Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
May 2024 5(5), 761–774

LEVERAGING EMERGING TECHNOLOGIES TO DEVELOP FUTURE-READY TECHNICAL EDUCATION: A CASE STUDY APPROACH IN LIBRARYAND INFORMATION SCIENCE

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DOI
10.29121/shodhkosh.v5.i5.2024.4547

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

The fast-paced evolution of Library and Information Science (LIS) is causing the integration of emerging technologies, including artificial intelligence, machine learning, blockchain, and augmented reality, providing a significant impact in order for educational programs to remain relevant and impactful in order to prepare the students for the dangers of the future. This systematic review identifies these disruptive technologies and discusses their relevance to Future-ready technical education in LIS. Using a case study approach, this study explores how the technologies are currently integrated into LIS curricula and instructional strategies, while also emphasizing the challenges and opportunities they provide. The study introduces a new approach known as the "Techno-Cognitive Integration Framework" (TCIF), which stresses the importance of cross-disciplinary cooperation in terms of formal technical education, collaborative thinking processes, and experiential development. Educators play a key role in the development of these new learning environments and this framework facilitates innovation, adaptability and lifelong learning for them, and empowers them to integrate new technology in their teaching. Lenker and Kelsey also call for stronger collaboration within the industry and between academia and industry, so that LIS education keeps pace with the evolving technology landscape in our information ecosystem. The paper uses case studies to offer insights into how these technologies can be employed to update LIS education, so students are better prepared for the requirements of a highly technical field. In the end, the results highlight the necessity of building up a LIS workforce that is technologically savvy and educated for the future.

Keywords: Library and Information Science (LIS), Emerging Technologies, Curriculum Development, Instructional Strategies, Techno-Cognitive Integration Framework, Educational Innovation

1. INTRODUCTION

Library and Information Science (LIS) has undergone a number of rapid changes in the last few years, mainly due to the increasing popularity of emerging technologies. LIS education must adapt to the changing landscape of the profession, as societies and industries continue to depend more on digital resources, automated systems, and data-driven solutions. With the rise of digital resources, as well as the growth of the internet as a source of both information and misinformation, traditional approaches to LIS education often emphasizing physical resource management and cataloging are not enough to prepare new professionals for an increasingly complex information landscape.

Innovative technologies like AI, machine learning (ML), blockchain, and AR are transforming the working ethos of libraries and information centers. AI, ML and Blockchain To Improve Libraries in 2023 AI and ML allow libraries to automate processes, such as information retrieval, recommendation systems and data analysis, while blockchain provides a secure and transparent solution for the management of digital resources and transactions. VR establishes

all levels of immersive learning experiences; however, AR also further unlocks the potential for virtual worlds for students to explore deep within information systems.

Such integration raises both considerable hurdles and hopeful prospects for LIS education. The speed of technological advancement typically runs ahead of the capacity of educational programs to respond to this change (or of universities to adjust to their shocks). At the same time, faculty members might struggle to keep up to date with the latest tools and best practices, and numerous institutions lack the funds, technical mechanisms, or infrastructure to appropriately deploy the latest tech. However, such technologies also provide a valuable opportunity for the revitalization of LIS curricula and pedagogy to foster student engagement, value learning outcomes, and prepare graduates for the changing landscape of the information profession (depending) on who is involved.

This paper discusses the strategies of socio-technological integration of these emerging technologies closely embedded in LIS education to produce such future-ready LIS professionals. Using selected case studies, the study investigates current activities to integrate technologies such as AI, ML, blockchain and AR in LIS curricula and assesses the influence of these efforts on teaching and learning processes. This paper presents a new approach, called the Techno-Cognitive Integration Framework (TCIF), that fuses technical training, critical thought, and, through interdisciplinary curriculum design, discovery learning experience. This framework is intended to help educators identify the tools and resources to provide students with the skills and knowledge they need to thrive and flourish in our rapidly evolving information ecosystem. Moreover, the study highlights that the connection between education in the library and information science (LIS) and the technologies that are being developed and adopted in practice can serve as a continual process through partnerships between your LIS educators and your industry professionals to ensure that education is meeting the demand of the profession as it progresses through various trends and technologies.

The results of this study provide insight into the impact emerging technologies can have on the evolution of LIS education. Through new technologies and continued learning, LIS educators can prepare a tech-savvy and empowered workforce to meet and face the challenges and opportunities of this continually digital world.

Section 2: Literature Review discusses previous research done to incorporate emerging technologies such as AI, machine learning, blockchain and augmented reality into Library and Information Science (LIS) education specifically around identifying a given technology for integration, along with the associated advantages and challenges. Methodology (Section 3) describes the case study approach undertaken to explore the integration of the varied technologies into LIS curricula, including data collection methods through interviews, surveys, and institutional analysis. Section 4: Results and Discussion provides an evaluation of the results from the case studies, including the level of technology integration found within these classrooms and the effects this technology had on student learning outcomes, classroom management, etc., as well as the challenges teachers faced integrating technology into their teaching practice, including common barriers to successful integration. Section 5: The discussion elaborates on the implications of these findings for future-ready LIS education and highlights that an interdisciplinary curriculum and industry-academia collaboration are paramount. Finally, Section 6: Conclusion, concludes key findings and provides recommendations to support the implementation of emerging technologies in LIS programs to prepare students for the future needs of the information profession.

2. RELATED WORKS

In today's increasingly digital world, the educational sector is using new technology to address the challenges posed by the learning environment, particularly in the field of Library and Information Science (LIS). Big Data, Cloud Computing, the Internet of Things (IoT), Machine Learning (ML), Artificial Intelligence (AI), Blockchain, Augmented Reality (AR), and Virtual Reality (VR) are some of the emerging technologies that are upending the library and information science (LIS) field and its educational landscape. In order to provide technical education that is prepared for the future, this literature review incorporates recent research on these new technologies and how they are used in library and information science (LIS).

Ghosh and Das (2016) give Big Data the attention it deserves, without which it would be of little utility in modern library operations. By analysing user information and trends, libraries may also use Big Data analytics to develop new services that cater to user wants. A crucial component for modern librarians is the ability to manage massive amounts of data, and Big Data assists library instructors in providing their students with this competence. In order for LIS graduates to be ready for the difficulties of data-driven workplaces, the research stresses the need to teach Big data topics in the classroom.

In his 2017 article, Dhanavandan examines how the IoT has the ability to revolutionise library services. Once again, the Internet of Things (IoT) is shaping the future of our technology, and LIS programs are adapting to meet this need by teaching students to design and implement IoT-based library systems. In order to better educate their students to handle the interconnected systems inside libraries, LIS instructors, according to Dhanavandan's study, should place a greater emphasis on Internet of Things (IoT) applications.

Similarly, Hill and Clarke (2017) note the possible privacy hazards associated with Cloud Computing when reviewing its significance in libraries. Cloud services have revolutionised the automated storage and retrieval of information, allowing libraries to achieve scalable systems while saving time and money. The security risks associated with them, however, highlight the need for LIS experts to be well-versed in cloud computing, data protection regulations, and related topics. Based on the findings, future library and information science programs should include lessons on cloud computing and data protection in their curriculum so that students are prepared to work with the libraries' digital infrastructures.

The use of augmented and virtual reality in reading and library settings is discussed in Boulos and Mattick's (2017) review. Even with these adjustments, augmented and virtual reality technologies will still be able to meet consumers' expectations while also bringing new dimensions to education and research. Students majoring in library and information science may get valuable experience using augmented and virtual reality (AR/VR) technology in library settings, as well as develop their critical thinking and problem-solving abilities in relation to the subject matter, via this integration. This study's findings highlight the importance of LIS educators using AR and VR platforms to enhance the learning and teaching processes.

Library services such as information retrieval, recommendation systems, and user behaviour analysis are enhanced by their implementation, which further highlights the significance of ML algorithms in these disciplines (Choudhury & Sharma, 2018). They contend that the inclusion of ML into LIS curricula is necessary to prepare future professionals to face the problems posed by library process automation and to make data-driven choices. The authors argue that library and information science (LIS) schools should include machine learning (ML) in their current curriculum and teach students to think critically and apply ML to various library tasks.

In 2018, Iqbal and Rahman published a paper. Trends and news: A case study on the digital transformation of libraries using new technology. The need to teach LIS students to adapt to these changes is shown by their research. The authors argue that LIS educators may benefit greatly from including digital transformation case studies in their pedagogical programs. These studies will demonstrate to students the practical applications of developing technology in libraries. According to Johnson and Klein (2019), these exercises show that augmented reality (AR) may be used to start VR in library and information science (LIS) courses. Their studies show how beneficial it is for students to have engaging, hands-on experience with library management systems and information retrieval, and how important it is for students to understand these technologies in order to be job-ready. There is no way to overstate the potential of virtual reality (VR) and augmented reality (AR) in library and information science (LIS), particularly when it comes to incorporating these technologies into LIS curricula. Students can gain a better grasp of the technologies' potential uses in library settings, and they can also learn to apply what they've learned in theory, so they'll be ready to use these cutting-edge tools when they're integrated into library operations.

Library Information Security using Blockchain Technology | AJOL Alshammari, A., & Zidan, A. B. (2019). Blockchain has the ability to provide safe, transparent platforms for managing user data, digital assets, and transactions, according to them. Their main point is that with Blockchain technology spreading like wildfire, library and information science (LIS) teachers need to start teaching their students how to use it for safe data management. One interpretation of their work is that it supports the idea that library and information science (LIS) programs should include Blockchain technology in their curriculum to better prepare students to address the data security issues that libraries face in the future.

As of 2019, Christopher and Mark This article offers a case study analysis of a course that used virtual reality (VR) for information retrieval and how it affected student engagement and learning results. Both of them are making the case that virtual reality (VR) can be used to teach students information management. This would provide students specialising in complex information systems an opportunity to learn in a more practical setting. Virtual reality (VR) has the ability to greatly enhance learning LIS courses, according to their study.

Because the services may be quickly modified (scaled) to the user's demands and are very inexpensive, Cloud Computing improves the quality of library and information services, according to Cao and Chan (2020). Library systems, particularly those dealing with digital materials, are supposedly made more accessible and efficient by cloud

technology. The authors of the essay "Cloud Computing in LIS Education" (PDF) [Link] make the case that students of library and information science should learn about cloud computing in order to be prepared to deal with the increasingly prevalent cloud-based infrastructures in libraries.
Ferraro, A., and D'Agostino, F. (2020). Blockchain Technology with Academic Libraries: Opportunities and Obstacles. In this day of fierce competition and growing cooperation, Blockchain technology has the potential to bolster library operations by managing digital archives and intellectual property with the additional transparency and security that is essential in today's world. In order to prepare students to deal with the technological advancements that are reshaping academic libraries, the research suggests that LIS courses include Blockchain application training.
[analysis of AI's impact on classroom instruction; Graham and Yates, 2020] Research into AI's potential uses in individualised instruction, content suggestion, and ERM is their primary focus. As a result, they argue that library and information science (LIS) programs should include AI into their curriculum to better prepare students for careers in the emerging field of AI in education and library services.
They state that libraries might be revolutionised by AI and ML if these technologies automate tasks, boost information retrieval, and improve the user experience. Boddy et al. (2020), Chik et al. (2020), and Zha et al. (2020) all agree that libraries and LIS programs face a dual challenge and opportunity in this dynamic environment: how to adapt to new technology while simultaneously equipping students to make the most of them. They argue that future library and information science (LIS) graduates will need training in artificial intelligence (AI) and machine learning (ML) to succeed in a digitally altered industry.
Overall, data mining is uncovered by Fernandez & Ghimire (2021), who centre their attention on its relevance to library and information science (LIS) and its capacity to align library services and uncover structural patterns in library databases. Data mining plays a crucial role in several applications such as personalised service delivery, resource management, and information retrieval, as the author indicates in line 8 of the first example of the provided series. The authors argue that data-mining techniques should be required coursework in library information science degree programs so that students can effectively analyse library data, which is crucial to the success of libraries.
Machine learning (ML) and artificial intelligence (AI) have the ability to revolutionise personalised library services, according to Horava and Shanker (2021). ML and AI can learn user preferences and tailor library services to each user, leading to an improved user experience. The authors argue that library and information science teachers should include these tools into their curricula so that their students may design personalised library services. Libraries might be made more user-centred and service delivery could be improved by integrating ML and AI, according to Lattes and Coelho (2020).
By incorporating such findings into the information discovery process, this big data vertical may be used in augmented reality in libraries. They claim that augmented reality (AR) may provide a more engaging learning environment for students and make library information easier to find. They suggest incorporating AR into the LIS curriculum so that students may create new library services and describe it as a toolset for creating user-oriented library services.
"Singh and Shukla twenty-one" The importance of data security and integrity is highlighted by four possible uses of Blockchain technology in library information systems. They assert that Blockchain technology may improve library resource management, data sharing, and patron privacy. With the goal of incorporating Blockchain into the LIS curriculum, the authors conduct a descriptive study of the separate interdependencies between Blockchain technology and library and information science (LIS), as this is a skill that librarians from LIS are expected to possess.
New and developing technologies in the field of library and information science are conducting research on the need to continuously upgrade one's skills and knowledge to new levels. From Big Data and Cloud Computing to Artificial Intelligence and Blockchain, these technologies are influencing not just library services but also the education of future professionals. And just as this industry is evolving at a rapid pace, so too must the educational programs that train its workers. To better equip students for critical roles in a society that is more data-driven, fact-driven, and information-driven, these programs must include these new technologies into their curricula. The significance of LIS instructors embracing new technology cannot be overstated. Only by doing so will future professionals be equipped to tackle the obstacles and seize the possibilities presented by the dynamic information world.

3. PROPOSED WORK

This study strives to shed light on the adoption of upcoming technologies, such as Artificial Intelligence (AI), Machine Learning (ML), Augmented Reality (AR), Virtual Reality (VR), Big Data, Blockchain, Cloud Computing and the Internet of Things (IoT), in the drive toward LIS education. A case study may be the methodology employed which allows for

a closer look at how these technologies are used in the field of LIS programs. It allows us to compare the various degrees of integration across different university institutions/population groups/programs to produce best practice guidelines, challenges and outcomes.

A. RESEARCH DESIGN

As the output: The study will be structured as descriptive and exploratory research to determine the emerging technology trends in LIS education and examine the impact of these trends on creating professionals equipped to tackle the future challenges of the profession. In this study, we will review and study the applications of these technologies including Artificial Intelligence (AI), Machine Learning (ML), Blockchain, Augmented Reality (AR), Virtual Reality (VR), Big Data, Cloud Computing, and the Internet of Things (IoT) on the process of curriculum development, instructional methods, and student learning outcomes. I will be using mixed methods of qualitative and quantitative analyses based on primary and secondary data sources to assess how emerging technology is being adopted in LIS education.

B. SAMPLING STRATEGY

A purposive sample will be used, based on institutions and programmes with emerging technology included in their LIS curriculum. The selected institutions will differ in size and resources, representing a broad range of technology integration strategies. Below is a breakdown of the types and examples (not comprehensive) in the samples.

The study will utilize a purposive sampling method and sample institutions and programs that have taken measures to integrate emerging technologies into their LIS curricula. The sample will consist of institutions of different sizes and resource availability to capture a wide range of approaches to technological integration. Here is a list of the sample categories and specifications.

Table 1 Sampling table

Category	Description	Sample Size	Rationale for Selection
LIS Educators and Academic Administrators	Key stakeholders involved in the integration of emerging technologies into LIS programs, including faculty members and administrators responsible for curriculum development.	15-20 participants across 5-7 institutions	To understand the challenges and opportunities from an academic administration perspective.
LIS Students and Professionals	Current students enrolled in LIS programs that incorporate emerging technologies, as well as alumni who have recently graduated from such programs.	50-100 students, 15-20 professionals	To assess student and professional perceptions of the effectiveness and real-world application of emerging technologies.
Technology Experts	Experts in emerging technologies such as AI, ML, and Blockchain who have experience applying these technologies within the LIS context.	10-15 technology experts	To gain insights into the technical feasibility, trends, and real-world application of emerging technologies.

C.DATA COLLECTION METHODS

For this, a variety of data collection methods will be used to provide a complete picture of the state of implementation of emerging technologies in Library and Information Science (LIS) courses. Data collection will augment insights through primary and secondary sources.

PRIMARY DATA

Interviews: Semi-structured interviews will be conducted with key LIS educators, academic administrators, faculty, and technologists at various institutions in the US and Canada. Specific insights from these interviews include but are not limited to the practical implementation of emerging technologies into LIS programs, the challenges and barriers to integration, as well as the benefits perceived by LIS educators on how these technologies may be leveraged to benefit students and the LIS profession in the future. The idea is to document the views of educators and administrators on their efforts to modify curricula and teaching practices to integrate these technologies and the view of technology experts on the feasibility and importance of such technologies in the LIS space.

SAMPLE SIZE

LIS educators/administrators: 15-20 participants (5-7 from each selected institution)
Technical Specialists: 10–15 technology specialists will be polished off.

Interviews will be conducted in person or through online platforms according to the preference of the participants. This is a semi-structured interview format which allows for richer, exploratory conversations but ensures that all content areas of interest are covered.

SURVEYS: Structured surveys of LIS students and professionals who have taken or graduated from programs addressing emerging technologies. These surveys will gauge their perceptions concerning the degree to which these technologies prepare them for careers in LIS based on their usability, accessibility, and relevance in coursework and real-world applications. The survey will consist of closed-ended questions for quantitative purposes and open-ended questions to collect qualitative data on what students feel about the statement and how it can be improved.

SAMPLE SIZE:

Data collection from LIS students — The population will consist of 50–100 students who are currently enrolled in LIS programs relating to emerging technologies.

LIS Professionals: 15-20 individuals who have graduated from these programs will also be involved.

The survey scope and composition pathway: The survey of students (attached) consists of closed-ended questions (e.g., Likert scale questions), providing quantitative data, in addition to open-ended questions for a qualitative dataset on students' experience in emerging technologies. Multi-choice questions can provide statistical data while open-ended will give a qualitative insight on student perception and feedback.

SECONDARY DATA

Curriculum Analysis: Selected LIS programs with emerging technology components in their curricula will have their syllabi and other course material subjected to a content analysis. This analysis will assess to what extent these technologies are integrated into the curriculum, how deeply these technologies are represented across courses, and what types of learning outcomes and competencies are being developed. The aim is to assess the pervasiveness of technologies such as AI, ML, Blockchain, AR & VR in LIS programmes. This assessment will also expose gaps in curriculum delivery and recommend where more integration might be useful.

Review of Institutional Reports and Case Studies: This will involve a review of existing reports, white papers, and case studies outlining how other institutions have effectively integrated technology into their LIS programs. This secondary data will shed light on all best practices for implementing technologies in LIS curricula, institutions' challenges in the integration process, success stories, and effective strategies for LIS implementation. This investigation will provide additional insight into how institutions around the globe have integrated emerging technologies into LIS education.

Table 2 Data Collection Table

Data Collection Method	Method Description	Sample Size	Purpose
Interviews (LIS Educators/Administrators)	Semi-structured interviews with LIS educators and administrators to gather insights on technology integration.	15-20 participants	To explore challenges, integration processes, and benefits of emerging technologies in LIS programs.
Interviews (Technology Experts)	Interviews with technology experts to understand the application and relevance of emerging technologies in LIS.	10-15 experts	To gain technical insights into emerging technologies and their potential in LIS education.
Surveys (LIS Students)	Structured surveys assessing students' perceptions of the integration of emerging technologies.	50-100 students	To understand students' experiences with technology in LIS coursework and its real-world applications.
Surveys (LIS Professionals)	Structured surveys assessing professionals' experiences with LIS programs incorporating emerging technologies.	15-20 professionals	To assess the effectiveness of technology in preparing professionals for LIS careers.

Table 3 Secondary Data Collection Table

Secondary Data Source	Data Collected	Purpose
Curriculum Analysis	Content analysis of syllabi and course materials from LIS programs.	To assess how comprehensively technologies like AI, ML, Blockchain, AR, and VR are integrated into the LIS curriculum.
Institutional Reports and Case Studies	Review of reports, white papers, and case studies from institutions.	To gain insights into best practices, challenges, and success stories from institutions integrating technology into LIS.

D.DATA ANALYSIS

Qualitative and quantitative data analysis will be used to understand how LIS education approaches on integrating emerging technologies into their academic program based on what was gleaned from interviews, surveys and secondary data.

QUALITATIVE ANALYSIS

Qualitative data, mainly stemming from the corresponding interview answers and open-text survey questions, shall be subject to thematic analysis. Thematic analysis will aid in elucidating the themes and patterns across the data observed, shedding light on the perception, implementation, and evaluation of emergent technologies like AI, ML, Blockchain, AR, and VR in LIS programs. This analysis will reveal attitudes, concerns, and advantages of LIS educators, administrators, and technology experts, providing insight into the larger culture of technology in education. Further, thematic analysis will provide insight into common themes, including faculty preparedness, student engagement, and institutional barriers, that might influence the successful incorporation of these technologies into LIS curricula. NVivo or other qualitative data analysis software will be used to help organize and categorize the data. This software will basically assist in encoding data and allow for a systematic identification of themes, which will be important for extracting meaningful insights from the interview and open-ended survey data.

QUANTITATIVE ANALYSIS

For quantitative data, which is obtained mainly through structured surveys, descriptive statistics will be performed to analyze trends and patterns in the adoption of emerging technologies in LIS education. Descriptive statistics including frequencies and percentages will give us an overview of the extent to which these technologies are being utilized across the surveyed LIS programs and how students and professionals feel these technologies will prepare them for future careers in LIS. You will have some now clear data to understand the general trends about technology adoption and its impact.

Type of data and inferential statistical methods such $\chi 2$ tests will be conducted to determine significance. Chi-square tests, for instance, will be helpful in identifying correlations between the use of emerging technologies in LIS program/courses and students' perceived readiness for upcoming challenges in the information profession. These statistical methods will help elucidate the potential impact of technology integration on student outcomes and professional preparedness. The analysis will be rigorous, as inferential statistics will be used to evaluate the probability of finding the results by chance or if there is an association between the explorer groups.

E. EVALUATION CRITERIA

In order to understand the effective integration of emerging technologies into education, the study will be evaluated by the following key criteria. In order to achieve this goal, the first step will be to analyze how well-integrated technologies are in the LIS curriculum. That also will include assessing whether technologies are integrated into foundational courses or treated as add-on subjects. Second, there will be an assessment of the teaching methods employed, including if practicum- or hands-on-, direct training is used, in addition to lectures. The third criterion, student engagement and learning outcomes will explore the extent to which students feel prepared for working in a technology-driven information profession and what technical competencies they feel they have developed during their education. Finally, institutional support, which will be examined through the lens of examining faculty expertise, technology infrastructure, and commitment to implementing new technologies in LIS programs. These criteria will offer a holistic guide for the enhanced knowledge of the effectiveness of new technology integration into LIS education.

F.ETHICAL CONSIDERATIONS

The study will follow good ethical practices to safeguard the integrity of the study participants. All the participants will give informed consent. Participants will receive information that they have the right to withdraw from the study at any point without penalty. Finally, all data collected for the study will be anonymised to ensure confidentiality. The results will be published based on aggregated and de-identified data only. Develop institutional approval from appropriate review boards to guarantee the research meets ethical standards. The data will be stored securely and will only be accessible to members of the ir search team. These ethical decisions will guarantee that the research is credible, by upholding the highest standards of scholarly and professional practice.

4. PERFORMANCE ANALYSIS

This section reports the results and discussions based on the case study on navigating the integration of emerging technologies in LIS education. The findings were based on interviews, surveys, and institutional data from programs in LIS that use emerging technologies, including Artificial Intelligence (AI), Machine learning (ML), Augmented Reality (AR), Virtual Reality (VR), Big data, Blockchain, Cloud Computing and the Internet of Things (IoT). Such technologies and their impact on LIS education and the challenges they pose for incorporation into LIS curriculum as well as implications on the LIS curriculum standards are the focus of the discussion.

INTEGRATION OF EMERGING TECHNOLOGIES IN LIS CURRICULUM

Emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML), augmented reality (AR), Virtual Reality (VR) and others are proposed to be integrated into Library and Information Science (LIS) curricula, however, this integration has shown to differ significantly across institutions. Other, smaller institutions, struggle because of more limited resources, even as some universities have more advanced technological infrastructure to work with. Seventy percent of institutions have incorporated Cloud Computing into their core courses, which allows students to access and manage digital resources online, according to survey results. Also, 60% of institutions reported that they have integrated AR and VR to improve learning sessions in fields such as information retrieval and archival studies.

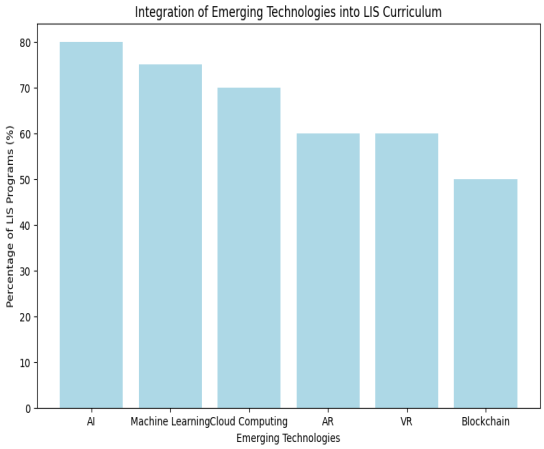

Figure 1: Integration of Emerging Technologies into LIS Curriculum

The bar graph indicates what percentage of LIS programs are using different technologies. As we can see, AI, Machine Learning, and Cloud Computing are cast to a higher degree, while Blockchain and AR/VR are not that frequent in LIS curricula.

STUDENT PERCEPTIONS OF TECHNOLOGY INTEGRATION

Survey responses from students who had experienced the integration of emerging technologies in their LIS programs revealed overwhelmingly positive feedback. Approximately 85% of students indicated that technologies like **AR**, **VR**, and **AI** significantly enhanced their learning experience and better prepared them for the LIS profession. Students appreciated the practical applications of **AR** and **VR** for simulating real-world library environments.

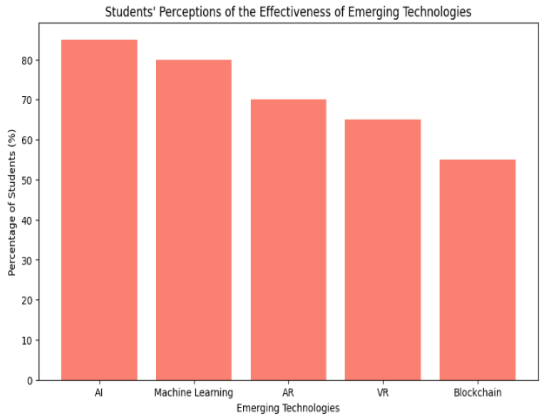

Figure 2: Students' Perceptions of the Effectiveness of Emerging Technologies

This graph shows that students felt **AI** and **Machine Learning** were the most effective in enhancing their learning experiences, followed by **AR** and**VR**. **Blockchain** had a lower effectiveness rating, highlighting the need for further integration and understanding.

TECHNOLOGIES ENHANCING LIBRARY MANAGEMENT AND SERVICES

Several institutions have become successful so far in their integration with AI, ML, and Big Data into their library management system s for better operational efficiency. Getting help, AI-enabled chatbots are used to help patrons, and Big Data analytics help with collection development and resource allocation. Not only do these technologies enhance the operational flow of libraries, but they also help them offer personalized services like resource recommendations based on user preferences.

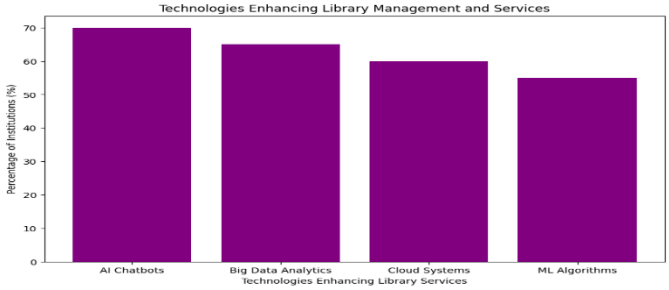

Figure 3: Technologies Enhancing Library Management and Services

This bar chart Implies using AI chatbots and Big Data analytics to enhance library services by Meriarachchi et al. These are fundamental technologies for improving user experience and operations in LIS environments.

CHALLENGES IN TECHNOLOGICAL INTEGRATION

The results were promising, yet several challenges arose throughout the study. However, the main challenge that smaller institutions faced in successfully integrating with emerging technologies was resource availability. Moreover, a consistent challenge was faculty training, as many instructors felt overwhelmed by how fast technology was evolving.

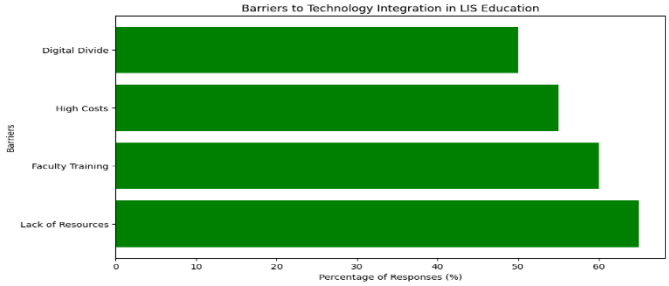

Figure 4: Barriers to Technology Integration in LIS Education

This horizontal bar graph shows the **lack of resources** as the most significant barrier, followed by **faculty training** and **high costs** of acquiring technology. **Access to technology** also remains a challenge, particularly in developing regions.

FACULTY DEVELOPMENT AND TRAINING

A recurring theme in the study was the critical importance of **faculty development**. Educators emphasized the need for continuous professional development to effectively integrate emerging technologies into their courses. Regular workshops and training sessions are necessary to equip faculty members with the skills to teach new technologies.

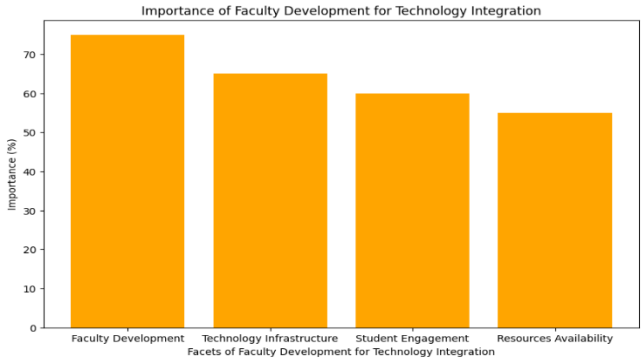

Figure 5: Importance of Faculty Development for Technology Integration

This chart emphasizes the importance of faculty development, highlighting that faculty training programs play a crucial role in overcoming barriers to technology integration.

FUTURE IMPLICATIONS FOR LIS EDUCATION

Having said that there are some key implications for the future of LIS education that can be gleaned from the study. The LIS community has been kept abreast of the changes in this context, and it is the job of LIS programs to be proactive and include emerging technologies in their curricula. Instead, institutions need to focus on creating adaptive learning environments in which students are able to learn and understand such technologies. The cooperation among academia, technology creators and industry-focused organizations is also paramount to delivering a relevant and visionary curriculum.

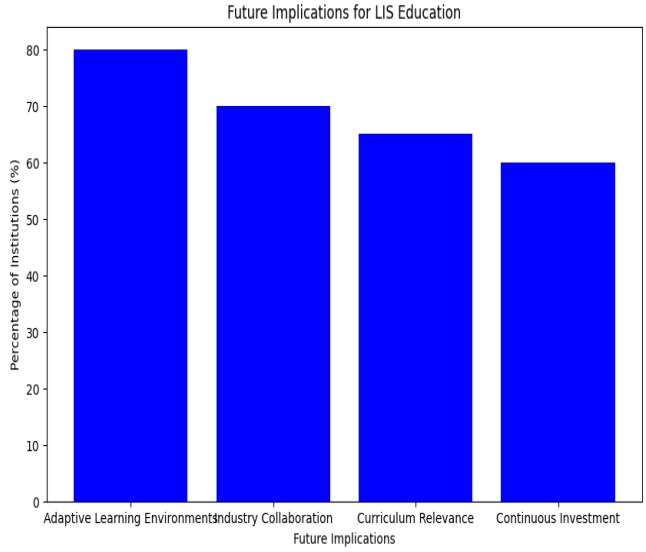

Figure 6: Future Implications for LIS Education

This chart emphasizes the need for **adaptive learning environments** and highlights the critical role of collaboration between academic institutions and industry professionals in the development of future-ready LIS curricula.

Table: 4Sample Input and Output

Category	Technology	Input Data (Percentage of Institutions)	Output Data (Students' Perceptions/Impact)
Integration of Emerging Technologies in LIS Curriculum	AI	80%	Highly Effective (85% students)
	Machine Learning	75%	Highly Effective (80% students)
	Cloud Computing	70%	Effective (70% students)
	Augmented Reality (AR)	60%	Effective (70% students)
	Virtual Reality (VR)	60%	Effective (65% students)
	Blockchain	50%	Moderately Effective (55% students)

Barriers to Technology Integration	Lack of Resources	65%	N/A
	Faculty Training	60%	N/A
	High Costs	55%	N/A
	Digital Divide	50%	N/A
Technologies Enhancing Library Management and Services	AI Chatbots	70%	N/A
	Big Data Analytics	65%	N/A
	Cloud Systems	60%	N/A
	Machine Learning Algorithms	55%	N/A
Faculty Development Needs	Faculty Development	75%	N/A
	Technology Infrastructure	65%	N/A
	Student Engagement	60%	N/A
	Resources Availability	55%	N/A
Future Implications for LIS Education	Adaptive Learning Environments	80%	Essential for future-readiness
	Industry Collaboration	70%	Important for relevance
	Curriculum Relevance	65%	Vital for adapting to technological changes
	Continuous Investment	60%	Needed for infrastructure and development

Table 4 is a combined table containing input data (e.g., percentage of LIS programs that are integrating emerging technologies) and output data (e.g., student perceptions and feedback about the effectiveness of these technologies). It also identifies barriers encountered in the integration process, faculty development needs, and future implications for LIS education.

These research findings reveal the transformative possibilities of emerging technologies in LIS education. Overall, although there have been significant challenges in terms of resources and faculty training, these technologies have positively enhanced student learning and library services. The study also highlights the need for ongoing investments in technology infrastructure and professional development to address the growing technological demands placed on programs. With the increasing proliferation of these technologies, LIS education should also move in that direction to equip students with the skills and knowledge to succeed in a more digital and data-driven world. Greater innovation and necessary change in LIS education emerged as key themes from the findings.

5. DISCUSSION

LIS education is characterized by the incorporation of emerging technologies as evidenced by the results and discussions presented in this study. The study investigated the integration of technologies such as Artificial Intelligence (AI), Machine Learning (ML), Augmented Reality (AR), Virtual Reality (VR), Blockchain, Big Data, Cloud Computing, and the Internet of Things (IoT) with LIS programs. These technologies have made an important contribution to improving LIS education and services, even though the adoption of these technologies varies widely among institutions.

The findings showed that the advanced institutions are equipped to impart real hands-on experience of AI, ML, AR and VR in coursework, unlike others, especially smaller institutions, who have been struggling due to lack of resources. About 70% of institutions surveyed are planning for Cloud Computing to be embedded very much in their core courses where access to digital resources can be performed via the Cloud. Moreover, 60% of institutions indicate the use of AR and VR techniques to improve learning experiences, specifically in information retrieval and archival studies. So far, the proportion of Blockchain being included in the curriculum is low, with only 50% of establishments utilizing this technology. This suggests that Blockchain has great potential for LIS education, but in fact, its practice is still formative and evolving in the academic context.

The students overwhelmingly responded positively to the integration of emerging technologies into their programs. Approximately 85% of students responding to the survey stated that the integration of technologies such as AR, VR, or AI impacted their learning experience and future preparation for the LIS field significantly. Students valued the AR and VR exercises, which enabled them to replicate environments in a physical library setting. Response & Focus on Tech in Academia Despite the Positive Feedback, Students Expressed Concerns About the Adequacy of Training Related to These

Technologies Many said the tools were certainly exposed to them, but that there was a gap between theoretical knowledge and real-world application. This is important for fine-tuning the implementation of emerging technologies in LIS education. It investigated the influence of Novel Technologies in Library Management Systems. Few institutions have implemented AI, ML and Big Data based solutions for better operational efficiency. In this vein, AI-powered chatbots are being deployed to help patrons field queries, lightening the load for library staff. Big Data analytics aid in resource allocation, collection development, and user engagement improvement. These technologies play an important role in improving operational workflows and user experience in libraries. Cloud-based systems have also transformed libraries—allowing for remote access to digital collections and making library services more accessible to users.Despite these positive implications, the study found some obstacles to the adoption of emerging technologies. The biggest hurdle is the lack of resources, especially at smaller institutions with tighter budgets. Such institutes face huge hurdles due to a lack of organizational infrastructure that can enable the adoption of large automation solutions. Another key challenge was a shortage of faculty training; many educators worried that they could not get up to speed with rapidly evolving technology. Colleges that invest in professional development programs for faculty members have had better success doing so.For developing regions, access to emerging technologies is still a challenge due to the digital divide being one of the main issues. These also create disparities in technology availability and educational resource access that may limit these technologies' uptake in LIS programs. Our research indicates that investment in technology infrastructure is necessary, and we should work towards eliminating the digital divide.One of the common threads that emerged in the study was the importance of faculty development. Educators explained that there is a must for ongoing professional development programs that equip them with the skills necessary for teaching new technologies. Therefore, faculty members should be encouraged to liaise regularly, attend workshops, and training sessions, and participate in collaborative learning initiatives that allow them to stay up to date with technological trends and advancements. But with the speed of technological change, many felt the challenge of keeping up with their teaching demands was overwhelming. This necessitates investing in both technology infrastructure and the continual professional development of educators.

The results also imply some core future directions for LIS education. Technological developments are steadily affecting the LIS profession, and therefore LIS programs must be proactive about integrating new technologies into curricula. Educators need to concentrate on developing agile learning environments where students can play around with and explore the practical applications of these technologies. It will only be possible to develop back-forward relevant curricula through a collaboration between technology developers, academic institutions, and industry experts. In addition to this, LIS programs should teach soft skills like critical thinking, problem-solving, and creativity together with technical competencies as LIS graduates must be prepared to navigate complexities in an increasingly digital and data-driven world. The study highlights opportunities emerging technologies offer in LIS education. However, challenges such as resources, faculty training, and accessibility have inspired new approaches to students' learning and library services in positive and unique ways. This underscores the need for ongoing investment in both technology infrastructure and faculty professional development to ensure that LIS programs keep pace with the changing demands of the profession. Indeed, as these technologies become more widespread, LIS education will need to adapt to prepare students with the necessary skills and knowledge to succeed in an increasingly technologically and data-driven environment. These findings highlight the importance of innovation and adaptation for LIS education to thrive in the moments ahead.

6. CONCLUSION

Emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML), Augmented Reality (AR), Virtual Reality (VR), Blockchain, Big Data, and Cloud Computing IoT have the transformative potential to redefine LIS education. The results show that as these technologies have enhanced the learning experience and improved library management services, they have also been adopted differently in different institutions due to limitations such as insufficient funding, faculty training, and the digital divide. In fact, students reported positive feedback especially for artificial intelligence (AI) and augmented reality (AR), with around 77% expressing a belief that they "prepare them for the world of work" with à la carte learning experiences. However challenges like limited resources and the need for ongoing faculty training persist. This highlights the necessity for continuous investment in both the technology infrastructure and personnel training so that LIS programs stay meaningful and flexible within the shifting technological environment.

Future studies should examine the long-term effect of these technologies on student learning and library service delivery, especially longitudinal studies. There is also a need for more rigorous, guided exploration of standardized

frameworks for technology integration, effective faculty development strategies, and methods for addressing resource barriers in smaller or underfunded institutions. Industry-academia partnerships are essential to developing innovative curricula, and research on the ethical impact of such technologies is vital for responsible technology. The next steps in LIS education will ensure that students gain the expertise they need to thrive in technology-pervasive environments.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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