

Technological Tools for Effective Learning and Personalisation in Higher Education: Systematic Literature Review

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Abstract

The integration of technological tools in higher education represents a crucial shift towards personalised and effective learning environments. This systematic literature review highlights the crucial role of such tools, including Google Drive, WhatsApp, and augmented and virtual reality technologies, in transforming teaching and learning processes. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology, we conducted a search of databases such as Web of Science (WoS) and Scopus to analyze the impact of technology on higher education's teaching and learning paradigms. Our findings indicate that technological tools can facilitate personalized learning experiences, enhance student engagement, and improve learning outcomes. However, despite the potential benefits, challenges such as the digital divide, teacher reluctance, and the need for continuous training persist in the implementation of AR and VR technologies in education. Future research should explore strategies to overcome these barriers, further examine the long-term effects of these technologies on learning, and develop innovative pedagogical practices. This research emphasises the potential of technological tools to transform higher education. It also highlights the need for collaboration among educators, technologists, and curriculum designers to fully realise this potential.

Keywords: Technological, Tools, Effective, Personalisation, Higher Education

Introduction

In the dynamic world of higher education, the incorporation of technology into the teaching and learning process has become a revolutionary force. This paradigm change has brought new life to teaching methods and allowed students to have individualized learning experiences. The use of programs like Google Drive, WhatsApp, and other ICT technologies is indicative of it (Moreno-Guerrero as al., 2020; Baptista et al., 2021). "Additionally, the efficiency of mobile-assisted language learning (MALL) in improving speaking abilities in ESL and EFL students highlights the revolutionary potential of mobile technology in language instruction (Ajendran & Yunus, 2021).

The COVID-19 pandemic has contributed to the increase in virtual education, which has brought attention to the significance of synchronous and asynchronous digital platforms in maintaining educational continuity (Affouneh et al., 2021). While this was a fresh move, it also raised concerns about talents, attitudes, and the ability to modify technical infrastructure. Accordingly, a setting of constant assistance and progressive development was needed (Annese et al., 2022; Naamati-Schneider & Alt, 2023). Furthermore, it has been determined that the flipped learning methodology significantly enhances speaking abilities, offering a fresh viewpoint on technology-enabled education (Santhanasamy & Yunus, 2022).

Technology may be utilized in higher education to encourage critical thinking and raise student interest. The use of interactive platforms like virtual classrooms and learning management systems, which give students the freedom to interact with content in a dynamic way, and the application of digital pedagogies (Tsekhmister et al., 2022) serve as examples of this (Maureira-Cabrera et al., 2020). Immersion learning options have increased as a result of the integration of virtual reality (VR) and augmented reality (AR) in educational settings (Solmaz et al., 2021).

Nevertheless, there are obstacles in the way of the effective integration of these technical advancements. To guarantee accessible and equitable learning opportunities, it is imperative to address issues like the digital divide and access to technology, particularly in underprivileged populations (Davidovitch & Wadmany, 2021).

The integration of technological tools into higher education is now an inevitable trend, but there is still a need for educators, technologists and curriculum designers to work together to move closer to this goal. By embracing the challenges posed by the information revolution and utilising the power of technology to make changes that meet the needs of higher education to continue to evolve and to provide learning that is both effective and responsive to the learning needs of each student, for instance, a thorough assessment of the function of mobile learning in English for Specific Purposes (ESP) has shown the rising significance of this approach in specialized language instruction (Rafiq et al., 2021), the following two questions are posed in light of the above

QS1: How can technology tools help higher education students achieve more personalization and effective learning?

QS2: What are the challenges that technology tools face in promoting effective learning and personalization in higher education? How can these challenges be addressed?

Methodology

The present systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. As seen in Figure 1, this technique comprises four processes: identification, screening, eligibility, and inclusivity. PRISMA's comprehensiveness and flexibility to different investigations make it a popular tool among researchers. Thus, the following are the goals of the systematic review procedure and this study.

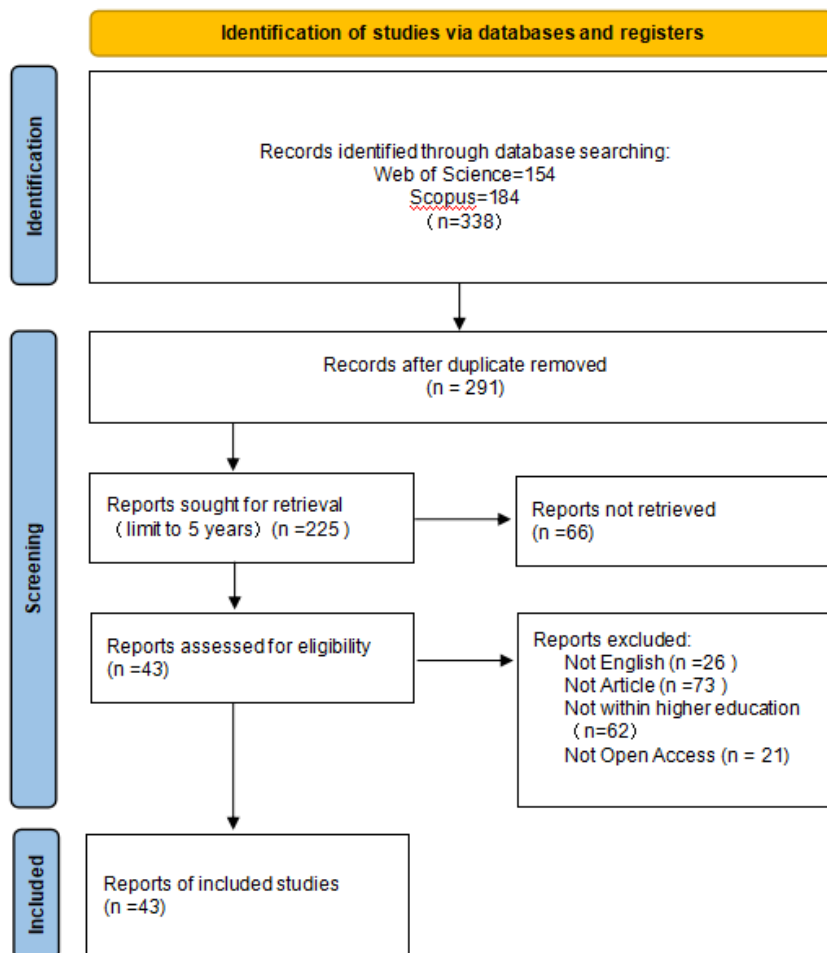


Fig. 1. PRISMA system overview adapted from (Page MJ et al.,2021) .

Identification

The identification procedure outlined in the PRISMA guidelines was the subject of the first phase of the systematic review. The WOS and Scopus databases were the two that we decided would be suitable for our investigation. The essential phrases utilized in this systematic review have been meticulously crafted to mirror the intended framework for examination. These include terms for technology aids, efficient instruction, and targeted higher education. The search terms for every database utilized in this investigation are displayed in Table 1 below.

Table 1

Search strings used in this study

Database	Search String
Web of Science(WOS)	TS= (("Technological tools" OR "Digital tools" OR "Information technology tools" OR "Electronic tools ") AND ("effective " OR "efficient " OR "productive" OR "successful" OR "POTENT" OR "POWERFUL") AND ("higher education" OR "University education" OR "College education" OR "Post-secondary education" OR "Advanced education"))
Scopus	Title-ABS-KEY: (("Technological tools" OR "Digital tools" OR "Information technology tools" OR "Electronic tools ") AND ("effective " OR "efficient " OR "productive" OR "successful" OR "POTENT" OR "POWERFUL") AND ("higher education" OR "University education" OR "College education" OR "Post-secondary education" OR "Advanced education"))

Screening

Following the identification of the articles, the screening procedure will be executed; that is, duplicate articles that occur in many databases will be excluded as the first step in this phase. After removing 47 duplicate articles during the initial screening process, 291 articles that qualified for additional screening were found. The year, language, and authority of these 291 articles were examined, and it was decided that they should be pertinent to technical work and higher education for certain uses. 248 papers were eliminated from consideration throughout this screening procedure on the grounds that they did not meet the screening standards and were not pertinent to the investigation's goal. Following exclusion, the inclusion and exclusion criteria were applied to filter the 43 remaining articles.

Table 2

Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Studies conducted between 2019 and 2023 (5-year period)	Articles published before 2019
Articles from journals	Conference proceedings, review articles, book chapters, reports
The text was written in English	Text not written in English
Related to Higher education 、 Technological tools、 Effective	Not Related to Higher education 、 Technological tools、 Effective

Forty-three publications were possibly included in this systematic review after rigorous selection based on inclusion and exclusion criteria. Even yet, we didn't include all of the reviewed papers because some of them lacked sufficient depth.

Included

This systematic review's articles are mostly focused on technical work. Table 3 displays the findings of the listed research.

Table above indicates that 9 papers were chosen from WoS and 10 from Scopus. The high caliber of the publications in these databases, particularly in the sphere of education, was the deciding factor. These studies' objectives are connected to technology and higher education. Universities and colleges as well as other higher education institutions hosted the study.

Table 3

Summary of selected studies

Study	Database	Aim	Sample	Finding	Challenge
Pakhomova, T et al.(2023)	WOS	to identify modern means of forming digital competence in higher education students through the use of information technology.	higher education students	the use of these technological tools improves the quality of learning, provides basic digital skills, and enhances the ability to use digital technologies in practical activities.	while technological tools offer numerous benefits in education, addressing these challenges is crucial to ensure their effective and equitable use in enhancing learning outcomes.
Mogas, J et al.(2023)	WOS	to investigate the relationship between the use of digital portfolios and the promotion of autonomous competence in higher education students	higher education students	the use of technological tools, specifically digital portfolios, can have a positive impact on the development of students' autonomy and digital competence in higher education.	they can be complex and require a certain level of digital literacy and technical skills. Not all individuals may be familiar or comfortable with using these tools, which can create a barrier to their effective use.

- Thurlow, L
et al. WOS
(2019)
- to analyze the phenomenon of sketch inhibition within contemporary design higher education.
- higher education students
- a balanced approach that incorporates both manual sketching and digital tools is crucial for effective design development. Educators should emphasize the value of sketching as a creative thinking tool and provide opportunities for students to develop their sketching skills.
- they can hinder the creative thinking process, limit the development of ideas, and inhibit the exploration and perception of multiple options that manual sketching allows.
- McGowan, N et al. SCOPUS
(2023)
- to present the design and development of a serious game called "Compete!" that focuses on raising awareness among higher education students about the importance of soft skill competencies in professional and personal settings.
- higher education students
- using technological tools, specifically gamification and serious games, is that they can effectively enhance the acquisition of soft skills in higher education students.
- these challenges requires collaboration between educators, administrators, policymakers, and technology providers. It is important to have a comprehensive strategy that considers the needs and resources of the educational community to maximize the benefits of using technological tools in education.

Mamedova, L et al. (2023)	WOS	to evaluate the academic performance of engineering students in offline and online learning formats during the COVID-19 pandemic.	Engineering students	technological tools can effectively support the educational process and facilitate learning for engineering students.	challenges such as socialization, physical activity, and the need for effective training activities should be addressed to ensure a successful online learning experience. these challenges highlight the complexity of utilizing technology tools in articles and the importance of addressing ethical considerations, comprehensive competence development, and social aspects of learning.
Kleimola, R & Leppisaari, I (2022)	WOS	to provide novel perspectives and insights into the importance of future competences and how these competences could be supported through Learning Analytics (LA).	higher education students	the potential of technology tools, particularly LA, in supporting comprehensive digital competence and enhancing learning experiences in higher education is emphasized.	the need to incorporate insights about the study context to provide more relevant content.
Braad, E et al. (2022)	SCOPUS	to examine how self-explication of metacognition within a detached digital self-regulated learning (SRL) tool affects metacognition in learners.	1st-year students	improving metacognition, enhancing self-regulated learning, facilitating goal setting and tracking progress, promoting reflection and evaluation of learning, making learning easier and	

Suri, M (2021)	M SCOPUS	to investigate university students' perceptions of e-learning implementation during the COVID-19 pandemic.	higher education students	more effective, and providing support for learners who need help with learning and planning. e-learning implementation, as mentioned in the article, include the ability to study anywhere and anytime, cost-efficiency, improved learning speed, new learning experiences, exposure to technological advancements, development of critical thinking skills, easy handling of tasks and assignments, improved time management, and autonomous learning.	indicated in the information provided, include poor internet connection in remote areas, difficulties in operating certain features of online systems, financial constraints in purchasing internet data, distractions from social media, and a preference for face-to-face learning.
Diaz-Núñez, C et al. (2021)	SCOPUS	to discuss the results and discussions of a survey conducted among teachers and students regarding their experiences with online classes and the use of digital	higher education students	helpful in enhancing their digital skills and improving the teaching and learning experience. The article emphasizes the convenience and accessibility of mobile	

<p>Castillo-Parra, B et al. (2022)</p>	<p>SCOPUS</p>	<p>tools such as Moodle, WhatsApp, Zoom, and Google Meet.</p> <p>to investigate the efficiency of applying gamified design in higher university e-courses, specifically in the fields of 3D modeling and programming</p>	<p>higher education students</p>	<p>applications, as well as their ability to promote interaction and engagement among students and teachers.</p> <p>growing interest in gamification in e-learning and the increasing number of research articles and systematic reviews in this field. The review identified the use of game elements such as points, badges, leaderboards, levels, feedback, and challenges in digital higher education.</p>	<p>a decrease in student motivation, resulting in a lack of engagement and participation in courses, as well as instructors struggling to maintain learners' attention, leading to the abandonment of online education systems.</p>
<p>Toriida, Marie-Claude et al. (2020)</p>	<p>WOS</p>	<p>to investigate the attitudes and behaviors of English for Academic Purposes (EAPP) students towards digital tools (DTs) for language learning.</p>	<p>Academic Purposes (EAP) 49 students</p>	<p>the digital tools helped them improve their English skills, provided a variety of exercises and examples, were easy to use, corrected errors and provided useful feedback, were fun and interesting with</p>	<p>Participants reported difficulties with certain tools, such as the need for advanced English vocabulary, lack of experience with digital tools among older students, and the desire</p>

				<p>games, did not require an internet connection, offered personalized learning experiences, covered a range of topics, and were accessible through mobile apps and online platforms.</p>	<p>for more teacher guidance in finding, selecting, trialing, and evaluating the tools.</p>
<p>Mondragon-Estrada, E et al.(2023)</p>	<p>WOS</p>	<p>to explore the teaching-learning strategies and educational tools that have been successfully incorporated by faculty members during Emergency Remote Teaching (ERT) in order to extrapolate them to current and future education.</p>	<p>100 faculty members from a private university</p>	<p>the integration of technology tools in education supports digital transformation and improves the effectiveness of teaching and learning processes.</p>	<p>limitations in terms of access to technology and the digital divide, particularly in regions with limited resources. Furthermore, the successful implementation of technology tools requires proper training and support for educators to ensure their effective use.</p>
<p>Gupta, Y et al.(2021)</p>	<p>SCOPUS</p>	<p>to explore and identify the factors influencing the acceptance and usage of mobile learning in higher education.</p>	<p>higher education students</p>	<p>Firstly, it enhances the accessibility and availability of information, allowing readers to easily access and retrieve relevant articles. Technology</p>	<p>technological issues such as software glitches or compatibility problems can hinder the smooth integration of these tools into the research process.</p>

tools also facilitate collaboration and communication among researchers, enabling them to share and exchange ideas more efficiently. Additionally, these tools provide advanced search and analysis capabilities, allowing researchers to quickly identify relevant articles and extract key information. Furthermore, technology tools enable the organization and management of articles, making it easier for researchers to keep track of their reading and citation lists.

Furthermore, there may be concerns regarding the reliability and accuracy of information obtained through technology tools, as well as potential privacy and security risks. Lastly, the rapid advancement of technology means that researchers need to continuously update their skills and knowledge to keep up with the latest tools and techniques.

					students may have unequal access to technology and internet connectivity. This can create barriers to participation and engagement for students who do not have reliable access to the necessary tools.
Tunjera, N & Chigona, A (2022)	SCOPUS	to explore the use of multiple platforms and devices for teaching and learning in order to increase inclusiveness and reduce the digital divide among students' populations.	higher education students	the use of technology tools in articles enhances the learning experience, improves attendance, reduces dropout rates, and promotes equity and inclusiveness in online learning environments.	Additionally, technical issues and compatibility problems can arise when using multiple platforms, leading to frustration and decreased productivity. Moreover, there may be a learning curve for both students and educators in adapting to new technology tools, which can initially hinder the smooth integration of these tools into the learning process.

García-
Martínez,
J.-A. et
al.(2020)

SCOPUS

to analyze the
Personal
Learning
Environments
(PLEs) of
university
students in
relation to
their use of
Information
and
Communicatio
n Technology
(ICT)

higher
education
students

These tools, such as Information and Communication s Technology (ICT) and web 2.0 resources, can facilitate access to information, content creation, and interaction among university students. However, the effective utilization of these tools depends on factors such as teacher training, instructional design, and students' familiarity with digital data. When integrated properly, technology tools can contribute to the development of Personal Learning Environments (PLEs) and support self-directed, lifelong learning.

the need for proper teacher training and instructional design to effectively integrate technology tools into the learning process. Additionally, there may be obstacles related to technical issues and the availability of resources. Furthermore, the inclusion of technology tools in articles requires careful consideration of the pedagogical implications and the alignment with educational objectives.

Bessarab, A et al.(2022)	WOS	to explore the principal aspects of the work of a modern digital higher educational institution from the perspective of students.	173 students from 12 higher educational	the use of virtual tools in higher education is seen as a way to make the educational process more accessible, flexible, and effective.	the low digital literacy of teachers and students, excessive workload on students with formal tasks, and the lack of experience and necessary educational tools for mastering learning technologies.
Koc-Januchta, M M et al.(2022)	WOS	to investigate the relationship between cognitive load types (intrinsic, germane, and extraneous) and learning gain, self-regulated learning, and usability perception in university students using an AI-enriched digital biology textbook.	higher education students	enhance the learning experience by providing interactive features, multimedia resources, and personalized suggestions for further learning. They can also support self-regulated learning by helping students plan, monitor, and evaluate their own learning process. Additionally, technology tools can reduce cognitive load by presenting information in a clear and organized	the potential decrease in student motivation when learning from digital environments, which may require advanced skills in independent learning and self-regulation. Another challenge is the risk of cognitive overload, particularly when poorly designed digital tools present excessive information or have complicated interfaces.

Keese, J et al.(2023)

SCOPUS

to propose a model for individualized professional development for technological tools (IPDTP)

higher education students

manner, thus promoting deep learning.

enhancing the learning experiences of students. Individualized professional development approaches that incorporate new technological tools within the framework of technological, pedagogical, and content knowledge (TPACK) have been effective in integrating these tools into faculty teaching practices. Mentorship and one-on-one experiences have been found to facilitate the successful adoption of new technologies in educational settings.

One challenge is the need for faculty to continually update their instructional skills and proficiency with new tools to remain relevant to the educational needs of students. Outdated professional development models may not effectively integrate technology into university teaching. Additionally, faculty members may lack training and familiarity with new technological tools, which can hinder their adoption and implementation. Furthermore, incorporating technology into articles

Martzoukou,
K et al. (2022)
SCOPUS

to explore the development of digital competences among higher education students in the context of higher education, specifically in the field of Law

it allows for the development and enhancement of digital competences among students studying in law-related courses. This is crucial in preparing them for the digital transformation and changing demands of the legal profession, such as cybersecurity, electronic records management, and online interactions. Technology tools also enable the replication of real-world legal processes in an online learning environment, providing students with

requires careful consideration of the tool's affordances and limitations, as well as the alignment with pedagogy and content.

These challenges can act as barriers to digital development and learning, particularly for students. Limited digital connectivity and opportunities for digital skills development within everyday life, work, and educational contexts can contribute to digital inequalities and hinder students' educational journeys.

hands-on experience and practical skills. Additionally, the use of technology tools facilitates the delivery and management of online client services, automates legal processes, and improves productivity and efficiency. It also helps students stay updated with technological innovations in the legal field, such as artificial intelligence and big data analysis.

Result

After a systematic study of the literature, the following

QS1: How Can Technology Tools Help Higher Education Students Achieve More Personalization and Effective Learning?

There are several advantages to using technology in higher education for effective and personalized learning. Students are able to learn in their desired way and at their own speed because to the flexible and engaging learning environments they offer. For example, by streamlining training and monitoring procedures, the usage of Google Drive and WhatsApp has demonstrated a favorable influence on student learning (Moreno-Guerrero et al., 2020). In a similar vein, it has been noted that Information and Communication Technology (ICT) tools would be essential for training requirements in the future in areas such as sustainable agriculture (Baptista et al., 2021). Meanwhile, the integration of social media in teaching speaking skills offers novel insights into student engagement and pedagogical practices (John & Yunus, 2021).

Thanks to their ability to improve learning outcomes, encourage active study, and break down social barriers between teachers and students, digital technologies such as WhatsApp provide much-needed flexibility in the classroom (Annese et al., 2022). Moreover, learning outcomes, motivation, and engagement can all be enhanced by the use of technology tools into formative assessment (Kaya-Capocci et al., 2022). Personalized feedback messages sent by

technology are also beneficial since they increase student engagement and encourage active learning (Iraj et al., 2021).

QS2: What Are the Challenges that Technology Tools Face in Promoting Effective Learning and Personalization in Higher Education? How Can These Challenges be Addressed?

Technology tools in higher education encounter a number of difficulties despite their benefits. One important problem is that instructors and students do not have equal access to these resources, which can lead to differences in the possibilities for learning (Moreno-Guerrero et al., 2020). Furthermore, adopting an online learning environment brings with it obstacles pertaining to attitudes, abilities, and technological infrastructure (Affouneh et al., 2021).

In order to effectively integrate technology into teaching methods and improve digital competences, it is imperative that continuous training and assistance be given (Perdomo et al., 2022). Crucial actions include offering resources and assistance, giving students with restricted access other alternatives, and iteratively enhancing the remote learning environment through feedback and adaptation (Shen et al., 2023). Technical problems may be resolved and a seamless learning process can be ensured by providing students with the necessary training, assistance, and guidance in addition to continuous contact and feedback channels (Naamati-Schneider & Alt, 2023).

Discussion

Limitation

Even if technology has completely changed higher education, there are still certain obstacles to overcome. The digital gap, which results in differences in educational chances since not all pupils have equal access to technology, is a major problem (Polianovskyi et al., 2021). Furthermore, there are differences in the efficacy of online learning; certain research suggests that students may do worse while studying remotely as opposed to in-person classrooms (Polianovskyi et al., 2021). Moreover, instructors who are not used to utilizing digital resources frequently oppose them, which calls for extra assistance and training (Gil & Dueñas, 2023). The complete integration and use of technology resources in educational settings may be hampered by this opposition.

Implication

In spite of these obstacles, technological use in higher education has shown promise. According to Solmaz et al (2021), augmented reality (AR) and virtual reality (VR) technologies, for example, have demonstrated the ability to offer immersive educational experiences that improve student engagement and learning results. With the use of these technologies, traditional classrooms may be changed into dynamic, exciting spaces that give students a more interesting approach to study difficult subjects. Digital tool usage has also been demonstrated to improve critical thinking and participation in educational activities, encouraging a more dynamic and interactive style of instruction (Zou et al., 2023). Also, it has been demonstrated that blended learning methodologies work well for teaching ESL, highlighting the value of integrating traditional and digital teaching techniques (Ramalingam et al., 2022).

Future Research

The difficulties of integrating technology in higher education should be the subject of future research. Assuring fair access to technology for every student and investigating methods to close the digital gap are part of this (Polianovskyi et al., 2021). In order to improve digital competences and facilitate the use of technology-enhanced teaching techniques, research

have to look on efficient training programs for teachers (Gil & Dueñas, 2023). Studies that investigate the long-term effects of AR and VR technology on learning outcomes and student engagement are also necessary (Solmaz et al., 2021). In order to fully realize the potential of technology to improve the caliber of higher education, research should also create and evaluate innovative pedagogical practices that incorporate technology into instruction.

Conclusion

The comprehensive assessment of the literature highlights the promise and problems of technological tool integration in higher education, underscoring the trend that is certain to happen. Learning results and student engagement have been demonstrated to be greatly enhanced by technologies such as AR and VR. Significant barriers, meanwhile, include the digital divide and opposition from educators. Collaboration between educators, technologists, and curriculum designers is necessary to address these issues. Subsequent studies have to concentrate on formulating efficient plans for teacher preparation, fair technology access, and evaluating the long-term effects of new technologies like augmented reality and virtual reality. The intention is to make the most of technology's ability to improve the standard of higher education while guaranteeing that instruction is efficient and sensitive to the demands of the learners.

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