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FUTURE-READY DIGITALIZED EDUCATION: UNRAVELING THE DYNAMICS OF SUSTAINABLE AND ETHICAL DIGITAL TRANSFORMATION

Vaishnavi Rode

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FUTURE-READY DIGITALIZED EDUCATION: UNRAVELING THE DYNAMICS
OF SUSTAINABLE AND ETHICAL DIGITAL TRANSFORMATION

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Information Systems and Technology

by
Vaishnavi Rode
August 2024

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ABSTRACT

Amid the brisk advancement of digital technologies, higher educational institutions and universities are finding themselves at a crucial turning point, with significant obstacles and new prospects in the realm of digital transformation. This culminating experience project delves deeply into the compounded terrain of digital transformation in higher education, emphasizing the need for sustainable practices in the face of rapidly evolving technical advancements. The research questions are: (Q1) What strategies can universities adopt to foster digital literacy among students and faculty while promoting sustainability values within their digital education programs and Why? (Q2) What ethical considerations, concerning data privacy and digital equity arise in utilizing online platforms and Why? The findings are that: (Q1) Platforms like RiPPLE and Intrepid promote sustainability in education by optimizing resource utilization and reducing environmental impact with a cost-effective nature. (Q2) Box ensures ethical data handling and promotes digital equity by providing secure storage, compliant data protection measures, and equitable access to educational resources. The conclusions are: (Q1) Adaptive learning platforms demonstrate effective strategies for universities to enhance digital literacy, cost effectiveness and sustainability through innovative educational practices. (Q2) Digitally secure storage platforms play a crucial role in safeguarding data privacy, promoting digital equity, and upholding ethical standards through secure storage solutions

and transparent data handling practices in educational contexts. The long-term effects of programs such as RiPPLE and Intrepid on transition and student learning experiences, digital literacy, and sustainability education could be further researched. Additionally, further detailed research can be performed on how data localization requirements like laws mandating data storage within a specific geographic region affect the security and accessibility of educational data.

Keywords – Digital Education, Data Ethics, Online Platforms, Learning Management Systems, Ethical Use of AI in Education, Digital Transformation Strategy in Education, Digital Transformation, Digital Integration, Digital Divide, Digital Threats, Digital Tools, Digital Literacy, Online Education, Massive Open Online Courses, Digital Curriculum, E-learning, Online Pedagogy Virtual Learning Environments.

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DEDICATION

In loving memory of my Father,

Endless support from my Mom, Brother & Grandmother

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CHAPTER ONE

INTRODUCTION

*The biggest part of our digital transformation is changing the way we think.
~ Simeon Preston (2020)*

The demand for implementing changes in colleges and universities has been constantly influenced by a mix of external factors that have reshaped the perception of higher education. The rapid evolution and incorporation of technologies are transforming the foundation of education prompting significant concerns about its sustainability and ethical implications that require attention (Gkrimpizi et al., 2023). COVID-19 has had a huge impact on accelerating digital integration in education and educators have been facing challenges in adapting to teaching techniques, access restrictions due to device requirements. Though digitalizing improves teaching methods and helps to attract students, there is a lack of will to incorporate the use of technology into the learning process (Nieto, 2023; Timotheou et al., 2022). Educators and policymakers are actively deliberating on destiny profession trajectories and hurdles within higher training amidst technological progress (Akour and Alenezi, 2022). These challenges encompass educators' need to comply to virtual pedagogy, accessibility constraints due to device necessities, and the catalyzing effect of activities like the COVID-19 pandemic on accelerating virtual integration in training (Englund et al., 2016; Battle, 1999; I. Horváth, 2016).

Sustainable digital transformation represents a dynamic process propelled by continuous technological advancements, necessitating extensive research collaboration (OpenAI, 2024). Universities must respond to technological shifts by formulating new conceptual frameworks and cultivating fresh insights (Ashmel et al., 2022; Hwang and Lin, 2023). Digital transformation is imperative for enhancing performance and expanding educational reach (Lampron, 2022). Technological advancements, including AI, promise advantages such as enhanced learning outcomes, operational efficiency, and global accessibility (Kamalov et al., 2023). Sustainable digital transformation necessitates ongoing research collaboration and the development of innovative conceptual frameworks (Hwang and Lin, 2023; Riedl, 2020).

Recent bibliometric analyses have explored the sustainability of digital transformation in higher education. Abad-Segura et al. (2020) and Ashmel et al. (2022) have examined trends in global research, proposed empirical models for Digital Transformation Strategy (DTS) in higher education, underscored the significance of cloud computing, advocated for enhanced sustainability awareness through education, and endorsed sustainable practices to maximize benefits and mitigate economic disparities.

Further research is warranted to devise tailored strategies for diverse educational settings, comprehend the enduring impacts of these strategies, and effectively evaluate the success of sustainable management practices (OpenAI, 2024). According to Abad-Segura et al., (2020), future research directions in this domain should encompass exploring the implications of Sustainable Development Goal 4 (SDG 4) on digital transformation in higher education across regions, countries, or continents; assessing corporate susceptibility to digital threats; examining the nexus between artificial intelligence and sustainable development; elucidating the role of higher education in the digital transformation landscape; scrutinizing cybersecurity in higher education; forecasting the future of higher education in the context of Industry 4.0.

Challenges of Digital Transformation in Education

The COVID-19 pandemic has compelled higher education establishments to live in a cycle of version and innovation, requiring them to enhance their aggressive ability of coaching and mastering methods within the pandemic era through distance schooling systems. Digital transformation remains a critical issue in the global educational sector (Al Kodri, 2022). Despite the most urgent requirement of digital transformation, developing countries like Tanzania faces immense challenges such as the limited reliability of power supply, slow internet connectivity, and poor technology infrastructure (Kelefa et al., 2022). Hence, such challenges prevent access to electronic sources and disrupt effective digital

technology application to better people's learning, teaching, and research practices (Kagoya, 2020).

Regardless of the urgent need for digital transformation in the industry that has been spearheaded by the recent COVID-9 pandemic, low-income economies face a myriad of significant challenges. The infrastructure deficit and lack of resources in most developing countries remain significant obstacles to the realization of distance learning for their students. According to Uleanya et al. (2021), students' difficulties in accessing online education were amplified by the outbreak of the epidemic, including inadequate access to online learning equipment and differentiated learning patterns in online and in-person delivery of education. Belousova et al. argued that low levels of information and communication technologies literacy among teachers and students and their families are another obstacle (Belousova et al., 2022). The lack of sufficient resources and investment gaps also obstruct the facilitation of inclusive education practices. Such fundamental barriers must be addressed and resolved to achieve a sustainable digital transformation in education (Ari et al., 2022).

Particularly in the big data era, ethical concerns around data privacy have become crucial issues in higher education research (Florea & Florea, 2020). Big data research has brought out new issues with privacy, secrecy, and anonymity because of the transition from traditional research methods (Miyares & Catalano,

2016). Big data may have educational benefits but concerns about protecting personal and institutional data highlight the need for strong authentication and security measures.

Historical Evolution of Digital Education

The journey of virtual transformation in schooling has been soaking up, having all started from rather unassuming origins to turn out to be a foundation for most academic tactics as we recognize them these days (Paige, 2023). In the Seventies and early Eighties, low-priced computers started out seeing use in colleges, which were eager to attempt out in exercise. While this epoch may have been marked by sustained enthusiasm, it was also tempered by the realization that the benefits of computer use in learning had yet to be proven (Howard & Mozejko, 2015).

Overall, the history of digital education began in the early 20th century in terms of possible usage. With automated teaching being explored, the idea of Computer-Assisted Instruction became more pronounced in the 1950s (Watters, 2021). Advocates and critics fought with visions of how computers could change education and its outcomes. The last decade of the previous century constituted the time when the shift to digital education through the internet progressed, and even the failed Dot Com bubble could not restrain that. The early 2000s turned into the years when pioneers such as Lynda Weinman and Sal Khan began to

create digital education platforms. The Massive Online Open Courses (MOOC) confronted scrutiny over final touch rates and content quality, prompting issues about fairness and accessibility (Watters, 2021).

According to Terada (2020), the shift in writing and evaluation practice from conventional whiteboards to virtual packages marks a considerable paradigm shift that aligns with a generational shift in academic practices. This shift, which is occasionally called going from "blackboard to dashboard," represents a thorough departure from traditional pedagogy in instructional theory and methods. Despite the potential blessings of generation integration, annoying situations in conjunction with inadequate training and expert development remain limitations to powerful implementation. The significance of knowledge and choosing suitable technology strategies, advocating for a move in the direction of more transformative uses of generation in training has also been emphasized as important for fostering innovation, enhancing scholar engagement, and preparing rookies for the needs of the virtual age. Learning Management Systems (LMS) and various learning apps have risen and are now allowing humans to interact hassle free and assist with research on new visions giving birth to new technological advances (Evanick, 2023).

In a recent publication by Meltzer (2024) he has stated that it is time to 'address digital divides in access, use, and design to unlock more opportunities

presented by technology in learning'. Despite the widespread availability of digital tools, passive use of technology abounds computers are meant to be used for students' learning but are not. We must get serious about balancing efforts to protect student's information privacy and foster responsible use and protection by educators and students with efforts to promote digital literacy.

Research Background

For this culminating experience project, ChatGPT 3.5 (Generative Artificial Intelligence) has been used to refine the parameters and objectives of the investigation as there is a lack of literature available. Specifically, the inquiry was directed towards: (a) identifying additional research avenues pertaining to sustainable digitalized education, (b) ethical considerations including privacy. Further areas of study suggested were the strategies for implementation of sustainable digital education and ethical considerations with digital learning (OpenAI, 2024).

Problem Statement

In the midst of this fast-paced digital transformation of higher education across various domains such as learning, credentialing, and research, significant barriers hinder the achievement of sustainable positive impacts, particularly in terms of ethically integrating digital technologies during disruptive events like student protests and university shutdowns. The study by Czerniewicz et al., (2019) illuminates this challenge, revealing a complex intersection of political pressures, ethical considerations, and technological mediation that necessitates further scholarly scrutiny to ensure that digital learning practices align with ethical principles and effectively contribute to the educational mission of institutions (Czerniewicz et al., 2019).

Given the areas of future research suggested by previous researchers and ChatGPT 3.5, the outstanding research questions are:

1. *What strategies should universities adopt to foster digital literacy while promoting sustainability values within their digital education programs and Why?* (Ashmel et al. (2022), Ramísio et al. (2019), and Findler et al. (2018)) & (OpenAI, 2024)
2. *What ethical considerations concerning data privacy and digital equity arise in utilizing online platforms and Why?* (Memarian & Doleck (2023), Akgun & Greenhow (2021), Didmanidze et al. (2020), and Mandinach & Jimerson (2021)) & (OpenAI, 2024)

Organization Of Study

The structure of this project is outlined as follows: Chapter 1 presents an introduction to the research problems. Chapter 2 covers the literature review. Chapter 3 covers the methods that will be used to answer the research questions. Chapter 4 covers case selection, analysis and presents the research findings. Finally, Chapter 5 presents the discussion, conclusion and identifies potential areas for future study.

CHAPTER TWO

LITERATURE REVIEW

The emergence of the term "digitalization" coincided with the rapid advancement of information and communication technologies. Klaus Schwab, speaking at Davos, categorizes the initial digital revolution spanning 1960 to 1980 as "industrial," attributing its catalyst to the evolution of semiconductor computers in the 1960s and 1970s, followed by personal computers in the 1980s and the Internet in the 1990s (Yakovenko et al., 2019). Notably, renowned researcher Gilly Salmon has provided an overview of historical experiences regarding Higher Education methodologies; given suggestions on the future of educational delivery. Moreover, the concept of Education 4.0 is explored by Gilly Salmon, has impacted discussions in numerous platforms such as blogs and social media, as well as governmental organizations among others (Feldman, 2018; Hao, 2019; JISC, 2018). There is a lack of a clear roadmap for institutions on how to develop spaces, services and curricula for future graduates under the umbrella of Education 4.0 despite the increasing attention being given to it. Clearly there isn't any standard model on education planning for Education 4.0 that is available. Countries and institutions are so different from each other that even this area does not have uniform progress dictated by their social, economic or political contexts (Bonfield et al., 2020). Moreover, external disruptors like global

pandemics and emerging technologies make the planning process more complicated (Salmon, 2019).

Q 1. *What strategies can universities adopt to foster digital literacy while promoting sustainability values within their digital education programs and why? (Ashmel et al. (2022), Ramísio et al. (2019), and Findler et al. (2018)) & (OpenAI, 2024)*

Ashmel et al. (2022) used qualitative grounded theory to give an explanation for how digital transformation can sustainably affect universities. Researchers came to the conclusion that digitally improving the makeover of universities in a sustainable manner materially influences the competitiveness in shifting towards virtual teaching and learning. This survey is backed up by previous studies including Abad-Segura's bibliometric analysis, which emphasized that specific strategies are crucial to ensure sustainability within organizations. Their study called for universities to analyze how they are able to sustainably leverage virtual technologies to promote student studying inside the academic sector (Abad-Segura et al., 2020).

Ramísio et al. (2019) shed more light on the integration of sustainability into higher schooling, utilizing the University of Minho (UMinho) as a case study.

In an attempt to embed sustainability values throughout all factors of the group, they take a look at employed blended strategies along with both bottom-up and top-down processes. Bottom-up means projects originating from grassroots stages or person stakeholders within a business enterprise and top-down means strategies driven by way of institutional management or relevant management, highlighting their relevance in integrating sustainable techniques like fostering digital literacy in better schooling's virtual transformation projects. Such insights can be transferred to the better training sphere when it comes to virtual transformation in which establishments may additionally broaden sustainable techniques like fostering virtual literacy. This has sparked the importance of integrating strategies for sustainability into digital transformation initiatives inside better education.

While many higher education institutions (HEIs) have initiated the integration of sustainable development (SD) principles into their frameworks, a multitude of sustainability assessment tools (SATs) have emerged to aid HEIs in systematically measuring, auditing, benchmarking, and communicating their SD endeavors (Findler et al., 2018). However, most existing SATs are more focused on appraising internal operations at the expense of wider HEIs' impacts beyond organizational boundaries. Hence, research calls for the revision and establishment of alternative SATs intended to enable HEIs to exhibit their potential towards sustainable development. This means that various educational

establishments need to come up with strategies that would be consistent with overall sustainability goals as well as enabling them to effectively measure their contribution towards Sustainable Development Goals (SDGs).

Q 2. What ethical considerations, concerning data privacy and digital equity arise in utilizing online platforms and Why? (Memarian & Doleck (2023), Akgun & Greenhow (2021), Didmanidze et al. (2020), and Mandinach & Jimerson (2021)) & (OpenAI, 2024)

According to Memarian & Doleck (2023) the deployment of AI-pushed surveillance systems in instructional settings has sparked debates about privacy infringement and the need for ethical oversight. They understand that as AI becomes extra incorporated into academic methods, concerns surrounding the privacy and protection of pupil records emerge. The writers highlight the importance of ensuring equitable access to AI technologies and resources throughout all demographics to prevent widening academic disparities. This entails addressing issues such as digital literacy, access to technology infrastructure, and ensuring that AI applications in education do not inadvertently reinforce existing inequalities. The need for thoughtful consideration of ethical implications to safeguard student privacy and promote digital equity in the deployment of AI in education has been emphasized. The deployment of AI-driven surveillance systems in academic settings has sparked debates about

privacy infringement and the need for ethical oversight. Akgun & Greenhow (2021) call for research to delve deeper into these ethical challenges and advocate for reflective teaching practices to foster awareness of ethical implications among educators and students alike. This emphasis on ethical awareness is crucial for ensuring responsible and equitable integration of AI in higher education.

Didmanidze et al.'s (2020) study aimed at specifying educational administrators leading towards ethical transformations in online digital information security instead of traditional management aspects used in technology networks did so. In its methodology, this study focused on social and educational topics advocating for improved safety assessment techniques then discussed organizational issues of business education. The findings emphasized the necessity for ethical assessments in online learning environments and recommended additional research on the influence of internet activities on teaching methodologies and privacy concerns. The results highlighted the need for ethical evaluations in online learning contexts and suggested further study into understanding how activities done through the Internet affect teaching practices and privacy. They emphasized addressing emerging moral dilemmas in web-based learning as well as digital information security.

Mandinach & Jimerson (2021) used scenario-based analysis and an extensive literature search to explore the complex interplay between data literacy and ethics in education. The research showed that there is a lot more to data than just privacy issues, calling for a focus on the well-being of students and equity among others. This research also highlights ongoing initiatives towards ethical data use in education with action points such as increasing awareness and confronting biases during interpretation being provided for proper implementation. Aspects of ethics center on matters like data security, digital divide or fairness when dealing with educational information.

CHAPTER THREE

RESEARCH METHODS

Case Study Research Design

This project employs a case study research design to explore the reception of adaptive learning technology for sustainable digital education and ethical issues in data privacy and digital equity. The study is based on the main propositions: that adaptive learning technologies can provide personalized, cost-effective, and scalable digital learning experiences while promoting sustainability, and that online platforms can address data privacy and digital equity concerns. The subject matter of research is universities which have taken these technologies into operation. These results will be tied to the hypotheses by looking at educational outcomes, cost-effectiveness, scalability, data privacy, digital equity and authenticated access. The benchmarks for interpreting findings comprise both positive and negative evidence, with rival explanations considered to ensure robust conclusions.

1. What strategies should universities adopt to foster digital literacy while promoting sustainability values within their digital education programs and Why?

Propositions

Proposition 1: Personalized learning experiences enhance educational outcomes through Adaptive Learning Systems in large heterogeneous student groups.

Proposition 2: Sustainability should be integrated as part of Digital Education Platforms without compromising its quality standards.

The Unit(s) of Analysis

Individual Universities: Here adaptive learning technologies and secure online platforms used by each institution will be examined with respect to personalized learning, cost-effectiveness, scalability, data privacy, and digital equity.

Logic Linking the Data to the Propositions

Proposition 1 - Personalized learning experiences enhance educational outcomes through Adaptive Learning Systems in large heterogeneous student groups.

Data - Student and instructor feedback on personalized learning experiences.

Proposition 2 - Sustainability should be integrated as part of Digital Education Platforms without compromising its quality standards.

Data - Environmental impact analysis comparing digital versus traditional educational practices.

Criteria to Interpret Findings

Educational Outcomes

Positive: Enhanced student engagement and performance.

Negative: No significant improvements either or which may have been caused by other factors.

Cost-Effectiveness

Positive: Substantial cost savings.

Negative: Few or unrelated cost savings.

Scalability

Positive: Successful growth at scale that does not compromise quality.

Negative: Limited scaling or deteriorating quality of education.

2.What ethical considerations concerning data privacy and digital equity arise in utilizing online platforms and Why?

Propositions

Proposition 3: Equitable access to digital resources fosters inclusivity and reduces digital divides among students and faculty.

Proposition 4: Trust and ethical use of digital educational platforms are promoted by transparency in data-handling practices.

The Unit(s) of Analysis

Programs or Departments within Universities: There will also be a specific case study of academic disciplines that have embraced these programs in order to highlight how they differ according to their administrative structures and other academically related affairs.

Logic Linking the Data to the Propositions

Proposition 3 - Equitable access to digital resources fosters inclusivity and reduces digital divides among students and faculty.

Data - Surveys/interviews assessing perceptions of digital resource

Proposition 4 - Trust and ethical use of digital educational platforms are promoted by transparency in data-handling practices.

Data - Incident reports on data breaches or misuse.

Criteria to Interpret Findings

Data Privacy

Positive: Strong data security and favorable user experiences.

Negative: Data breaches and bad reports from users.

Digital Equity

Positive: Equitable access and effective accessibility features.

Negative: Significant disparities in access.

Authenticated Access

Positive: Secure access for authorized users.

Negative: Frequent unauthorized access or cumbersome processes.

Table 1: Case Study Analysis Criteria (Yin 2017)

1	Questions	1.What strategies should universities adopt to foster digital literacy while promoting sustainability values within their digital education programs and Why?	2.What ethical considerations concerning data privacy and digital equity arise in utilizing online platforms and Why?
2	Research Propositions or Justification (for using an exploratory Study)	<p>Proposition 1: Personalized learning experiences enhance educational outcomes through Adaptive Learning Systems in large heterogeneous student groups.</p> <p>Proposition 2: Sustainability should be integrated as part of Digital Education Platforms without compromising its quality standards.</p>	<p>Proposition 3: Equitable access to digital resources fosters inclusivity and reduces digital divides among students and faculty.</p> <p>Proposition 4: Trust and ethical use of digital educational platforms are promoted by transparency in data-handling practices.</p>
3	Unit(s) of Analysis	Individual universities implementing adaptive learning technologies and secure online platforms.	Specific programs or departments used within universities.
4	Logic Linking the Data to the Research Question	<p>Data - Student and instructor feedback on personalized learning experiences.</p> <p>Data - Environmental impact analysis comparing</p>	<p>Data - Surveys/interviews assessing perceptions of digital resource</p> <p>Data - Incident reports on data breaches or misuse.</p>

		digital versus traditional educational practices.	
5	Criteria for Interpreting the Findings	<p>Educational Outcomes</p> <p>Positive: Improved student engagement and performance.</p> <p>Negative: No significant improvements or improvements due to other factors.</p> <p>Cost-Effectiveness</p> <p>Positive: Significant cost savings.</p> <p>Negative: Minimal or unrelated cost savings.</p> <p>Scalability</p> <p>Positive: Successful expansion without compromising quality.</p> <p>Negative: Limited scalability or reduced quality.</p>	<p>Data Privacy</p> <p>Positive: Robust data protection and positive user feedback.</p> <p>Negative: Data breaches or negative feedback.</p> <p>Digital Equity</p> <p>Positive: Equitable access and effective accessibility features.</p> <p>Negative: Significant disparities in access.</p> <p>Authenticated Access</p> <p>Positive: Secure access for authorized users.</p> <p>Negative: Frequent unauthorized access or cumbersome processes.</p>

Selection Of Case Study

In this culminating experience project three case studies will be carried out as a combination of “What” and “Why” questions have been posed that will be

exploratory and explanatory. This approach enables us to investigate different dimensions of the case so as to establish trends, connections, and newer insights that can guide future research or practice (Hollweck, 2016). An explanatory case study tries to explain complicated causal links which may be too complex for surveys or experiments (Yin, 2014; Chong et al., 2014).

The first search on “Digital education in an ethical and sustainable way” yielded many examples of online education, e-learning, sustainable education but there was no comprehensive literature about recent methods adopted in education specifically post Covid-19. Consequently, the selection for the two case studies used inclusion and exclusion criteria mentioned in Table 2 to ensure they were relevant cases chosen and provide enough information to answer all three research questions presented in this project.

Table 2: Inclusion Exclusion Table for Digital Education

Criteria	Inclusion	Exclusion
Relevance to Digital Education	Case studies directly address issues, strategies, and solutions in digital education.	Case studies unrelated to digital education or online learning.
Data	The case study must contain empirical data in the form of pre and post assessment information	Non-scholarly literature
Relevance	Case studies relevant to answering the question	Off topic case studies

Variety of Settings	Inclusion of case studies from diverse educational setting of higher education	Case studies limited to specific educational contexts such as K2
Timeliness	Preference for case studies published within a recent timeframe to reflect current trends.	Outdated case studies lacking relevance to current practices.

The process of establishing the inclusion and exclusion criteria for this study was based on the principles of Systematic Literature Review (SLR) as expressed by Mengist et al. (2019). According to their research, a systematic literature review comprises systematically identifying, selecting, and critically appraising research that addresses specific research questions. By using precise selection criteria, it made sure that only those studies were chosen that directly answered the questions while at the same time minimizing as much as possible the biases and other related factors that could influence it even more than expected.

Figure 1: Inclusion Exclusion Criteria (Mengist et al., 2019)

SLR study selection of literature using inclusion and exclusion criteria.

Criteria	Decision
When the predefined keywords exist as a whole or at least in title, keywords or abstract section of the paper.	Inclusion
The paper published in a scientific peer-reviewed journal	Inclusion
The paper should be written in the English language	Inclusion
Studies that present pieces of evidence on synergic/tradeoff studies	Inclusion
When the articles address at least one MES indicator	Inclusion
Papers that are duplicated within the search documents	Exclusion
Papers that are not accessible, review papers and meta-data	Exclusion
Papers that are not primary/original research	Exclusion
Papers that got published before 1992	Exclusion

Due to a scarcity of comprehensive data sets directly addressing the research questions, the focus of this study shifted towards case studies. The research project thus will make use of case studies that are publicly available via the Google Scholar and OneSearch engines. The research project aims to analyze the efficacy of how sustainable education can be by also keeping ethics in mind and this will be done with the help of case studies available through Google Scholar and OneSearch. Researchers from various fields, including prominent scholars such as Robert K. Yin, Sharan B. Merriam, John W. Creswell, and Robert E. Stake, have advocated for case studies in educational research. For instance, in a review of literature by Sarker et al., 2019, it is shown that educational technology needs to take into account ethical and equity issues as

far as the privacy concerns and digital divide is concerned. According to this review, technology can be leveraged in modern education, but sustainability and ethics are crucial during its integration. Similarly, Selwyn wrote a book called “Distrusting Educational Technology: Critical Questions for Changing Times” with a similar point of view emphasizing the need to navigate the challenges of using technology for education so that it integrates ethically, fairly and sustainably.

The case studies aimed to be selected for this project were searched from academic engines including Google Scholar Microsoft Academic and Scopus and Google Search. The search's academic teaching libraries of MIT Sloan and the Harvard Business Review store were accessed. The final choices were based on various criteria which were closely tied to Digital Learning subjects and aimed at answering these questions. In this study, English language use was considered (English), emphasizing openness (Open Access), and limiting time frame (2010-2024). Subsequently, specific keyword searches relevant to the research objectives were conducted on both platforms such as “Ethical Higher Education”, “Sustainable Digital Learning”, “Online Education Strategies” etc. The choice of keywords was determined by their alignment with the research questions and their ability to yield results supportive of the proposed inquiries.

Table 3: Selection of Case Studies

Database Searched	Search Words	Number of Relevant Cases found	Number of Cases Selected	Authors
Google Search Engine/ Google Scholar	Sustainable digital transformation in education	9	2	(Khosravi et al.) (Pallen, 2019)
Google Search Engine/ Google Scholar	Ethical Online Education, Fair Use of Educational Technology	4	1	(ITCS Berkeley, 2016)

To answer specific research questions, three independent digital education case studies are examined. The RiPPLE platform at the University of Queensland is the subject of the first case study, which applies explainable AI and learner sourcing methods to personalize learning in response to large-scale classroom challenges. In relation to educational settings, this case study shows how RiPPLE facilitates digital literacy and conserves the environment. Also, another case study showcasing another sustainable digital education solution – integration of the Intrepid platform into “Innovating in the Digital World” program run by London Business School. On its part, this second case study looks at UC Berkeley’s use of Box for document storage within Phoebe A. Hearst Museum and how it helps streamline data access with increased security measures being put in place. This explanatory case study provides a detailed examination into

aspects such as functionalities of this platform and various ethical concerns tied to it including privacy around data and fairness in terms of access to technology within educational contexts. Taken together, these examples give an idea about how innovative solutions can help improve practices related to digital education.

CHAPTER FOUR

CASE STUDY ANALYSIS AND FINDINGS

To answer the research questions proposed in this project, three case studies related to sustainable and ethical digital education have been chosen. The selected case studies included all five items listed in the inclusion criteria in Table 2. In addition to the inclusion criteria, the scope of the case studies targeted different universities that have conducted these case studies. Considering this, the following section will be an executive summary of each case study and how the case study addresses the two proposed research questions in Chapter 1.

Case 1: a) RiPPLE at the University of Queensland

The first case study is by Dr. Hassan Khosravi from the University of Queensland (UQ). UQ has long been renowned for providing knowledge for a better world in the education realm. Dr. Hassan Khosravi and his team came together and addressed the challenges faced by multiple students from diverse backgrounds and then came up with the development of an affordable, easy to learn and sustainable personalized learning tool named RiPPLE (Recommendation in Personalized Peer Learning Environments).

This creative idea emerged to address the shortcomings of customary teaching methods that have been followed for a long time, especially in large classrooms. Dr. Khosravi who is a well-known senior lecturer and researcher at UQ's Institute for Teaching and Learning Innovation, saw adaptive and sustainable learning as a complementary tool that will greatly impact students in learning at their own pace by smoothening student learning experience and decrease the load of pressure on teachers.

Problem

As the class sizes were larger the issues of individual attention and personalized learning for each student became a question, with limited opportunities for instructors to identify knowledge gaps and offer individualized support. Access to adaptive learning platforms, crucial for personalized learning, was restricted due to high development costs and scalability issues.

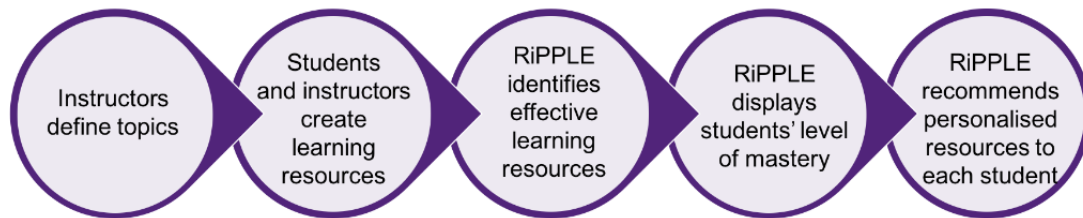
Solution

These challenges were confronted by Dr. Khosravi and his team as they developed the RiPPLE platform, where techniques like explainable AI algorithms and learner sourcing to facilitate this development were used. In addition, RiPPLE allows students to develop learning resources that are moderated at any level while suggesting customized activities on the basis of their masteries. The platform overcomes the barrier of content creation by harnessing the collective

intelligence of students, thus providing cost-effective, sustainable and personalized learning experiences at scale. By optimizing the use of digital resources and minimizing waste, RiPPLE reduces the environmental footprint associated with traditional educational methods, such as printed materials and physical infrastructure.

Figure 2: The Working of RiPPLE (The RiPPLE Project, n.d.)

How Does it Work?



The objective of the school was to develop an adaptable and scalable e-learning setting that offers high quality education while promoting sustainability. The adoption of modern electronic platforms allowed UQ to reduce its carbon emissions and widen its global coverage so as to ensure executive education remains meaningful amidst constant technological innovation. RiPPLE is a tool that has been provided with the easy usability of integration (via Learning Tools Interoperability LTI) to most standard LMSs which gives researchers and teachers a chance to explore the value of crowd sourcing and adaptive learning

in real-life teaching situations without the utmost need to create new learning activities continuously and develop elaborated schemes on how they are related. This emphasizes RiPPLE's sustainability because it can be used more widely without much additional effort, which could lead to lower use of resources and long-term viability in education (Khosravi et al.).

Case 1: b) Intrepid at London Business School

Another analysis of London Business School (LBS) made by Pallen (2019) is about making the school sustainable in its quest to become an online institution and at the same time keeping up with its great reputation for academic excellence. The study points out that LBS has collaborated with Intrepid to design a web-based training course titled "Innovating the Digital World" that was intended to provide flexibility, scalability, and quality learning experiences. Sustainability is one of the key features of this program; The reduction of physical resources and development of digital literacy among participants through an educational structure that minimizes environmental impact by cutting down on physical resource usage while maintain high levels of academic integrity and ensuring that long-term viability is maintained through digital literacy, innovative learning solutions aligning with LBS's commitment to environmental stewardship and educational leadership.

Problem

Although online learning could make education more accessible and flexible, the university had concerns about how to maintain its reputation for great experiences with students not physically present on campus. Furthermore, digital learning had to be made symbiotic with environmentalist values while integrating sustainability into its curriculum. They were on how best they could deliver online high standard interactive learning, increasing digital literacy among students as well as faculty and embedding sustainability within an educational framework.

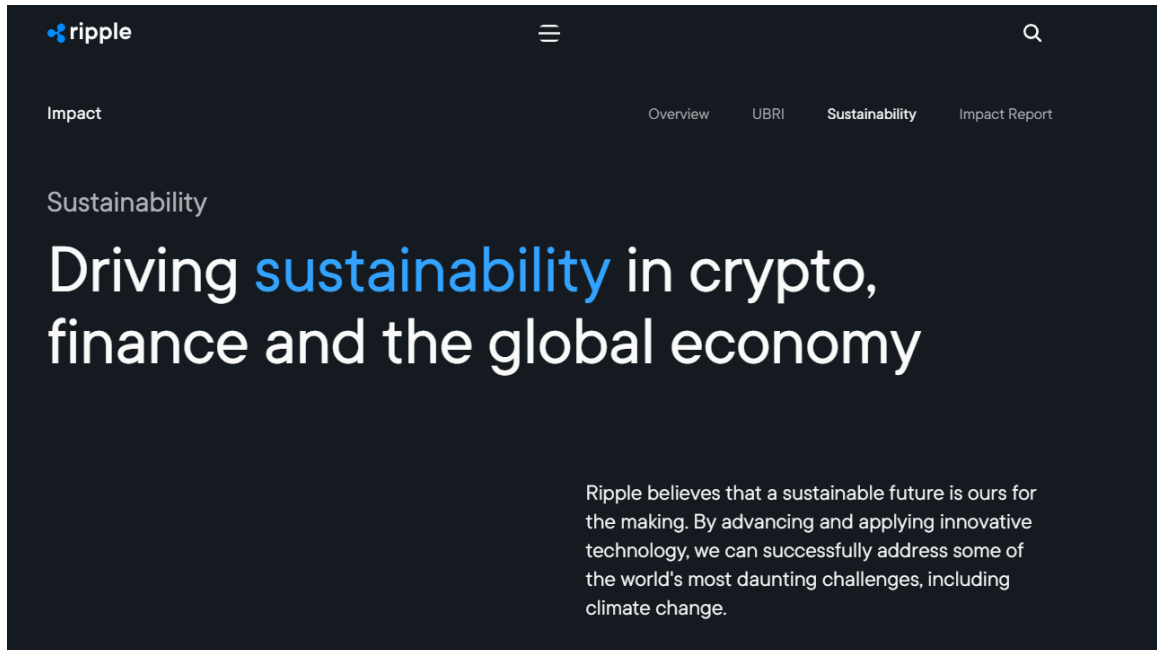
Solution

Thus, to tackle these challenges, LBS partnered with Intrepid for the development of “Innovating in the Digital World program”. In this initiative, an Intrepid platform which is a sustainable and user-friendly digital learning environment was used. It comprised short-form content, business cases, expert videos and moderated discussion forums among other things that were incorporated to guarantee engaging and interactive learning experience. Collaboration features like “Innovation Jams” helped participants to share insights as well as network effectively. Henceforth, by providing digital certification and having sustainability leadership in its subsequent programs, LBS promoted digital literacy and sustainability values. The scalability aspect of the platform facilitated reduction of LBS’ physical resource usage thus aligning it towards sustainable education besides maintaining high standards of excellence.

Q1. What strategies can universities adopt to foster digital literacy among students and faculty while promoting sustainability values within their digital education programs and Why?

For instance, Intrepid and RiPPLE are some of the platforms which give universities multiple directions for enhancing digital skills and sustainability in online education. Consequently, RiPPLE becomes an outstanding example by actively involving students towards authoring learning materials as well as using AI algorithms to customized personalized educational encounters. This way, it not only increases digital literacy skills but also leads to optimized resource utilization hence reducing the environmental footprint associated with traditional teaching practices. In doing so this sustainable approach creates a culture of continuous improvement in academic practice through peer collaboration and knowledge sharing. Likewise, RiPPLE's cost-effective learner sourcing model highlights its commitment towards achieving sustainable education by lowering costs while maximizing their impact on education. Similarly, Intrepid is one of such platforms that facilitate interactive scalable learning environments that will prepare students and teachers for a digitally fluent future thus further supporting sustainability through reduced reliance on physical resources and increased educational productivity. Conclusively, fitting these innovative technologies into educational frameworks would improve both digital literacy and environmental stewardship in schools.

Figure 3: A Snippet For Ripple Promising Sustainability Worldwide (Impact Through Sustainability And Financial Inclusion | (Ripple, n.d.)



Case 2: bConnected by UC Berkeley

This case study is by UC Berkeley's IT Client Services (ITCS) team on their initiative of bConnected. In navigating the digital landscape, the Phoebe A. Hearst Museum of Anthropology at UC Berkeley campus confronts ethical considerations concerning data privacy and security. As the museum digitizes its extensive archive of historical documents, safeguarding sensitive information becomes paramount. The adoption of online platforms like Box for document storage necessitates stringent measures to ensure the confidentiality and integrity of stored materials. Ethical responsibilities extend to preserving the privacy of individuals represented in these documents, respecting their cultural heritage and historical narratives. By implementing robust access controls and encryption protocols, the museum upholds ethical principles of data protection, safeguarding against unauthorized access and potential breaches. Additionally, transparent policies and practices surrounding data handling foster trust among stakeholders, reinforcing the museum's commitment to ethical conduct in the digital realm.

Problem

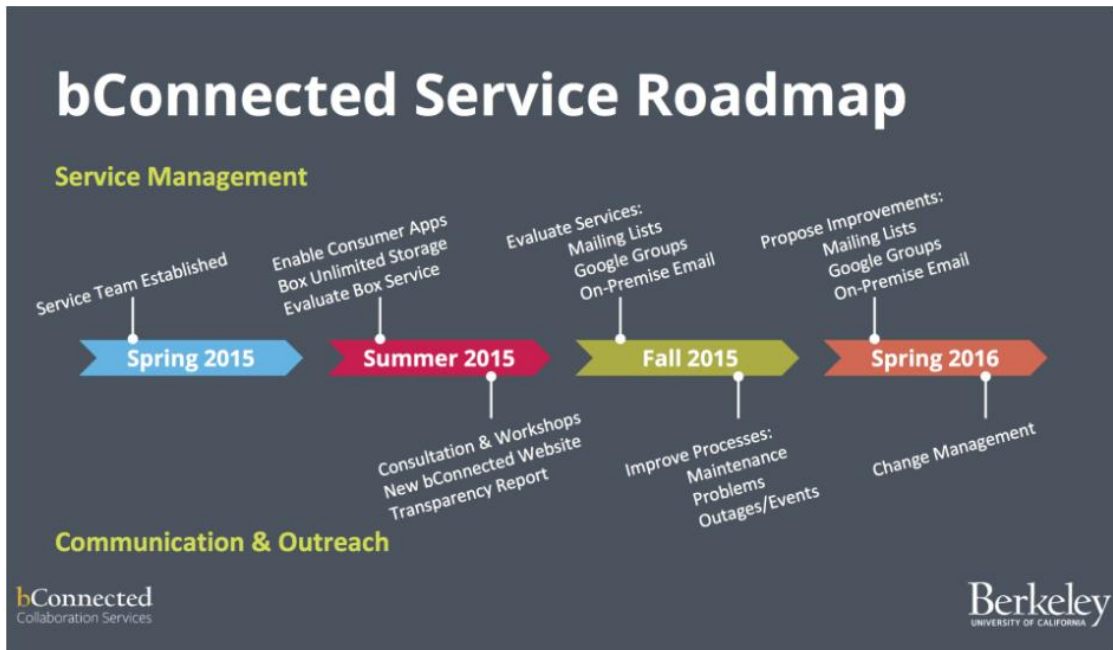
The Phoebe A. Hearst Museum of Anthropology encounters a critical challenge in effectively managing its vast repository of historical documents, comprising multi-page PDFs and Word files. With only a fraction of its archive

digitized, totaling 3,000 documents and 100,000 scanned pages, the museum faces the imperative need for a comprehensive solution to streamline storage, previewing, archiving, and sharing processes. Particularly crucial is the requirement for enhanced accessibility and seamless sharing, especially for external requests.

Solution

In response to these pressing challenges, the museum has embraced Box as its primary document storage platform. Through Box, the university gains streamlined access to documents, facilitating efficient search and preview functionalities, thereby optimizing time and resources. The migration of digitized documents to shared folders within Box enhances collaboration and communication, enabling staff to monitor views and downloads, thereby streamlining transactional processes. Box's provision for private folders ensures the secure storage and access of confidential documents, safeguarding sensitive information and maintaining ethical standards of data privacy.

Figure 4: Roadmap of bConnected (Berkeley, 2016)



Q2. What ethical considerations, concerning data privacy and digital equity arise in utilizing online platforms and Why?

The digital storage transition on Box corresponds with current educational practices that adopt technology to make the administrative process easier and raise its level of assistive measures, as well as privacy. The museum uses digital platforms to expand its knowledge base by streamlining historical document arrangement and ensuring all staff have equal chances for access.

Ethical Considerations

When it comes to storing sensitive information through such online platforms as Box, ethical issues become critical, especially in terms of data privacy and digital divide. To this end, authorized personnel only can log into

documents due to the strict access controls that prevent unauthorized disclosure of information. Furthermore, security measures like CalNet protection are put in place to safeguard stored data's integrity thereby making it compliant to ethical standards and regulation requirements. Furthermore, by using digital platforms there is no discrimination against any stakeholder because they can be accessed by everyone hence promoting inclusiveness and equal opportunities for all stakeholders.

Findings

1. Effective Strategies for Digital Literacy and Sustainability:

RiPPLE and Intrepid show that using adaptive learning technologies and co-creation of digital materials can lead to improved digital literacy among students and faculty. These are the adaptive learning technologies (namely RiPPLE and Intrepid) used to enable collaborative digital resource creation or personalizing learning experiences as well as to foster sustainability through optimizing resource use and reduced environmental impact. It is cost-effective in optimizing resource utilization over traditional teaching methods thereby reducing the environmental footprint.

2. Ethical Considerations in Data Privacy and Digital Equity:

In handling educational data, Box addresses ethical issues that concern data privacy and digital equality while fostering equal access to learning materials. Intrepid ensures compliance with data protection laws and practices

strong security measures to protect sensitive information. By integrating with Box, Intrepid promotes equal opportunity to education through central storage and instant retrieval of academic resources. For digital trust between educators and learners to be established, Box emphasizes clear data handling practices that promote transparency. Together, Intrepid and Box make developing a secure, accessible and ethically sound online learning environment possible. The bConnected initiative achieves data privacy and digital equity by using strict access controls together with encryption protocols promoting inclusivity via removal of physical barriers to accessing documents.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

We will discuss findings from Chapter 4 in Chapter 5; and how it answered the questions and will aim to provide potential areas of further study for each of the questions that will be proposed.

Discussion

These case studies show how personalized learning, sustainable digital education, fair access to resources and ethical data handling are what the research is looking at thus aligning with the propositions. The case studies effectively examine units of analysis as each of them looks at various individual universities in their programs concentrating on adaptive learning technologies, cost effectiveness, scalability, data privacy and digital equity. This also suggests that these cases meet the criteria for sustainability and ethics in education while it improves student engagement, reduces costs, scales profitably, protects data confidentiality, ensures digital equality and secures access.

Regarding sustainability in digital education, these findings imply universities may adopt adaptable learning technologies and this way provide cost effective, personalized and scalable digital learning experiences. Key among them is adaptive learning technologies like RiPPLE and Intrepid which according

to the authors are tools that can increase the level of digital literacy in students and faculties through personalizing the learning process therefore optimizing resource allocation resulting in lower ecological footprint of traditional teaching methods. Also, safety initiatives such as Box and initiatives like bConnected have gone far in addressing ethical implications related to data privacy as well as digital equity. These platforms ensure compliance with data protection laws, robust security measures are implemented, and equal access to educational resources is provided, thereby fostering inclusivity and ethical handling of data. Thus, they replicate the research design that provides evidence on how effective 'impact' ethical compliant' scalable adaptive learning technology in addition to secure tools contributes towards sustainable digital education.

Conclusion

Q1. What strategies can universities adopt to foster digital literacy among students and faculty while promoting sustainability values within their digital education programs and Why?

The experiences of RiPPLE at the University of Queensland and Intrepid demonstrate how universities may take on successful approaches. RiPPLE has shown that students should be actively involved in building learning resources while using AI algorithms for personalizing learning, which significantly enhances digital literacy skills. This not only enables learners to navigate digital environments ecologically well, but also optimizes resource consumption and reduces ecological impact.

Similarly, Intrepid provides novel solutions through interactive and adaptive learning environments. This firm ensures it addresses traditional teaching methods, which are associated with inefficiency of resource utilization as well as the issue of sustainability by enabling personalized educational paths and encouraging collaborative learning among students. Students need to recognize the ethical issues related to online studies such as ethical internet use or privacy.

When seen from a broad perspective, both RiPPLE and Intrepid demonstrate how universities can leverage technology to improve educational outcomes and foster sustainable values. Universities can therefore create inclusive learning environments that prepare students for a digitally fluent future by fostering digital literacy and embracing ethical practices in digital education. These initiatives thus underscore the need for continuous innovations in educational practices so as to cater to the changing requirements of students and society while still considering environmental concerns.

Q2. What ethical considerations, concerning data privacy and digital equity arise in utilizing online platforms and Why?

Question 2 of the case study addresses the ethical aspects related to data privacy and digital equity in education in using online platforms such as Box, for storing sensitive historical documents in universities. UC Berkeley's Phoebe A. Hearst Museum of Anthropology is tackling the problem of keeping data private while digitizing a vast archive. The question raises awareness of the moral issues when considering online storage applications thereby stressing on upholding principles of data privacy and ensuring that everyone has equal opportunities to access information.

Universities face severe consequences when addressing these ethical issues that must be treated carefully. Robust security measures should be implemented by universities to effectively protect classified data such as access controls on platforms like Box. It can significantly minimize cases of unapproved data breach thus, by limiting document access to authorized personnel and also having security protocols, including CalNet.

Moreover, in addition to improving data security, the adoption of digital platforms has made digital equity possible by eliminating physical barriers to accessing documents so that all learners have equal chances of education. This is demonstrated through Phoebe A. Hearst Museum of Anthropology at UC

Berkeley where they emphasize strict control and safety measures in accessing their resources. For example, Box helps in maintaining privacy and fairness of information by way of its strong security features while ensuring that it handles information legally. This dedication therefore leads to a safe and all-inclusive online learning atmosphere where educational materials can be safely stored with universal accessibility regardless of the location or computer skills of the user.

To sum up, these case studies show beyond doubt that universities can effectively apply adaptive learning technologies with secure online platforms for developing literacy skills in students who use the internet most frequently as well as helping learners develop sustainable practices while still protecting their privacy rights and ensuring equal opportunities in terms of technology use.

Areas For Further Study

It is imperative that more research is carried out on the long-term impact evaluation of initiatives such as RiPPLE and Intrepid on student learning outcomes, digital literacy development and educational sustainability. Precise insights on how personalized learning platforms enhance digital literacy, encourage collaborative learning environments, and promote sustainable educational practices will be provided by this study hence guiding the future development of digital education strategies.

Further detailed research can be made on how data localization requirements, like laws requiring data storage within a specific geographic region, affect the security and accessibility of educational data. Data localization requirements are important to be researched for their interaction with the security and accessibility of educational data in order to comply with local laws while maintaining integrity and availability.

APPENDIX 1
CHATGPT 3.5 SEPTEMBER 2022 RESULTS

Search Words: Further areas of studies for digital transformation in education

Results: Further Areas of Study for Digital Transformation in Education

1. Impact on Teaching Methods: Investigate how digital transformation influences teaching methodologies and the role of educators in a digital classroom.
2. Student Engagement: Examine the effectiveness of digital tools in enhancing student engagement and motivation in various educational settings.
3. Equity and Access: Study the impact of digital transformation on educational equity, focusing on access to technology and resources for underserved populations.
4. Assessment Techniques: Explore innovative digital assessment methods and their effectiveness in measuring student learning outcomes.
5. Teacher Training: Research the best practices for training educators to effectively integrate and utilize digital technologies in their teaching practices.
6. Digital Literacy: Analyze how digital transformation initiatives contribute to developing students' digital literacy skills and their readiness for the digital economy.
7. Long-Term Outcomes: Investigate the long-term effects of digital transformation on students' academic performance, career readiness, and lifelong learning.
8. Collaboration and Communication: Study the role of digital tools in enhancing collaboration and communication among students, teachers, and parents.
9. Curriculum Design: Explore how digital transformation influences curriculum design, including the integration of multimedia, interactive content, and adaptive learning pathways.
10. Sustainable Strategies: Investigate how digital transformation can promote sustainable educational practices, such as reducing paper usage, optimizing energy consumption, and utilizing eco-friendly digital tools.
11. Ethical Considerations: Research the ethical implications of digital transformation, focusing on data privacy, digital equity, and ensuring confidentiality, integrity, and equitable access to digital resources.

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