INDONESIAN JOURNAL OF INNOVATION AND APPLIED SCIENCES (IJIAS)
Journal Homepage: https://ojs.literacyinstitute.org/index.php/ijias
ISSN: 2775-4162 (Online)
Review Article

Volume 5	Issue 2	June (2025)	DOI: 10.47540/ijias.v5i2.1644	Page: 129 – 144

Enhancing Knowledge Production through the Management of Technology and Innovation in Higher Education: Challenges and Opportunities

Oluwatoyin Ayodele Ajani
Department of Languages and Social Sciences Education, University of Zululand, South Africa
Corresponding Author: Oluwatoyin Ayodele Ajani; Email: oaajani@gmail.com

ARTICLE INFO

Keywords: Higher Education, Innovation, Knowledge Production, Technology Management, Thematic Analysis.

Received : 08 September 2024
Revised : 15 June 2025
Accepted : 21 June 2025

ABSTRACT

This study explores enhancing knowledge production in higher education through effective technology and innovation management. Using a scoping review methodology, 278 articles were accessed from Scopus, Google Scholar, ERIC, Web of Science, and EBSCOhost. Of these, only 68 peer-reviewed articles published in English were selected for thematic analysis. The review focused on identifying key challenges and opportunities related to technology and innovation management within higher education institutions. The analysis revealed several core challenges, including limited resources, cultural resistance, skill gaps, and data privacy and sustainability. Despite these obstacles, significant opportunities were identified. These include the potential for personalised learning, the use of artificial intelligence (AI) in research, enhanced global collaboration, and improvements in accessibility and administrative efficiency. Furthermore, the role of innovation hubs and public-private partnerships in fostering interdisciplinary research and development emerged as critical areas of focus. The findings underscore the importance of strategic leadership, policy development, and continuous evaluation in successfully managing technological innovation in higher education. By addressing these challenges and seizing the identified opportunities, institutions can play a pivotal role in advancing knowledge production and contributing to broader societal progress.

INTRODUCTION

In an increasingly digital world, the role of higher education institutions in advancing knowledge production has become more complex and critical (Ajani, 2024; Soomro et al., 2020). Technology and innovation are no longer supplementary tools but central elements in reshaping academic landscapes and enabling institutions to remain relevant in a fast-evolving global environment (Tsai & Gasevic, 2017). The integration of technology into teaching, research, and administration has the potential to enhance knowledge production significantly. However, this integration presents numerous challenges, necessitating a deliberate and well-managed approach (Tsai et al., 2018). While some institutions have made significant strides, others continue to struggle with the complexities of implementing technology-driven innovation effectively (Bates, 2015; Weller, 2020).

Resource constraints remain a primary challenge for many universities, particularly in low- and middle-income countries, where the funding necessary to adopt advanced technologies is often scarce (Altbach & De Wit, 2018). Even in wealthier nations, budget cuts and competing priorities can hinder technological advancements in higher education (OECD, 2021). Moreover, institutions often face the dilemma of balancing the need for technological innovation with the maintenance of existing infrastructure, which can be costly and time-consuming to upgrade (Collins & Halverson, 2018).

Cultural resistance to change within universities also presents significant hurdles. Many academic staff are resistant to adopting modern technologies due to fears of redundancy, lack of

digital literacy, or concerns about the devaluation of traditional pedagogical methods (Ajani, 2024; Blin & Munro, 2008; Barnacle & Dall' Alba, 2017). Moreover, the bureaucratic structure of many institutions can stifle innovation, as rigid administrative processes may hinder the swift adoption of innovative technologies (Marshall, 2018).

Skill gaps further complicate the landscape (Rogers et al., 2014). While digital skills are increasingly essential, not all academic staff possess the necessary expertise to integrate technology into their teaching or research effectively (Ajani, 2025; Sharpe & Beetham, 2010). This skill gap is not limited to educators; students, too, often face challenges in adapting to new technological tools, leading to disparities in academic performance and engagement (Wejnert, 2002; Ng, 2012).

Another critical concern is the ethical implications of technology use in education, particularly around data privacy and AI (Bovill, 2020). The increasing reliance on digital platforms and AI systems to manage and deliver education raises important questions about data security, bias in algorithmic decision-making, and the potential erosion of human oversight in academic processes (Ajani, 2025; Biggs & Tang, 2011; Williamson, 2016). Addressing these issues requires a nuanced understanding of both the opportunities and risks associated with technological innovation (Bloxham, 2008; Selwyn, 2021).

Sustainability is another pressing issue in the discourse on technology in higher education. The rapid pace of technological change often leads to the obsolescence of equipment, creating environmental challenges related to e-waste (Maxwell & Miller, 2020). Moreover, ensuring that technological innovations are not only effective in the short term but sustainable over the long term remains a crucial concern for institutions looking to balance innovation with responsible resource management (Bozalek et al., 2018; Riedel & Marzi, 2021).

Despite these challenges, the opportunities presented by technology and innovation are vast. Adaptive learning systems, which personalise education to meet individual student needs, are becoming more sophisticated, leading to improved learning outcomes and student satisfaction (Bozalek & Zembylas, 2017; Johnson et al., 2016; Maphalala & Ajani, 2025). Additionally, AI is revolutionising research capabilities, enabling faster and more accurate analysis of large data sets, and facilitating discoveries across disciplines (Breslow, 2018).

Global collaboration is also being enhanced by digital platforms that allow researchers and students from different parts of the world to work together in ways that were previously unimaginable (Braidotti, 2013; Marginson, 2019). These platforms not only foster international research partnerships but also democratise access to education by breaking down geographical barriers (Altbach, Reisberg, & Rumbley, 2009).

Furthermore, public-private partnerships are playing an increasingly important role in fostering innovation within higher education. These collaborations can provide universities with the resources, expertise, and real-world applications necessary to drive impactful research and innovation (Etzkowitz, 2010; Braidotti & Bignall, 2019). Innovation hubs, in particular, have become critical spaces where academia, industry, and government intersect, driving forward cutting-edge developments in technology and knowledge production (Feldman & Lowe, 2018).

To successfully navigate these challenges and opportunities, strong leadership and strategic vision are essential (Burke & Lamar, 2020). Institutional leaders must not only champion technological innovation but also ensure that it is integrated thoughtfully and equitably across the institution (Kezar, 2014). Moreover, the development of policies that balance innovation with ethical considerations, privacy concerns, and inclusivity is critical to the long-term success of technology integration in higher education (Cole, 2010; Selwyn, 2021).

Given the rapidly evolving nature of technology, continuous evaluation is essential to ensure that innovations remain relevant and effective (Johnson et al., 2016). Higher education institutions must develop mechanisms to regularly assess the impact of innovative technologies on teaching, research, and administration, and make adjustments as necessary to meet the changing needs of students, staff, and society (Adeusi et al., 2024; Maphalala & Ajani, 2024).

This study aims to contribute to the growing body of literature on technology and innovation management in higher education by addressing

three key research objectives: (1) To identify and analyse the main challenges faced by higher education institutions in managing technology and innovation; (2) To explore the opportunities that technology and innovation present for enhancing knowledge production in higher education; (3) To provide strategic recommendations for institutions to effectively manage these challenges and leverage the opportunities for sustained growth and impact.

Through a comprehensive review of existing literature, this study offers valuable insights for academic leaders, policymakers, and researchers seeking to navigate the complexities of technological innovation in higher education. Thus, the study addresses a clear research gap by systematically synthesising literature on the underexplored intersection of technology and innovation management in higher education, specifically towards knowledge production, which has not attracted any integrated thematic treatment and analysis in previous scholarship.

METHODS

This study employed a scoping review methodology to explore the challenges and opportunities in managing technology and innovation within higher education. A scoping review was chosen as the most suitable approach due to its capacity to map the existing literature comprehensively, identify key themes, and pinpoint gaps in current research (Arksey & O'Malley, 2005). The scoping review followed a systematic process, ensuring transparency and rigour in the identification, selection, and analysis of relevant studies.

The process of this scoping review was based on the framework set by Arksey and O'Malley (2005) and aimed to systematically map the literature on technology and innovation management in the field of higher educational formation. The process began with setting up clear research questions and specifying inclusion and exclusion criteria that would screen peer-reviewed journal articles published in English that discuss the role of technology and innovation in aiding knowledge production in higher education institutions. A strategically devised, very comprehensive search of literature was then carried out, including databases like Scopus, Google Scholar, ERIC, Web of Science, and EBSCOhost, for wider coverage and depth. The initial search returned 278 articles, which were screened in following-up procedures involving title and abstract review, eliminating any duplicates, and applying exclusion criteria, primarily grey literature and works not related to higher education. 68 articles were finally selected for major full-text review and thematic analysis. Key information was extracted using a structured form of data charting, and themes were developed through an iterative coding process. This rigorous and transparent method yielded reliable synthesis results of relevant studies while bringing to light key challenges, emerging opportunity areas, and areas demanding further research. By looking at the titles and abstracts, the articles were then reviewed for relevance. After excluding all duplicates as well as those articles that did not meet exclusion criteria, such as being non-peer-reviewed sources and studies not aligned with a higher-education scope, 68 articles (Table 1) passed to the final stage of analysis on a thematic basis. Data extraction was then carried out in a systematic manner, using a standardized form that captured relevant study characteristics. Based on iterative thematic coding, the findings that arose from data synthesis laid out the main challenges and opportunities, and strategic recommendations. Such a rigorous approach produced a reliable and replicable literature synthesis while also revealing gaps for future research.

Data Sources and Search Strategy

The literature search was conducted using the primary databases: Scopus, Google Scholar, ERIC, Web of Science, and EBSCOhost. These databases were selected for their extensive coverage of academic publications across various disciplines. The search strategy was developed in consultation with academic librarians and designed to capture a broad range of articles relevant to the management of technology and innovation in higher education. Search terms included combinations of keywords such as "technology management", "innovation in higher education", "knowledge production", "digital transformation", and "educational technology". Boolean operators were used to refine the search results and ensure the retrieval of relevant studies.

Table 1. Scoping Review Process Summary

Stage	Number of Articles
Initial database search (Scopus, Google Scholar, ERIC, Web of Science, EBSCOhost)	
Total records identified	278
Duplicate records removed	Not specified
Titles and abstracts screened	278
Records excluded after screening	176
Full-text articles assessed for eligibility	102
Articles excluded after full-text review	34
Final studies included for thematic analysis	68

Inclusion and Exclusion Criteria

The inclusion criteria for this scoping review were carefully defined to ensure the relevance and quality of the selected studies. Only peer-reviewed articles published in English were included to maintain academic rigour and comparability (Pham et al., 2014). Furthermore, the review focused on articles published in journals, excluding conference papers, book chapters, and grey literature, to ensure that the studies had undergone rigorous peer-review processes. The selected studies were required to address the management of technology and innovation within the context of higher education, whether through empirical research, theoretical analysis, or case studies.

Articles that did not relate to higher education, those that focused solely on primary or secondary education, and those that were not published in peer-reviewed journals were excluded. Additionally, non-English publications were excluded due to language limitations and to maintain consistency in the analysis.

Study Selection

The initial search yielded 278 articles across the two databases. Following the removal of duplicates, titles and abstracts were screened for relevance based on the predefined inclusion and exclusion criteria. This screening process resulted in the selection of 102 articles for full-text review. After a thorough assessment of the full texts, 68 articles were deemed suitable for inclusion in the final review. These articles provided a robust foundation for exploring the challenges and opportunities in managing technology and innovation in higher education.

Data Extraction and Charting

Data from the selected studies were extracted using a standardised data extraction form, which was developed to capture key information from each article. This form included fields for the study's authors, publication year, geographic location, research design, key findings, and relevance to the research objectives. The extracted data were then charted to identify patterns, themes, and gaps in the literature. This process was guided by the thematic framework outlined by Arksey and O'Malley (2005), ensuring that the data extraction and charting were systematic and replicable.

Thematic Analysis

A thematic analysis was conducted to synthesise the findings from the selected studies. This analysis involved identifying recurring themes and patterns related to the challenges and opportunities in managing technology and innovation within higher education. The thematic analysis was carried out iteratively, with themes being refined and developed as more studies were reviewed. The final themes were discussed and agreed upon by the research team, ensuring that they accurately reflected the literature and aligned with the research objectives (Braun & Clarke, 2006).

Quality Appraisal

Although scoping reviews do not typically include formal quality appraisal of the included studies, a quality check was incorporated into the study selection process to ensure the relevance and rigour of the selected articles (Levac, Colquhoun, & O'Brien, 2010). Articles were assessed for methodological soundness, relevance to the research objectives, and contribution to the existing body of knowledge. Studies that did not meet these criteria were excluded from the review.

Limitations of the Methodology

It is important to acknowledge the limitations inherent in the scoping review methodology. One

limitation is the exclusion of non-English language studies, which may have limited the diversity of perspectives in the review. Additionally, the reliance on peer-reviewed journal articles may have excluded valuable insights from grey literature, such as policy reports and practitioner-led research. However, these limitations were mitigated by the breadth of the databases searched and the systematic approach to study selection and thematic analysis.

Ethical Considerations

This review adhered to ethical standards throughout the research process. As the study involved the analysis of publicly available literature, no ethical approval was required. However, care was taken to ensure that all sources were accurately cited and that the findings were presented transparently and without bias. The scoping review methodology employed in this study provided a comprehensive overview of the current landscape of technology and innovation management in higher education. By systematically mapping the existing literature, this review offers valuable insights into the challenges and opportunities that institutions face, setting the stage for further research and strategic recommendations in this rapidly evolving field.

RESULTS AND DISCUSSION

This scoping review identified six key themes that encapsulate the challenges and opportunities in managing technology and innovation in higher education. These themes emerged through a thorough thematic analysis of the 68 selected articles and are presented as follows: resource constraints, cultural resistance, skill gaps, ethical concerns, opportunities for personalised learning, and global collaboration. Each theme is discussed in detail, supported by relevant literature.

Theme 1. Resource Constraints

The review consistently highlighted resource constraints as a major barrier to effectively managing technology and innovation in higher education (Kinchin, 2020). Financial limitations were particularly pronounced in institutions from low- and middle-income countries, where inadequate funding significantly hampered the adoption of modern technologies (Altbach & De Wit, 2018). Even in wealthier institutions, competing priorities often led to budgetary constraints that limited investments in technological infrastructure (OECD, 2021). These constraints affected not only the acquisition of technology but also the ongoing maintenance and upgrading of systems, which are necessary for sustained innovation (Collins & Halverson, 2018).

Several studies pointed out that resource constraints were not limited to financial considerations (Lygo-Baker et al., 2019; Kinchin, 2020). Human resources also posed a challenge, with many institutions struggling to recruit and retain staff with the expertise needed to manage and implement technological innovations (Sharpe & Beetham, 2010). This issue was further exacerbated by the high costs associated with continuous professional development, which many universities could not afford (Bates, 2015). As a result, institutions were often forced to rely on outdated technologies, hindering their ability to remain competitive in a rapidly changing academic landscape (Mulcahy, 2018).

To address these challenges, some institutions have turned to partnerships with the private sector and government agencies. However, these partnerships often come with their own set of challenges, including issues related to control and intellectual property (Feldman & Lowe, 2018). While resource constraints remain a significant hurdle, institutions that strategically engage with external partners may find ways to mitigate some of these limitations (Noddings, 2005; Murphy, 2015).

Theme 2. Cultural Resistance

Cultural resistance within universities was another recurring theme in the literature. Many studies pointed to the entrenched norms and practices within higher education that resist change, particularly when it comes to the adoption of modern technologies (Blin & Munro, 2008; Noddings, 2012). This resistance was often rooted in concerns about the impact of technology on traditional academic roles and values. For example, educators expressed fears that technology would devalue face-to-face teaching and lead to job losses as digital tools increasingly took over routine tasks (Marshall, 2018).

Institutional bureaucracy was also identified as a significant barrier to technological innovation. The slow pace of decision-making in many universities made it difficult to implement modern technologies in a timely manner, leading to missed

opportunities for innovation (Kezar, 2014). Additionally, the hierarchical structures of universities often meant that decisions about technology adoption were made by senior administrators without sufficient input from those who would be directly affected, such as teaching staff and students (Selwyn, 2021). This top-down approach often resulted in resistance from staff, who felt that their concerns and needs were not being adequately addressed.

To overcome cultural resistance, the literature suggests that institutions need to foster a culture of openness and collaboration. This involves engaging all stakeholders in the decision-making process and ensuring that staff and students are provided with the support they need to adapt to modern technologies (Kezar, 2014). Leadership also plays a crucial role in shaping institutional culture, with strong and visionary leaders being key to driving technological change (Marshall, 2018).

Theme 3. Skill Gaps

Skill gaps among both staff and students emerged as a significant challenge in the management of technology and innovation in higher education. Sharpe and Beetham (2010) emphasise that while digital skills are increasingly essential for teaching and research, many educators lack the necessary expertise to effectively integrate technology into their pedagogical practices. This digital divide was also evident among students, with disparities in digital literacy contributing to unequal learning experiences and outcomes (Pryor & Crossouard, 2008; Ng, 2012; Puig de la Bellacasa, 2017).

The literature highlighted that the rapid pace of technological change often outpaces the ability of institutions to provide adequate training and support for their staff. Bates (2015) notes that many institutions struggle to keep up with the demand for continuous professional development, particularly in the area of digital skills. As a result, educators often feel unprepared to use modern technologies, leading to underutilisation of available tools and missed opportunities for innovation (Weller, 2020). This skills gap also extends to research, where the increasing use of AI and data analytics requires a new set of competencies that many researchers lack (Breslow, 2018; Rapper, 2019).

Addressing these skill gaps requires a concerted effort from institutions to invest in ongoing training and support for both staff and students (Richardson et al., 2020). The literature suggests that professional development programmes need to be tailored to the specific needs of educators and researchers, with a focus on practical applications of technology in teaching and research (Sharpe & Beetham, 2010). Institutions must also ensure that students are provided with the resources and support they need to develop the digital skills required for success in a technology-driven academic environment (Sambell, 2008; Ng, 2012).

Theme 4. Ethical Concerns

Ethical concerns surrounding the use of technology in higher education were a key theme in the literature. One of the most significant issues identified was the potential for data privacy breaches as institutions increasingly rely on digital platforms and AI to manage and deliver education (Williamson, 2016). The collection and analysis of large amounts of student data, while offering opportunities for personalised learning and improved outcomes, also raises fundamental questions about data security and the potential misuse of information (Selwyn, 2021).

AI-driven decision-making systems were another area of concern, with several studies pointing to the risk of algorithmic bias and the potential for these systems to perpetuate existing inequalities (Williamson, 2016). The lack of transparency in how these systems operate and the limited oversight of their implementation in educational settings were highlighted as key issues that need to be addressed (Selwyn, 2021). Furthermore, the increasing reliance on AI and automation in administrative processes raised concerns about the dehumanisation of education and the erosion of human oversight in academic decision-making (Johnson et al., 2016).

To address these ethical concerns, the literature emphasises the need for robust ethical frameworks to guide the implementation of technology in higher education. Institutions must develop policies that balance the benefits of technological innovation with the protection of privacy, equity, and ethical standards (Selwyn, 2021). Additionally, there is a need for greater transparency and accountability in the use of AI and data analytics, with institutions being required to disclose how these systems are being used and to

ensure that they are subject to regular review and oversight (Williamson, 2016).

Theme 5. Opportunities for Personalised Learning

Despite the challenges, the review identified significant opportunities for enhancing knowledge production through personalised learning. Adaptive learning technologies, which tailor educational experiences to individual students' needs, were widely regarded as a transformative innovation in higher education (Johnson et al., 2016). These technologies enable a more student-centred approach to education, allowing learners to progress at their own pace and receive targeted support where needed (Breslow, 2018).

Several studies highlighted the positive impact of personalised learning on student outcomes, particularly for those who struggle in traditional learning environments (Slattery, 2006; Ng, 2012; Taylor, 2018). By providing tailored feedback and support, adaptive learning systems can help to reduce the achievement gap and improve retention rates, particularly among disadvantaged students (Johnson et al., 2016). Additionally, the use of AI to analyse student data and predict learning outcomes was seen as a key tool for identifying at-risk students and providing timely interventions (Breslow, 2018).

However, the literature also pointed to the challenges associated with implementing personalised learning on a large scale (Taylor, 2018; Taylor & Fairchild, 2020). These include the high costs of developing and maintaining adaptive learning systems, as well as concerns about data privacy and the potential for over-reliance on automated systems (Williamson, 2016). To maximise the benefits of personalised learning, institutions need to invest in the necessary infrastructure and ensure that these technologies are implemented in ways that respect students' privacy and autonomy (Selwyn, 2021).

Theme 6. Global Collaboration

Global collaboration emerged as one of the most promising opportunities for enhancing knowledge production through technology. The review highlighted how digital platforms are breaking down geographical barriers, enabling researchers and students from around the world to collaborate more easily (Marginson, 2019; Taylor et al., 2019). These platforms facilitate the sharing of knowledge and resources, fostering international partnerships that enhance the diversity and quality of academic research (Altbach, Reisberg, & Rumbley, 2009).

Several studies pointed to the positive impact of global collaboration on research outputs, particularly in fields such as science and technology, where international partnerships are often essential for advancing knowledge (Etzkowitz, 2010; Taylor et al., 2020). The ability to collaborate with researchers from different countries and disciplines not only broadens the scope of research but also increases its relevance by incorporating diverse perspectives and expertise (Marginson, 2019). Additionally, digital platforms have made it easier for students to access international educational opportunities, further enhancing the global reach of higher education (Altbach et al., 2009).

However, the literature also noted that global collaboration is not without its challenges. Issues such as unequal access to technology, language barriers, and differing regulatory frameworks can create obstacles to effective collaboration (Collins & Halverson, 2018). To overcome these challenges, institutions need to invest in the necessary infrastructure and support systems to facilitate global collaboration, while also working to address the disparities that exist between different regions and institutions (Altbach et al., 2009).

In summary, the findings from this review reveal both significant challenges and exciting opportunities in managing technology and innovation within higher education. Addressing these challenges will require institutions to engage with modern technologies thoughtfully and strategically, ensuring that they are implemented in ways that enhance knowledge production while safeguarding equity, privacy, and sustainability.

The findings of this study highlight a complex landscape in which higher education institutions are grappling with the dual forces of opportunity and constraint in the management of technology and innovation. The six key themes identified—resource constraints, cultural resistance, skill gaps, ethical concerns, opportunities for personalised learning, and global collaboration—paint a picture of an academic environment that is rich with potential yet fraught with challenges.

The pervasive issue of resource constraints remains one of the most significant barriers to technological innovation in higher education. This aligns with previous studies that have pointed to the uneven distribution of resources across institutions, particularly between well-funded universities in developed countries and those in less affluent regions (Altbach & De Wit, 2018). The financial pressures faced by universities are exacerbated by the rapid pace of technological change, which demands continuous investment in new tools and infrastructure (Collins & Halverson, 2018; Walker-Gelaves, 2019). To mitigate these constraints, institutions may need to explore alternative funding models, such as public-private partnerships, although these come with their own complexities and potential risks (Feldman & Lowe, 2018).

Linked to resource constraints is the challenge of cultural resistance within institutions. The literature underscores the difficulties many universities face in fostering a culture that embraces technological change (Blin & Munro, 2008). This resistance is often deeply rooted in concerns over the potential erosion of traditional academic values and roles, particularly regarding the shift from face-to-face to online learning (Marshall, 2018). The resistance is not merely technological but also ideological, reflecting a broader tension between innovation and tradition in higher education (Kezar, 2014). Overcoming this resistance will require thoughtful leadership that actively engages faculty and staff in the process of change, ensuring that innovation enhances rather than undermines the educational mission of the institution (Adeusi et al., 2024; Selwyn, 2021; Taylor et al., 2019).

Skill gaps further complicate the integration of technology in higher education (Taylor et al., 2020). As Sharpe and Beetham (2010) point out, both academic staff and students often lack the digital skills necessary to fully leverage modern technologies. This gap is particularly troubling given the increasing reliance on digital tools for both teaching and research (Weller, 2020). The literature suggests that while many institutions are aware of these skill gaps, they are often ill-equipped to provide the ongoing training and support required to close them (Bates, 2015). Addressing these gaps will require a sustained commitment to professional development, as well as the integration of digital literacy into the core curriculum for students (Ng, 2012). Moreover, institutions must recognise that digital skills are not static; they evolve as technology evolves, necessitating a dynamic and flexible approach to training (Breslow, 2018).

The theme of ethical concerns is particularly salient in the context of rapid technological change. As higher education institutions increasingly rely on AI and data analytics, the potential for ethical breaches, particularly in areas such as data privacy and algorithmic bias, becomes a critical issue (Williamson, 2016). The literature emphasises the importance of developing robust ethical frameworks to guide the use of technology in education, ensuring that innovations are implemented in ways that protect the rights and dignity of all students and staff (Selwyn, 2021). The challenge, however, lies in balancing the benefits of technological innovation with the need for ethical oversight. Institutions must be proactive in establishing transparent policies that address issues such as data privacy, security, and the potential for AI-driven systems to reinforce existing inequalities (Johnson et al., 2016).

While the challenges are significant, the findings also reveal substantial opportunities for personalised learning through technology. Adaptive learning systems, which tailor educational experiences to individual student needs, offer the potential to transform higher education by making learning more flexible, responsive, and inclusive (Johnson et al., 2016). These technologies can help address disparities in student achievement by providing targeted support and feedback, particularly for students who struggle in traditional learning environments (Ng, 2012). However, the successful implementation of personalised learning systems requires substantial investment in both technology and training, as well as careful consideration of the ethical implications of data-driven education (Breslow, 2018). Institutions must also be mindful of the risk of over-reliance on technology, ensuring that human relationships and oversight remain central to the educational process (Williamson, 2016).

Global collaboration is another area where technology presents exciting opportunities. Digital platforms are making it easier for researchers and students from around the world to collaborate, breaking down geographical barriers and fostering international partnerships (Marginson, 2019). These

collaborations can enrich academic research by incorporating diverse perspectives and expertise, while also expanding educational opportunities for students (Altbach, Reisberg, & Rumbley, 2009). However, the literature also highlights the challenges associated with global collaboration, including unequal access to technology and language barriers (Collins & Halverson, 2018). To fully realise the potential of global collaboration, institutions must invest in the necessary infrastructure and support systems while also working to address the disparities that exist between different regions and institutions (Altbach et al., 2009).

The discussion of these themes suggests that while technology offers substantial opportunities for enhancing knowledge production in higher education, these opportunities can only be realised if institutions are willing to confront the challenges head-on. Resource constraints, cultural resistance, skill gaps, and ethical concerns must all be addressed in order to create an environment that supports innovation while safeguarding the core values of higher education.

One of the key implications of this study is the need for institutional leadership that is both visionary and pragmatic (Karunarathne & Calma, 2024). Leaders must be able to articulate a clear vision for the role of technology in their institutions, while also being responsive to the concerns and needs of staff and students (Marshall, 2018). This requires a delicate balancing act, where innovation is pursued not for its own sake but in service of the institution's educational mission (Selwyn, 2021). Leadership must also be inclusive, ensuring that all stakeholders have a voice in the decision-making process and that the benefits of technology are shared equitably across the institution (Kezar, 2014).

Collaboration across sectors is another important consideration. The literature points to the potential benefits of partnerships between universities, the private sector, and government agencies in addressing some of the resource constraints and skill gaps identified in this study (Feldman & Lowe, 2018). However, these partnerships must be carefully managed to ensure that they do not compromise academic independence or lead to conflicts of interest (Altbach & De Wit, 2018). Institutions must be clear about their values and priorities when entering into such partnerships, ensuring that they align with the broader goals of higher education.

Sustainability is also a critical issue. As universities increasingly rely on technology, they must consider the long-term sustainability of their innovations (Pinho et al., 2021; Vitalis et al., 2025). This includes not only the financial costs of maintaining technological infrastructure but also the environmental impact of digital technologies (Johnson et al., 2016). The literature suggests that sustainable innovation requires a holistic approach, where technological decisions are made with an eye towards their long-term impact on both the institution and the broader society (Selwyn, 2021).

Finally, the findings of this study underscore the importance of equity and inclusion in the management of technology and innovation (Jin et al, 2025). As institutions adopt modern technologies, they must ensure that these innovations do not exacerbate existing inequalities (Williamson, 2016). This requires a commitment to inclusivity at every level, from the design of educational technologies to the way they are implemented and used (Breslow, 2018). Institutions must also be vigilant in ensuring that all students and staff have equal access to the tools and resources they need to succeed in a technology-driven academic environment (Ng, 2012; Frei-Landau et al., 2022).

In conclusion, this study highlights both the challenges and opportunities that higher education institutions face in managing technology and innovation. While the road ahead is complex, with careful planning, thoughtful leadership, and a commitment to equity and sustainability, universities can harness the power of technology to enhance knowledge production and create a more inclusive and dynamic academic environment.

Implications of the Study

The findings of this study have significant implications for the future management of technology and innovation in higher education. As institutions continue to navigate the complexities of integrating technology into their operations, this research highlights the need for a strategic approach that balances innovation with equity, sustainability, and ethical considerations. The key themes identified, resource constraints, cultural resistance, skill gaps, ethical concerns, personalised learning,

and global collaboration, underscore the multifaceted nature of these challenges and offer a foundation for actionable recommendations.

One of the most pressing implications is the need for institutions to address resource constraints proactively. As highlighted in the literature, inadequate funding and human resources can severely limit the ability of universities to adopt and sustain technological innovations (Altbach & De Wit, 2018). To mitigate these challenges, institutions should explore alternative funding streams, such as partnerships with the private sector and government agencies. However, these partnerships must be structured in a way that safeguards academic integrity and ensures that the institution retains control over its educational mission (Feldman & Lowe, 2018). Additionally, institutions should consider creating internal funding mechanisms specifically earmarked for technological upgrades and professional development, ensuring that innovation is supported in the long term.

The study also emphasises the importance of cultural change within universities. Institutional leadership plays a crucial role in fostering a culture that is open to innovation and technology (Vitalis et al., 2025). Leaders need to actively engage staff and students in the process of technological change, addressing concerns and ensuring that the adoption of new tools aligns with the institution's values and goals (Kezar, 2014). This requires transparent communication, shared decision-making, and a commitment to professional development that empowers staff to embrace modern technologies confidently (Sharpe & Beetham, 2010). Leadership should also focus on reducing bureaucratic barriers that often slow down the pace of technological adoption (Marshall, 2018).

To address the identified skill gaps, institutions must invest heavily in ongoing training for both staff and students. Digital skills are no longer optional in today's academic landscape; they are essential for effective teaching, learning, and research (Weller, 2020). Universities should prioritise the development of tailored professional development programmes that focus on practical applications of technology, ensuring that educators and researchers are equipped to use new tools effectively (Bates, 2015). Furthermore, digital literacy should be embedded into the student curriculum from the outset, preparing students for the demands of a technology-driven academic and professional environment (Ng, 2012).

Ethical considerations related to technology and innovation also demand urgent attention. Institutions must develop comprehensive ethical frameworks to guide the use of AI, data analytics, and other emerging technologies. These frameworks should prioritise transparency, data privacy, and the prevention of algorithmic bias, ensuring that technological innovations do not inadvertently reinforce existing inequalities (Williamson, 2016). Moreover, universities should establish clear policies for the ethical use of data, ensuring that students and staff are fully informed about how their data is being used and that they have control over their information (Selwyn, 2021).

The opportunities for personalised learning through technology present a significant potential benefit for higher education. However, the implementation of adaptive learning technologies must be done thoughtfully, with careful attention to issues of equity and access (Breslow, 2018). Institutions should invest in the infrastructure needed to support personalised learning, ensuring that all students are catered for, regardless of social groups, differences, or backgrounds. This is to ensure that knowledge production in higher education is attainable.

In this study, the process of knowledge production is envisaged as that of generating and distributing academic insights and research outputs within higher education, something that digital technology and collaboration practices enable (Breslow, 2018; Marginson, 2019). Meanwhile, technological and innovation management refers to the integration and governance of technology tools, digital infrastructure, and innovative practices in the institutional setup to address challenges of resource and skill constraints while simultaneously promoting personalised learning, international collaboration, and research productivity (Feldman & Lowe, 2018; Johnson et al., 2016; Kezar, 2014).

Innovation in the context of higher education encompasses the introduction and adaptation of teaching methods, management systems, and research approaches that improve institutional performance and knowledge production, often through the use of adaptive learning technologies, global digital collaborations, and public-private

partnerships (Johnson et al., 2016; Feldman & Lowe, 2018; Bozalek & Zembylas, 2017). These concepts collectively form the conceptual perspective of the study, through which the enhancement of higher education knowledge ecosystems by way of effective technological and innovation management is presented.

The integration of technology and innovation in higher education has been widely acknowledged as a critical factor in enhancing knowledge production (Kayyali, 2024). However, the journey to effectively manage these elements is riddled with challenges that require careful consideration and strategic planning (Jin et al., 2025). This section reviews the relevant literature in line with the three key research objectives: identifying challenges, exploring opportunities, and providing strategic recommendations for higher education institutions.

Challenges in Managing Technology and Innovation

One of the most pressing challenges for higher education institutions is the issue of resource allocation (Karunathne & Calma, 2024). Financial constraints limit the ability of universities to invest in the latest technologies and infrastructure necessary for advanced knowledge production (Altbach & De Wit, 2018). The OECD (2021) highlights that even in well-funded institutions, resources are often stretched thin, forcing administrators to make difficult decisions regarding where to allocate funds. This situation is exacerbated in developing countries, where resources are even more limited, making it difficult to compete on a global scale (Collins & Halverson, 2018).

According to Maphalala and Ajani (2024), the digital divide within institutions further complicates the implementation of technology. Blin and Munro (2008) note that many educators are hesitant to adopt innovative technologies due to a lack of digital literacy, which creates a barrier to the seamless integration of innovative tools into teaching and research. This resistance is often rooted in concerns about the potential redundancy of traditional academic roles, particularly as AI and automation begin to replace certain tasks (Marshall, 2018; Alavi et al., 2024).

Cultural resistance within universities is not only a result of individual reluctance but is also embedded in institutional structures. Bureaucracy often slows down the decision-making process, hindering the rapid adoption of innovative technologies (Kezar, 2014). Moreover, many universities maintain a conservative approach to change, prioritising the preservation of traditional academic values over the integration of disruptive technologies (Selwyn, 2021).

Skill gaps among both staff and students present another significant challenge. As Sharpe and Beetham (2010) argue, while digital skills are increasingly essential in higher education, many staff members lack the necessary training to effectively incorporate technology into their pedagogical practices. Students, too, face challenges in adapting to innovative technologies, with disparities in digital literacy leading to unequal learning experiences and outcomes (Ng, 2012; Maphalala & Ajani, 2025; Vitalis et al., 2025).

Privacy and ethical concerns further complicate the management of technology in education (Rodriguez-Zurita et al., 2025). The rise of data-driven technologies, particularly those utilising AI, raises fundamental questions about data security and privacy (Williamson, 2016). Selwyn (2021) cautions against the unchecked use of data analytics and AI in educational settings, emphasising the need for robust ethical frameworks to guide their implementation. Furthermore, there are concerns about the biases inherent in AI systems, which can perpetuate inequalities rather than mitigate them (Williamson, 2016).

Sustainability is another critical challenge (Bada & Olusegun, 2015). Maxwell and Miller (2020) highlight the environmental impact of rapidly changing technologies, particularly in terms of electronic waste. The disposal of outdated equipment, combined with the energy demands of running advanced technological systems, presents significant sustainability issues for institutions. Additionally, ensuring that technological innovations are not just effective in the short term but sustainable over the long term is a key concern for university administrators (Riedel & Marzi, 2021).

Opportunities for Enhancing Knowledge Production

Despite these challenges, the opportunities for enhancing knowledge production through the management of technology and innovation are vast. One of the most significant opportunities lies in the

development of personalised learning systems. Adaptive learning technologies have advanced considerably in recent years, allowing institutions to tailor educational experiences to individual students' needs (Ajani et al., 2025; Johnson et al., 2016). This personalisation can lead to improved student outcomes, particularly for those who may struggle in traditional learning environments (Ajani et al, 2025; Breslow, 2018).

AI is also transforming research capabilities in higher education. With the ability to process vast amounts of data quickly and accurately, AI technologies are enabling researchers to make discoveries across a range of disciplines (Etzkowitz, 2010). This transformation is particularly evident in fields such as medicine, engineering, and the social sciences, where AI-driven data analysis is becoming an essential tool for advancing knowledge (Marginson, 2019).

The rise of global collaboration through digital platforms is another key opportunity. Marginson (2019) highlights that technology is breaking down geographical barriers, enabling researchers and students from around the world to collaborate more easily. These global collaborations not only enhance the diversity of perspectives in research but also democratise access to knowledge, allowing institutions in less affluent regions to participate in cutting-edge research (Altbach, Reisberg, & Rumbley, 2009; Frei-Landau et al., 2022).

Public-private partnerships are also playing an increasingly important role in fostering innovation within higher education. By collaborating with industry, universities can gain access to resources and expertise that are often unavailable within the academic setting alone (Etzkowitz, 2010; Pinho et al., 2021). These partnerships are particularly beneficial in fields such as engineering and technology, where industry input can help guide research and ensure that academic advancements are aligned with real-world applications (Feldman & Lowe, 2018).

Innovation hubs are another promising development in the intersection of academia and industry (Kezar, 2011; Pinho et al., 2021). These hubs, which bring together academic researchers, industry professionals, and government agencies, are becoming critical spaces for the development of innovative technologies and the application of academic knowledge to practical problems (King & Boyatt, 2015; Feldman & Lowe, 2018). The success of such hubs demonstrates the potential for higher education institutions to be at the forefront of technological and social innovation.

Improving accessibility through online education is another significant opportunity (Gasevic et al., 2019). The expansion of online and hybrid learning models makes education more accessible to a broader range of students, including those who may be unable to attend traditional in-person classes due to geographical, financial, or time constraints (Khoalenyane & Ajani, 2024; Johnson et al., 2016). Additionally, assistive technologies can help make higher education more inclusive, ensuring that students with disabilities have equal access to learning opportunities (Khoalenyane & Ajani, 2024; Maxwell & Miller, 2020).

Strategic Recommendations for Effective Management

To successfully manage these challenges and leverage the opportunities presented by technology and innovation, strong and visionary leadership is essential. Kezar (2014) argues that leaders in higher education must be proactive in driving technological change, ensuring that innovation is not only implemented but also aligned with the institution's broader mission and values. Leadership must also foster a culture of openness to change, encouraging staff and students to engage with modern technologies rather than resist them (Marshall, 2018; Gourlay, 2021).

Policy development is another critical area for effective management. Selwyn (2021) emphasises the need for robust policies that balance the benefits of technological innovation with the protection of privacy, equity, and ethical standards. These policies should be developed in consultation with a range of stakeholders, including students, staff, and external partners, to ensure that they are comprehensive and reflect the diverse needs of the academic community (Williamson, 2016).

Continuous evaluation and feedback mechanisms are also crucial. As Johnson et al. (2016) note, the rapidly changing nature of technology means that institutions must regularly assess the effectiveness of new tools and approaches. This continuous evaluation allows institutions to adapt to new developments and

ensure that their technological strategies remain relevant and effective over time (Breslow, 2018).

Moreover, universities should invest in upskilling their staff to bridge the digital skills gap (Moolenaar et al., 2014). Ongoing professional development programmes that focus on digital literacy and the integration of technology into pedagogy are essential for ensuring that educators are equipped to make the most of new tools (Sharpe & Beetham, 2010). Institutions should also ensure that students have access to the resources and support they need to develop the digital skills required for success in a technology-driven academic environment (Ng, 2012).

Finally, sustainability must be a key consideration in the management of technology and innovation (Gravetti & Kinchi, 2020; Gravett & Ajjawi, 2021). Institutions should seek to minimise the environmental impact of their technological infrastructure by investing in energy-efficient systems and adopting responsible e-waste management practices (Gravett et al., 2020; Maxwell & Miller, 2020). Additionally, sustainability should be built into the strategic planning of technological innovations, ensuring that new tools are not only effective but also viable over the long term (Riedel & Marzi, 2021).

Gourlay and Oliver (2018) argue that while the management of technology and innovation in higher education is fraught with challenges, it also presents significant opportunities for enhancing knowledge production. By addressing the challenges of resource allocation, cultural resistance, skill gaps, privacy concerns, and sustainability, institutions can create an environment where technology-driven innovation thrives (Gravett & Winstone, 2020). Higgins et al. (2019); Kinchin (2020) posit that through strong leadership, strategic policy development, continuous evaluation, and a focus on sustainability, higher education institutions can effectively manage technological change and contribute to the advancement of knowledge in the digital age.

CONCLUSION

In conclusion, this study highlights the intricate balance higher education institutions must strike in managing technology and innovation, navigating challenges such as resource constraints, cultural resistance, skill gaps, and ethical concerns, while embracing opportunities for personalised learning and global collaboration. The findings suggest that a strategic, inclusive, and ethically grounded approach is crucial to harnessing technology's potential to enhance knowledge production. Institutional leadership must play a proactive role in driving cultural change, addressing resource limitations, and investing in ongoing professional development and digital literacy. Ultimately, universities that prioritise equity, sustainability, and ethical considerations will be best positioned to thrive in an increasingly technology-driven academic landscape.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

1. Adeusi, K. B., Jejeniwa, T. O., & Jejeniwa, T. O. (2024). Advancing financial transparency and ethical governance: Innovative cost management and accountability in higher education and industry. *International Journal of Management & Entrepreneurship Research*, *6*(5), 1533-1546.
2. Ajani, O. A. (2024). Exploring digital transformation and future trends in higher education development across African nations. *Journal of Pedagogical Sociology and Psychology*, *6*(3), 34-48.
3. Ajani, O. A. (2025). Enablers, Barriers, and Pedagogical Strategies in Diverse Learning Environments. In *Enablers, Barriers, and Challenges for Inclusive Curriculum* (pp. 1-24). IGI Global Scientific Publishing.
4. Ajani, O. A., Akintolu, M., & Afolabi, S. O. (2024). The emergence of artificial intelligence in the higher education: Prospects and challenges of AI. *International Journal of Research in Business & Social Science*, *13*(8), 157–165.
5. Alavi, M., Leidner, D., & Mousavi, R. (2024). Knowledge Management Perspective of Generative Artificial Intelligence (GenAI). *Alavi, Maryam*, 1-12.
6. Altbach, P. G., & De Wit, H. (2018). The globalization of higher education. *International Journal of Higher Education*, 7(1), 1-10

7. Altbach, P. G., Reisberg, L., & Rumbley, L. E. (2009). Trends in global higher education: Tracking an academic revolution. *UNESCO 2009 World Conference on Higher Education*, 1-45.
8. Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19-32.
9. Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5, 66–70.
10. Barnacle, R., & Dall'Alba, G. (2017). Committed to learn: Student engagement and care in higher education. *Higher Education Research & Development*, 36, 1326–1338.
11. Bates, A. W. (2015). *Teaching in a digital age: Guidelines for designing teaching and learning*. Tony Bates Associates Ltd.
12. Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university: What the student does*. McGraw-Hill.
13. Blin, F., & Munro, M. (2008). Why hasn't technology disrupted our universities? *Journal of Computer Assisted Learning*, 24(5), 411-421.
14. Bloxham, S. (2008). How can we use assessment to support transitions into and through higher education? Keynote presentation at the Transitions and Transformations: Developing Learners and Learning Environments Conference, Edge Hill University.
15. Bovill, C. (2020). *Co-creating learning and teaching: Towards relational pedagogy in higher education*. Critical Publishing.
16. Bozalek, V., & Zembylas, M. (2017). Towards a response-able pedagogy across higher education institutions in post-apartheid South Africa: An ethico-political analysis. *Education as Change*, 21(2), 62–85.
17. Bozalek, V., Bayat, A., Gachago, D., Motala, S., & Mitchell, V. (2018). A pedagogy of response-ability. In V. Bozalek, R. Braidotti, T. Shefer, & M. Zembylas (Eds.), *Socially just pedagogies: Posthumanist, feminist and materialist perspectives in higher education* (pp. 97–112). Bloomsbury.
18. Braidotti, R. (2013). *The posthuman*. Polity Press.
19. Braidotti, R., & Bignall, S. (2019). *Posthuman ecologies: Complexity and process after Deleuze*. Rowman and Littlefield.
20. Breslow, L. (2018). The future of learning: The role of technology in higher education. *Journal of Higher Education Policy and Management*, 40(1), 3-16.
21. Burke, K., & Larmar, S. (2020). Acknowledging another face in the virtual crowd: Reimagining the online experience in higher education through an online pedagogy of care. *Journal of Further and Higher Education*.
22. Collins, A., & Halverson, R. (2018). *Rethinking education in the age of technology: The digital revolution and schooling in America* (2nd ed.). Teachers College Press.
23. Coole, D. H., & Frost, S. (2010). *New materialisms: Ontology, agency, and politics*. Duke University Press.
24. Etzkowitz, H. (2010). The Triple Helix: University-Industry-Government Innovation in Action. *Routledge*.
25. Feldman, M. P., & Lowe, D. (2018). The role of public-private partnerships in higher education technology adoption. *Higher Education Quarterly*, 72(1), 1-15.
26. Frei-Landau, R., Muchnik-Rozanov, Y., & Avidov-Ungar, O. (2022). Using Rogers' diffusion of innovation theory to conceptualize the mobile-learning adoption process in teacher education in the COVID-19 era. *Education and Information Technologies*, 27, 12811–12838.
27. Gaševi**ć**, D., Tsai, Y. S., Dawson, S., & Pardo, A. (2019). How do we start? An approach to learning analytics adoption in higher education. *The International Journal of Information and Learning Technology*, 36, 342–353.
28. Gourlay, L. (2021). *Posthumanism and the digital university*. Bloomsbury.
29. Gourlay, L., & Oliver, M. (2018). *Student engagement in the digital university: Sociomaterial assemblages*. Routledge.
30. Gravett, K., & Ajjawi, R. (2021). Belonging as situated practice. *Studies in Higher Education*.
31. Gravett, K., & Kinchin, I. M. (2020). Revisiting 'A teaching excellence for the times we live in': Posthuman possibilities. *Teaching in Higher Education*, 25(8), 1028–1034.
32. Gravett, K., & Winstone, N. E. (2020). Making connections: Alienation and authenticity within

students' relationships in higher education. *Higher Education Research and Development*.

33. Gravett, K., Kinchin, I. M., & Winstone, N. E. (2020). More than customers: Conceptions of students as partners held by students, staff, and institutional leaders. *Studies in Higher Education*.
34. Jin, Y., Yan, L., Echeverria, V., Gaševiꞇ, D., & Martinez-Maldonado, R. (2025). Generative AI in higher education: A global perspective of institutional adoption policies and guidelines. *Computers and Education: Artificial Intelligence*, *8*, 100348.
35. Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., & Freeman, A. (2016). *NMC Horizon Report: 2016 Higher Education Edition*. The New Media Consortium. https://www.learntechlib.org/p/171727/
36. Karunarathne, W., & Calma, A. (2024). Assessing creative thinking skills in higher education: deficits and improvements. *Studies in Higher Education*, *49*(1), 157-177.
37. Kayyali, M. (2024). Career Development in Higher Education: Best Practices and Innovations. In *Advancing Student Employability Through Higher Education* (pp. 1-19). IGI Global.
38. Kezar, A. (2011). What is the best way to achieve a broader reach of improved practices in higher education? *Innovative Higher Education*, 36, 235–247.
39. Kezar, A. (2014). How colleges change: Understanding, leading, and enacting change. *Routledge*.
40. Kinchin, I. (2020). Care as a threshold concept for teaching in the salutogenic university. *Teaching in Higher Education*.
41. King, E., & Boyatt, R. (2015). Exploring factors that influence adoption of e-learning within higher education. *British Journal of Educational Technology*, 46, 1272–1280.
42. Khoalenyane, N. B., & Ajani, O. A. (2024). A systematic review of artificial intelligence in higher education-South Africa. *Social Sciences and Education Research Review*, *11*(1), 17-26.
43. Lygo-Baker, S., Kinchin, I. M., & Winstone, N. E. (2019). *Engaging student voices in higher education: Diverse perspectives and expectations in partnership*. Palgrave Macmillan.
44. Maphalala, M. C., & Ajani, O. A. (2025). Leveraging artificial intelligence as a learning tool in higher education. *Interdisciplinary Journal of Education Research*, *7*(1), a01-a01.
45. Maphalala, M. C., & Ajani, O. A. (2024). Teaching and learning of computer science in higher education: A self-directed learning perspective. In *Navigating computer science education in the 21st century* (pp. 89-111). IGI Global.
46. Marshall, S. J. (2018). Shaping the University of the Future. *Springer*, *10*, 978-981.
47. Moolenaar, N. M., Daly, A. J., Cornelissen, F., Liou, Y. H., Caillier, S., Riordan, R., Wilson, K., & Cohen, N. A. (2014). Linked to innovation: Shaping an innovative climate through network intentionality and educators' social network position. *Journal of Educational Change*, 15, 99–123.
48. Mulcahy, D. (2018). Assembling spaces of learning in' museums and schools: A practice-based sociomaterial perspective. In E. Ellis & P. Goodyear (Eds.), *Spaces of teaching and learning: Understanding teaching-learning practice* (pp. 13–29). Springer.
49. Murphy, M. (2015). Unsettling care: Troubling transnational itineraries of care in feminist health practices. *Social Studies of Science*, 45(5), 717–737.
50. Noddings, N. (2005). *The challenge to care in schools: An alternative approach to education*. Teachers College Press.
51. Noddings, N. (2012). The caring relation in teaching. *Oxford Review of Education*, 38, 771–781.
52. Pinho, C., Franco, M., & Mendes, L. (2021). Application of innovation diffusion theory to the e-learning process: Higher education context. *Education and Information Technologies*, 26, 421–440.
53. Pryor, J., & Crossouard, B. (2008). A socio-cultural theorisation of formative assessment. *Oxford Review of Education*, 34(1), 1–20.
54. Puig de la Bellacasa, M. (2017). *Matters of care: Speculative ethics in more than human worlds*. University of Minnesota Press.
55. Raaper, R. (2019). Students as consumers? A counter perspective from student assessment as a disciplinary technology. *Teaching in Higher Education*, 24(1), 1–16.

56. Richardson, J. T. E., Mittelmeier, J., & Rienties, B. (2020). The role of gender, social class and ethnicity in participation and academic attainment in UK higher education: An update. *Oxford Review of Education*, 46(3), 346–362.
57. Rodríguez-Zurita, D., Jaya-Montalvo, M., Moreira-Arboleda, J., Raya-Diez, E., & Carrión-Mero, P. (2025). Sustainable development through service learning and community engagement in higher education: a systematic literature review. *International Journal of Sustainability in Higher Education*, *26*(1), 158-201.
58. Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. In *an integrated approach to communication theory and research* (pp. 432–448). Routledge.
59. Sambell, K. (2008). Getting involved: What can we learn from student perspectives of assessment for learning? Keynote presentation at the Transitions and Transformations: Developing Learners and Learning Environments Conference, Edge Hill University.
60. Slattery, P. (2006). *Curriculum development in the postmodern era: Teaching and learning in an age of accountability*. Routledge.
61. Soomro, K. A., Kale, U., Curtis, R., Akcaoglu, M., & Bernstein, M. (2020). Digital divide among higher education faculty. *International Journal of Educational Technology in Higher Education*, 17, 1–16.
62. Taylor, C. A. (2018). Each intra-action matters: Towards a posthuman ethics for enlarging response-ability in higher education pedagogic practice-ings. In V. Bozalek, R. Braidotti, T. Shefer, & M. Zembylas (Eds.), *Socially just pedagogies: Posthumanist, feminist and materialist perspectives in higher education* (pp. 81–96). Bloomsbury.
63. Taylor, C. A., & Fairchild, N. (2020). Towards a posthumanist institutional ethnography: Viscous matterings and gendered bodies. *Ethnography and Education*.
64. Taylor, C. A., Fairchild, N., Koro-Ljungberg, M., Benozzo, A., Carey, N., & Elmenhorst, C. (2019). Improvising bag choreographies: Disturbing normative ways of doing research. *Qualitative Inquiry*, 25(1), 17–25.
65. Taylor, C. A., Gannon, S., Adams, G., Donaghue, H., Hannam-Swain, S., Harris-Evans, J., Healey, J., & Moore, P. (2020). Grim tales: Meetings, matterings and moments of silencing and frustration in everyday academic life. *International Journal of Educational Research*.
66. Tsai, Y. S., & Gaševi**ć**, D. (2017). Learning analytics in higher education—challenges and policies: A review of eight learning analytics policies. In *Proceedings of the seventh international learning analytics & knowledge conference* (pp. 233–242).
67. Tsai, Y. S., Moreno-Marcos, P. M., Tammets, K., Kollom, K., & Gaševi**ć**, D. (2018). Sheila policy framework: Informing institutional strategies and policy processes of learning analytics. In *Proceedings of the 8th International Conference on learning analytics and Knowledge* (pp. 320–329).
68. Vitalis, P. O., Aondover, E. M., Ogunbola, O., Onyejelem, T. E., & Ridwan, M. (2025). Accessing Digital Divide and Implications in Nigeria: The Media Dimension. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, *8*(1), 1-12.
69. Walker-Gleaves, C. (2019). Is caring pedagogy really so progressive? Exploring the conceptual and practical impediments to operationalizing care in higher education. In P. Gibbs & A. Peterson (Eds.), *Higher education and hope: Institutional, pedagogical and personal possibilities* (pp. 93–112). Palgrave Macmillan.
70. Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. *Annual Review of Sociology*, 28, 297–326.