guide their progress and achieve desired learning outcomes effectively.

Technology Advancements. Another key theme identified was Technology Advancements, which focused on the benefits of easy access to e-learning materials for schools. This accessibility not only supports remote learning but also facilitates quicker technical support for queries from both learners and parents. Moreover, technological advancements were found to streamline school operations, making processes faster and more efficient. Three characteristics emerged from this theme: Easy access of schools e-learning materials, quickly provide technical support for queries from the learners and parents and make the school operations faster.

Easy access of schools e-learning materials to ensure that educational resources are readily available, allowing students to engage with course materials conveniently and effectively. Asadovna, Rustamova, and Laylo (2022) point out that distance learning is a modern educational method embraced by many academic institutions. Instead of traditional classrooms, much of the teaching happens online. With distance learning tech, educators can share study materials with students remotely. This approach applies to both the tools used for teaching and the methods employed in online instruction. When executed effectively, online learning taps into internet resources, like video conferences and email, fostering deeper comprehension through interaction between humans and computers. Furthermore, in terms of the delivery of computing services over the internet, Cloud computing revolutionizes how computing services are delivered over the internet. It does not only transform the economic landscape of information technology but also fuels progress in various other fields. With its ability to personalize and customize computing environments, cloud computing is attracting more organizations to build powerful computing clusters using cloud platform technology. For instance, leveraging the OpenStack cloud platform to enhance innovation and entrepreneurship education in colleges and universities offers rich resources and fosters a culture of innovation and entrepreneurship

among students, ultimately benefiting their educational development [17].

Quickly provide technical support for queries from the learners and parents to ensure smooth usage of educational technology. This quick and efficient support enhances the overall learning experience and fosters a positive relationship between the school and its stakeholders. As mentioned by Asadovna [14], learning plays a crucial role in empowering all involved parties to excel in online education. This is achieved through capacity-building and personal development programs, particularly aimed at key stakeholders such as students and teachers. The learning process, which encompasses technology and interactive methods, enhances individuals' skills and capabilities for effective participation in online learning environments. Although new technologies are crucial for digital transformation, it's everyone's responsibility to implement them and adjust to the changes they bring [20]. By quickly providing technical assistance to students and parents, schools ensure that technology is used smoothly for learning. This proactive approach creates a supportive atmosphere for effective interaction with educational technology, ultimately improving the learning experience for everyone involved. Furthermore, as discovered by Bozak [11], by using platforms such as Google Forms, Mentimeter, or Kahoot students can openly convey their sentiments, ideas, and expectations. The feedback gathered through these applications should be collected solely through anonymous electronic forms, omitting students' personal details and email addresses.

Make the school operations faster by automating tasks and streamlining processes, allowing staff to focus more on teaching and learning. This enhancement in efficiency enables smoother coordination and quicker responses to administrative needs, ultimately benefiting both students and educators. According to Sibi and Miranda [13], education is swiftly advancing into new realms in the 21st century. Leading in the education sector now demands modern skills and mindsets. It is crucial to equip and train principals to adopt and utilize these new leadership abilities, which poses a significant challenge in today's education landscape. Understanding the challenges, successes, and limitations encountered by principals as they apply their 21st-century leadership skills is essential for navigating this evolving terrain effectively. Additionally, according to Matayo et al., ICT resources are crucial for organizations as they fulfill diverse tasks, boosting overall operational efficiency and effectiveness. These resources not only automate and streamline business processes but also facilitate communication and collaboration among staff, enable efficient data handling, and enhance productivity by offering a range of tools and applications for various tasks. Embracing ICT tools and applications equips organizations with the necessary capabilities to navigate complex challenges and thrive in today's dynamic business landscape.

Technology resource management best practices in education: This systematic evaluation centered on examining the best practices for managing technology resources in education. The evaluation emphasized key characteristics that contribute to effectively handling technology resources in educational settings. Table 3 shows the best practices of technology resource management in education.

Table 5. Themes on the technology resource management impact in education

Themes on the Technology Resource Management in Education	Characteristics	Study ID	Number of Studies
Improve the quality of teaching	Diverse strategies can be applied	[4] [1]	2
	Gives positive outcome for the learners	[2][11] [5]	3
Technology advancements	Easy access of schools e-learning materials	[5] [8]	2
	Quickly provide technical support for queries from the learners and parents.	[2] [5] [11]	2
	Make the school operations faster	[4] [10]	2

Routine evaluation and review: This theme refers to consistently assessing the performance, security, and cost-effectiveness of technological tools and systems utilized within educational institutions. This has created two characteristics, namely: constant communication of the needs and improvements in using ICT tools and constant checking of the effectiveness of the technology used.

Constant communication of the needs and improvements in using ICT tools. The effectiveness of any degree of governance depends on institutional governance. Forward-thinking and business-oriented, these procedures concentrate on matters that have an impact on the company (e.g business administration, academic affairs, student services, etc.). Carefully developing the curriculum for online classes necessitates integrating the following components. atmosphere for education. The utilization of online materials, online courses, online communication platforms, instructor support, and grade distribution are all part of an online learning environment. A calm, comforting, and encouraging learning atmosphere is ideal for human learning. Therefore, every facet of the learning environment, including fitness, trust, respect, support, and freedom, should be comfortable. On the other hand, while it may help to establish a suitable learning environment in an online course, the online learning environment has little effect on learning results [14]. Moreover, to identify improvement areas, assess the efficiency and application of ICT resources regularly. Regularly review resource plans to make necessary adjustments for changing market conditions, organizational needs, and technological advancements. Moreover, Organizations must place a high priority on the effective management of their ICT resources to maximize their value and lower risks [19].

In terms of constant checking of the effectiveness of the technology used, [19] revealed that organizations need to assess their existing ICT resources to recognize strengths, limitations, and opportunities for improvement. This involves evaluating the effectiveness, efficiency, and dependability of hardware, software, networks, and data storage systems. In addition, Sibi & Miranda [13] that this field is expanding rapidly in the modern era as technology becomes increasingly integral to education. This aspect focuses on the leadership's ability to effectively introduce and incorporate technology into the school's educational processes. It encompasses the leader's capability to check, embrace and integrate new technologies within their own skills and competencies. Moreover,

Keep abreast of technological developments: This theme examines the updated enhancements and development of technology in resource management in education. This refers to the occurrence of new trends with the latest technology. This theme has produced two characteristics: staying updated on the new developments in technology and being able to adapt to new demands.

Stay updated on the new developments in technology in educational institutions pertaining to the new technological advancements and best practices for ICT resource planning and utilizing the emerging new trends in the digital market. Gayathri and Bella [12] observed that one of the best practices of emerging technologies is the successful implementation of artificial intelligence in integrating technology to transform human resources functions. Findings show that using technology such as artificial intelligence (AI) and machine learning (ML) to analyze and create personalized experiences provides various opportunities to enhance the function of human resource management. This is backed by Aron and Abraham, who stated that the emerging complex nature of efficient resource utilization and performance- driven solutions can be efficiently explored with the use of artificial technology and metaheuristics that can guide coming up with the procedures for complex learning processes at a more convenient pace. Furthermore, the study by Matayo et al. [19] highlighted that ICT resource management stays competitive in providing customers' demands, increased protection, and security measures, and increased efficient production by optimizing resource allocation and implementing cost-effective solutions.

To be able to adapt to new demands in education means that in this evolving modern world, technology enables new ways of engaging in new learning opportunities. As stated by Gayathri and Bella [12], advanced technology, such as artificial intelligence (AI) and machine learning (ML), plays an important role in automating regular tasks and focusing on an innovative and strategic way of adapting to the emerging new trends of technology. Furthermore, in the study of Sibi and Miranda [13], Although coping and adapting to the

changing technology trends is challenging, it is essential to keep up with the new features and capabilities for more opportunities to grow personally and professionally. Moreover, Matayo et al. [19] emphasized that organizations must adapt to the increasingly technologically advanced society to take advantage of new opportunities and maintain competitiveness, resulting in optimal performance.

Flexibility and scalability of the plan: This theme refers to designing adaptable systems and strategies that can accommodate changes in curriculum, teaching methods, and student needs. Scalability ensures that the technology infrastructure can efficiently grow or shrink in response to fluctuations in student enrollment, technological advancements, and resource demands, without compromising performance or functionality. Together, flexibility and scalability enable educational institutions to effectively leverage technology to support teaching and learning goals while remaining responsive to evolving requirements.

In terms of adaptable to changing circumstances [19] stated that to anticipate future expansion and evolution, ensure that your plans are both adaptable and scalable. This means designing strategies and systems that can easily accommodate changes in requirements, whether they involve increasing capacity, incorporating new technologies, or adapting to shifts in demand. By prioritizing flexibility and scalability, you can effectively future proof your initiatives and ensure their long-term viability and success. Moreover, Adoption of technology contributes to increased job accuracy and data availability, making tasks easier and faster to do. The organization's expansion and development are significantly influenced by the information technology hardware program. The primary goal is to investigate the many options for integrating information technology with the HRM function. For information technology and human resource management to be integrated, human resource management techniques like e-HRM must be used [12]. Furthermore, the ongoing advancement of new technologies is constant, yet any changes should only be implemented following a needs assessment customized and organized according to the specific requirements of each institution. Ensuring relevance in the New World Order is imperative for survival, underlining the critical importance of aligning technological evolution with organizational needs [20].

Regarding Efficient utilization of resources, [19] stated that, once organizations understand their current resource requirements and expected future needs, they can effectively manage their resources. This involves distributing resources based on strategic objectives, financial limitations, and essential business practices. Moreover, outsourcing can lead to reduced expenses, improved access to specialized skills, and increased efficiency because it involves hiring an external provider to handle ICT resources and services. By entrusting ICT management to experts, organizations can focus on their core competencies. In addition, leaders in the modern era require computer skills to capitalize on the widespread availability of application software. This entails proficiency in computer operation, software and hardware management, data storage, retrieval, and complex data analysis to reduce expenses and seek expertise [10]. Furthermore, according to Jiang & Huan [18], cloud computing employs resource sharing to enhance efficiency in resource utilization, ultimately aiming to decrease computing costs.

Discussing Anticipating future needs and designing the plan to accommodate growth without requiring a complete overhaul [19] discovered that, to ensure access to modern and efficient technology, maintaining up-to-date ICT resources requires a proactive approach. Moreover, log analysis tools examine log files of ICT resources to uncover system events, security issues, and potential performance issues. These tools can identify irregularities, connect events, and produce reports for additional scrutiny. Furthermore, in order to anticipating future needs and design a plan to accommodate growth without requiring a complete overhaul, leaders should equip with the necessary skills to address future needs as supported by Sibi and Miranda [13], the results of this study carry implications for principal leadership, contributing empirical evidence to the existing literature regarding principals' preparedness in 21st-century leadership skills. It underscores the importance of personal engagement in driving necessary changes and implementing innovative practices suited to the challenges of the modern era.

Table 6. Themes on the technology resource management best practices in education

Themes on the Technology Resource Management in Education	Characteristics	Study ID	Number of Studies
Routine evaluation and review	Constant communication of the needs and improvements in using ICT tools	[5] [10]	2
	Constant checking of the effectiveness of the technology used	[4] [10]	2
Keep abreast of technological developments	Stay updated to the new developments in technology	[3] [10] [6]	3
	To be able to adapt to new demands	[3] [4] [10]	3
Flexibility and scalability of the plan	Adaptable to changing circumstances	[3] [10] [11]	3
	Efficient utilization of resources	[1] [9] [10]	3
	Anticipating future needs and designing the plan to accommodate growth without requiring a complete overhaul.	[4] [10]	3

3. CONCLUSION

This Systematic Review aimed to investigate various literature on the challenges, impact and best practices of technology resource management in educational institutions following the Systematic Reviews and Meta-Analyses (PRISMA). Given the 11 reviewed articles from eight countries, this study carefully analyzed the data through thematic analysis. The researchers formulated themes emerged from the challenges of technology resource management in education, namely: insufficient funds, teacher's adaptability skills in new technology, and lack of connectivity. On the other hand, impact for technology resource management generated two main themes such as improve the quality of teaching and technology advancements. Finally, the best practices of technology resource management are presented through three themes: routine evaluation and review, keep abreast of technological developments, flexibility and scalability of the plan. With the themes formulated by the researchers from the reviewed journals, technology in resource management in education is vital in the teaching and learning environment. This paper offers impact and practices of resource management in using technology for educators and administrators to apply to overcome challenges that may occur with the various perspectives used from the literature presented.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Soonthodu, S. Innovative technology and human resource; 2022.
2. Nadhif KM, Warfa AO, Mumo RM. Information communication and technology resource availability and integration in instruction among secondary schools in habaswein sub-county. Asian J. Educ. Soc. Stud. 2024 May 9 [cited 2024 Jun. 8];50(6):110-21. Available:https://journalajess.com/index.php/AJESS/article/view/1398
3. Minga C, Ghosh S. Teachers' Perceptions of ICT use in promoting teaching learning Processes and its outcomes at senior secondary level in Mbeya Region, Tanzania: A Review. J. Educ. Soc. Behav. Sci. 2024 Feb. 3 [cited 2024 Jun. 8];37(1):39-50. Available:https://journaljesbs.com/index.php/JESBS/article/view/1296

4. Kozma RB. Comparative analysis of policies for ICT in education. International handbook of information technology in primary and secondary education. 2008;1083-96.
5. Fu J. Complexity of ICT in education: A critical literature review and its implications. International Journal of education and Development using ICT. 2013 Apr 19;9(1):112-25.
6. United Nations Conference on Trade and Development. (2021). Technology and innovation
7. Ali OH, Sharhan HN, Alsaedi RKR. The impact of human resource management; 2021.
8. Gerdruang A, Panwatanasakul C. An information technology resource management model for learners. Turkish Online Journal of Qualitative Inquiry. 2021;12(7):10965-10976.
9. Ministry of Education. Analysis of budget expenditures for the fiscal year 2020. Bangkok: The Secretariat of the House of Representatives; 2019.
10. Olaoye AA. Institutional administration: A review of management skills in entrepreneurship education. in proceedings. practices on organizational effectiveness considering the mediating role of information technology. PalArch's Journal of Archaeology of Egypt / Egyptology. 2023, November ;18(4) the impact of human resource management practices on organizational effectiveness considering the mediating role of information technology | palarch's Journal of archaeology of egypt / Egyptologyreport. Available:https://unctad.org/system/files/official-document/tir2020_en.pdf
11. Bozak A. Instructional reverse mentoring: A practice proposal for teachers' understanding the" Z" and" Alpha" Generations' Learning Perspectives. Online Submission. 2021;12(43): 114-142.
12. Gayathri K, Bella KMJ. Role of artificial intelligence technology and its i mpact on transformation of human resources management. Research in Multidisciplinary Subjects. 2023;12:41.
13. Sibi KK, Miranda J. School leadership in the 21ST century: Shared experiences of the claretian principals in northeast India. Agpe the royal gondwana research Journal of History, science, Economic, Political and Social Science. 2022;3(9): 32-47.
14. Asadovna RL. Methods for using distance education technologies in e ducational management in the era of ict development. Innovation in the Modern Education System. 2023;3(28):56-61.
15. Aron R, Abraham A. Resource scheduling methods for cloud computing environment: The role of meta-heuristics and artificial intelligence. Engineering Applications of Artificial Intelligence. 2022; 116:105345.
16. Rita H. Teacher efficiency and program implementation in primary schools Koboko district Uganda; 2023.
17. Xu C, Song C. Optimization of innovation and entrepreneurship education and training system in colleges and universities based on OpenStack cloud computing. Scientific Programming; 2022.
18. Jiang H. Check for updates construction of english teaching multimedia RESOURCE library based on cloud computing technology. Innovative Computing Vol 1- Emerging Topics in Artificial Intelligence: Proceedings of IC 2023, 1044, 424.management; 2023. Available:https://doi.org/10.4018/978-1-6684- 3873-2.ch032
19. Matayo VA, Abdulganiyu J, Musa MN, Ahmed AA. Efficient management of information communication technology resources in an organisation. Qeios; 2023.
20. Serna A. Transdisciplinary Science; 2024.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/118835