Strategies to Promote e-Learning, Engagement, and Belonging in Emerging Educational Technologies

Pamayla E. DARBYSHIRE
University of Phoenix, USA
usafrnped@email.phoenix.edu

Maria NAVARRO
University of Phoenix, USA
maria.navarro@phoenix.edu

Louise UNDERDAHL
University of Phoenix, USA
lunderdahl@email.phoenix.edu

As reliance on information and communication technology continues to grow, it is essential to recognize and explore the impact of emerging technologies in the field of education. These rapidly advancing tools require early integration of digital citizenship education in curricula to promote their adoption and adaptation. With the support of new teaching methodologies and diverse digital education tools, educators are better equipped to empower students, streamline academic processes, and foster effective collaboration. The present narrative reviews emerging technologies in education to examine their potential benefits in the field of education. The insights are poised to inspire universities and colleges worldwide to embrace innovative technology for enhanced academic performance and delivery of education.

Keywords: Artificial Intelligence, Augmented/Virtual Reality, E-learning, Emerging Technologies, Internet of Things

Introduction

While traditional teaching (classroom) is a fundamental aspect of education, a significant upgrade in this teaching method is needed to keep pace with new ways of learning (Kemp et al., 2024). A traditional structured framework in education is teacher centric. The tools for learning involve lectures, textbooks, worksheets, and standardized tests. The method involves the transmission of knowledge from the teacher to the learner, with a defined curriculum and clear expectations for student performance.

Digital technology in education revolutionized traditional frameworks by fostering a learner-centric approach, empowering students to take charge of their learning journeys (Ferreira et al., 2024). In turn, this learning method utilizes technology effectively and underscores the crucial and valued role of educators in guiding students through the digital world, reassuring them about the effectiveness of these tools (Alam & Mohanty, 2023; Ferreira et al., 2024; Rotolo et al., 2015)

Emerging Technologies

Emerging technologies combine online products and services, using data generated between people and their devices (Rotolo et al., 2015). Technology empowers learners to monitor their academic behavior, interact with digital environments, and improve their learning performance (Kuhlmann et al., 2024). Integrating technology transforms educational approaches to teaching. Most emerging educational technology (Figure 1) will continue to radically reshape itself and thus continue 'emerging.' (public domain).

Figure 1.
Examples of Emerging Educational Technologies (Heick, 2023).

1. Augmented Reality   2. Virtual Reality   3. 3D Printing   4. Robotics   5. Adaptive Learning Algorithms

6. Asynchronous Learning and Microlearning   7. Live Streaming   8. Artificial Intelligence   9. Social Learning   10. Learning Games and Simulations

Emerging Technologies for Teaching and Learning

Worldwide advancements in educational tools present both unprecedented opportunities and challenges in all aspects of human life (Almufarreh & Arshad, 2023; Shabir, 2024). To effectively teach in today's educational landscape, it is essential to utilize technologies that enhance engagement and learning experiences. Among the various tools available, three key visualization technologies emerge as significant virtual immersion technologies, each offering unique benefits (Chugh et al., 2023; Holeem et al., 2022).

Augmented Reality uses camera devices (e.g., smartphones or AR goggles), to combine digital content onto real-world scenarios. The immersive approach assists learners in engaging with the physical and virtual worlds. It is the intent of the program designers to enrich user understanding and interaction with the material visualized in the program (Chugh et al., 2023). Figure 2.

Figure 2.
*Augmented Reality (public domain)*

Desktop Virtual Reality (DVR) operates on typical 2D computer screens and allows users to interact with input devices such as keyboards, mouse, and joysticks (Simsek, 2024). Figure 3.

Figure 3.
Desktop VR (public domain)

Headsets that immerse the user in a virtual environment, eliminating distractions from the physical world, represent a form of virtual immersive reality. In addition, the user visualizes 3D images, while immersive VR tracks users' movements in real-time. Users can now interact virtually and visualize their actions firsthand. This is precisely what differentiates immersive virtual reality systems from conventional user interfaces (Seo et al., 2021). Figure 4.

Figure 4.
Immersive VR (public domain)
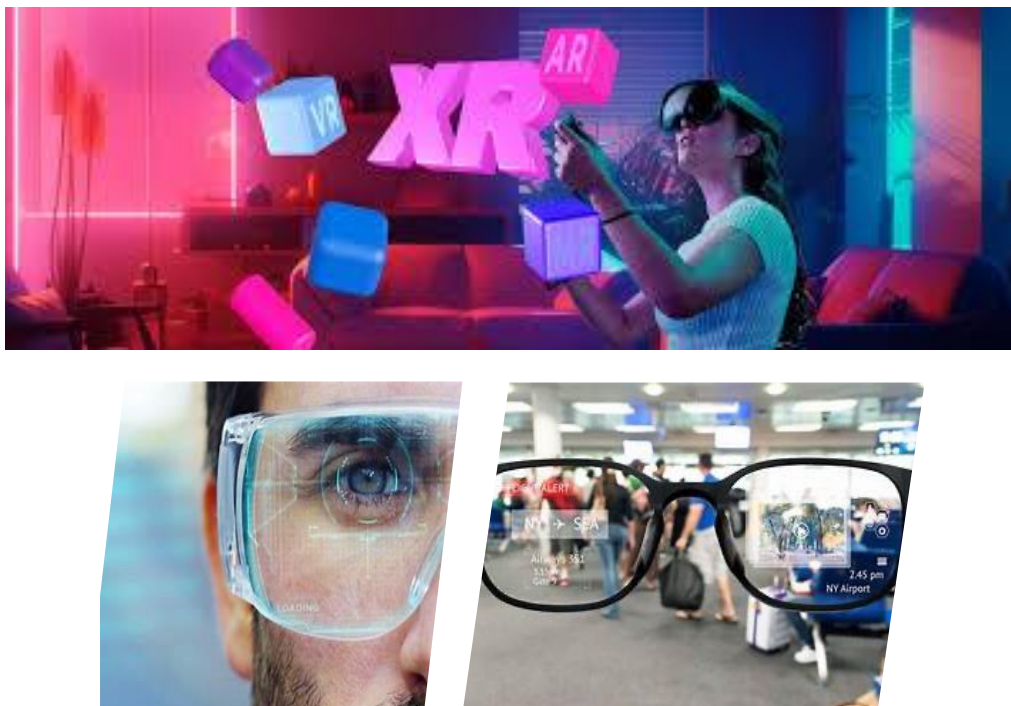
Virtual Reality (VR) Application in Education

Educators embracing and utilizing these powerful tools may discover new educational opportunities and build dynamic learning environments (Aithal & Maiya, 2024), making classrooms remarkably entertaining. The applications of VR in education seems limitless, given its flexibility and applicability to the many facets of teaching and learning. Learning with VR expands the classroom beyond its traditional walls. Typical field trips organized by schools have reduced budgets and logistic issues (Kuhlmann et al., 2024). VR technology, where students can go on these virtual field tripsto any location, anywhere around the world, without physically leaving the classroom, enhances the dynamics of this platform for student interaction and learning (Matovu et al., 2023). By providing experiential learning in a controlled environment (Kuhlmann et al., 2024), students with special needs or learning differences participate in events or learning opportunities tailored to their individual needs. VR in special education increases accessibility and promotes inclusivity in the classroom (Aithal & Maiya, 2024).

Several internet sites offer virtual field trips (Almufarreh & Arshad, 2023). Teambuilding.com has trips for a modest fee of 20 USD. Most of these 'trips' are conducted on a Desktop VR like Zoom. Travelnitch.com is a tour site designed for children. Weareteachers.com currently lists 40 plus tours to zoos, farms, aquariums, and other points of interest. Participating in technology or computer skills, virtual scholastic tours may interest those scientist or mathematician students (Matovu et al, 2023). Determining the type of virtual trip you may want to engage in (e.g., live streaming events, live group tours, or recorded tours) offers opportunities to mingle with others who share the same interests. Explorableplaces.com offers these types of programs.

Augmented Reality (AR)

Augmented reality is a significant driving force for growth and innovation in various industries, including education (Matovu et. al., 2023). Augmented reality as previously discussed, is designed to let the user see both real and virtual environments simultaneously (Aithal & Maiya, 2024). Interactive AR applications in healthcare, involve visualizing and manipulating human anatomy, surgeons using AI to plan a surgical procedure, digital educational games providing interactive simulations for learning; all represent examples in learning using AR (Zulfigar et al., 2023). Figure 5 provides other examples of AR.

Several limitations have developed utilizing AR in educational settings. AR is device specific, making student participation difficult; AR is content specific (some students may not benefit from the platform); institutions need an Internet infrastructure to support digital streaming without drop out (Zulfigar, 2024). These limitations are not a complete list, there are others specific to concept development, computer specific (e.g., Dell, IBM, Apple, etc.) and student access.

Figure 5.
Augmented reality
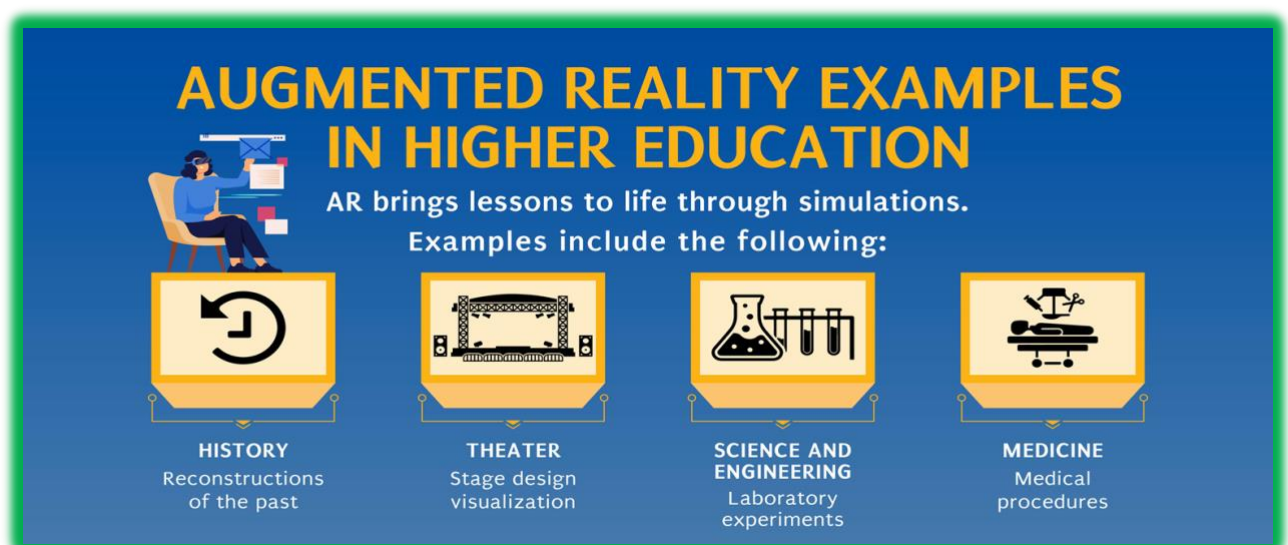
Artificial Intelligence (AI)

Advancements in the field of AI have significantly improved the ability of computers to learn independently (Almufarreh & Arshad, 2023). AI interacts with applications, to adapt, learn, and communicate, using their native language (binary code) and gestures (Hasas et al., 2024). The widespread use of intelligent terminals has allowed individuals to inhabit both physical space and the digital virtualized network (Hasas et al., 2024). Despite long-standing depictions in science fiction of the potential impact of artificial intelligence, today the technology is integrated into many aspects of people's lives.

Educational software, as part of a digital learning-by-teaching program, utilize a built-in pedagogical strategy (Ferreira et al., 2024; Seo et al., 2021). The software platforms provide students with guidance and feedback. Computer-assisted learning (CAL) also leverages AI and digital technologies to support students' learning processes by personalizing learning plans and trajectories (Wang & Li, 2024). Students can create individual learning strategies related to their strengths, weaknesses, and preferences with the help of AI and the support of teachers (Ahmed & Al Jumaili, 2024; Wang & Li, 2024).

AI Application in Education

AI's flexibility and applicability to every aspect of the teaching and learning relationship offer a beacon of hope for educators. It significantly improves learning outcomes and supports teachers in developing better educational practices (Iqbal et al., 2022; Kitcharoen et al., 2024). By applying individualized learning, automating administrative tasks, providing tutoring and support outside the classroom, and, most importantly, ensuring universal access for all students, AI is set to revolutionize education and promote equity (Engageli, 2024).

Adaptive learning, for instance, is used to teach students advanced skills and evaluate their skill level, creating a personalized instructional experience and guiding them to proficiency in their digital skill set. The future of education, with AI at its core, promises personalized learning, dynamic evaluations, meaningful online interactions, and learning experiences (Koumpouros, 2024).

Consider these examples of current applications of AI in education:
- study buddies or tutor bots (Porat et al., 2024), available 24/7 for student access
- conversational AI assistants give students one-on-one attention (Porat et al., 2024)
- chatbots answer student questions, analyze interactions for accuracy, and suggest improvements based on past performance (Iqbal et al., 2022)

Adaptive learning software incorporated in university infra-structures evaluates and adapts to student skill levels (personalized learning), continuously assessing the performance and providing real-time feedback (Koumpouros, 2024; UCAT, 2024).

Figure 6.
AI integration in online classes for faculty (public domain)

Internet of Things (IoT)

IoT, as a network, is a concept that is rapidly gaining headway in the education industry. It refers to an interconnected set of computing devices, mechanical and digital machinery, or people that exchange data across networks without requiring application-to-application or application-to-computer interaction (Kiran, 2019). Educational institutions areexploring this innovative technology to enhance teaching and learning capabilities, contribute to interactive learning possibilities, boost productivity, and offer real-time learning experiences (Eimicke at al., 2023). By integrating IoT technology, universities can create a sophisticated environment that empowers students (Eimicke et al., 2023) and allows those students familiar with technology to use it as an effective educational tool, giving them more control over their learning process.

IoT Application in Education

The flexibility of IoT applications and solutions directly influences classroom teaching and learning. These applications and education enhance the classroom experience and facilitate student learning in new ways by connecting devices, machines, and other objects on a shared network, or Hypergrid, a concept inspired by the movie TRON. Smart buildings, intelligent whiteboards, and other devices now incorporate IoT mechanisms, enabling all participants in the educational process to participate in and reap the benefits of this innovative approach to teaching activities (Holeem et al., 2022).

Examples of technology implementation in educational settings involve
- enabled smart boards (slowly replacing the traditional chalkboards and textbooks in classrooms) (Mhlongo et al., 2023)
- interactive holograms for medical anatomy (Medical Holography™)
- virtual conferencing (e.g., Zoom.us, Microsoft Teams™, Cisco Webex.com, Slack.com [external communication & collaboration])
- Blackboard Collaborate, Blackboard Collaborate Ultra, a classroom platform for higher education settings, has gone through several name changes to accommodate the continued growth and needs of higher education systems (class collaborate, now Class for Web) (Elsamanoudy et al., 2020).

Artificial Intelligence of Things (AIoT)

A crucial aspect of the evolutionary changes in higher education infrastructures, involves the integration ofinnovative digital platforms (learning and teaching models) (Shabir, 2024). It is the responsibility of educational leaders to take the lead in allocating and integrating AIoT technology,

as it can significantly improve the teaching environment, even for more complex subjects such as science and mathematics (Shabir, 2024).

Figure 7.
AI and IoT (public domain)

AIoT Application in Education

AIoT creates a widely accessible educational platform that enables interactive learning, ensures the safety of educational facilities, increases productivity, and provides real-time learning experiences (Ferreira et al., 2024; Holeem et al., 2022; InVideo.ai, 2024). Teachers can use online AIoT methods to grade students more efficiently and provide helpful internet resources, enhancing the learning experience. Some of the most beneficial uses of AIoT in education include facilitating communication between students and teachers, improving energy efficiency, and reducing operational costs (Engageli, 2024). AIoT can provide deeper insights into the teaching and learning processes. This transformative potential can inspire a hopeful vision for the future of education. Examples of AIoT include Google Colab™, Node-Red™, Machine Learning (interactive educational applications and materials) (Ferreira et al., 2024; Zhang et al., 2024).

Engagement, Learning, and Belonging

During the February 2024 University of Phoenix Faculty workshop, the virtual presentation of *Introducing Live Collaboration in Synthesia*, Victor Riparbelli, CEO and co-founder of Synthesia, a company that creates AI-generated video content, discussed user preferences: "People want to watch and listen—not read. . . Our brains are wired to understand better and remember visuals" (Boniface-Chang, 2024; Synthesia, 2024).

Research validates these trends, with students favoring video over traditional assignments, instructors preferring the immediate feedback facilitated by video assignments, and positive correlations between usefulness, attitude to use, and student intention to use (Kemp et al., 2024). These findings provide reassurance about the effectiveness of video in education (Ahmed & Al-Jumaili, 2024).

Since its launch in May 2020, Gather.Town™, a proximity-based video conferencing platform that combines two-dimensional game-like features with video-conferencing functionality, has been well-received by educators and students (McClure & Williams, 2021; Zhao & McClure, 2024). Costa's (2020) actionable observations have catalyzed video training initiatives in countless educational institutions. "Through peer support and attending conferences, it became clear that videos were the best option for me in immediately boosting student engagement" (p. 25).

Before students can benefit from video-enhanced pedagogy, educational administrators must inspire and recognize the crucial role of faculty buy-in. This buy-in is essential to facilitating instructors' transition from traditional pedagogy to video approaches. Nordgren and Schonthal's (2022) perceptive recommendations on "overcoming the resistance that awaits new ideas" (p. 89) have gained traction in the field for a reason (Alario-Hoyos et al., 2024; Engageli, 2024). Roadmaps

"overcome ambiguity, cut down on the cost of exploration, and present a clear path to action."
In understanding roadmaps, consider the following discussion as an example of promoting tetanus vaccinations:

> *Psychologists were asked to design a message to convince people to get a tetanus shot and created a variety of messages based on different theories of persuasion. One emphasized the benefits of the vaccine, another stressed the risks and life-threatening consequences of the disease, yet another simply showed a map highlighting a local clinic where people could get a tetanus shot and prompted people to find a time in their schedule that week to stop by the clinic. Twenty-eight percent of people who received the roadmap message got a tetanus shot. (Nordgren & Schonthal, 2022, p. 87-88).*

Video production workshops, self-help manuals (Costa, 2020), and professional training have emerged as powerful tools (LinkedIn, 2024; Synthesia, 2024). These mechanisms have equipped and empowered faculty, igniting their passion for developing foundational video skills and inspiring them to explore new possibilities in their teaching methods.

AI, including InVideo (2024) and Synthesia (2024), has revolutionized video production by automating editing, voiceover, and scriptwriting tasks. With faculty ready to deliver engaging videos and students open to video instruction, the potential of virtual learning platforms is bright and a beacon of hope for the future of education, especially when participants feel a sense of belonging (Crawford et al., 2024).

Research suggests that belonging and academic self-efficacy are intrinsic to optimizing outcomes in a distance learning environment (Yi et al., 2024). Collaborative tools such as Microsoft™ Teams can enhance belonging (Kahu et al., 2024), and digital tools may replace the properties of face-to-face contact (Pei et al., 2024).

Promoting interaction and collaborative learning situations in online environments continues to challenge higher education institutions (Alario-Hoyos et al., 2023). The platform, Engageli, is a potential option for use (Eimicke et al., 2023) and recognizes the importance of a sense of community (Pei et al., 2024), support to settle in (Crawford et al., 2024), and significant elements in creating a sense of belonging. Engageli (2024) combines "the best of in-person and online learning into a single platform to create an experience that is even better than in-person," making every participant feel valued and integral to the learning process.

Looking ahead, Savin-Baden and Burden (2024) suggest that the metaverse aligns with modes of learning that promote collaboration, interaction, application, engagement, and deep approaches to learning that students enjoy.

Calongne (2024) demonstrated how to use the Hypergrid to navigate the metaverse for those ready to explore. An avatar is generated at the starting point when traveling from one internet 'world' to another. The Hypergrid represents a plethora of virtual worlds — around 300 — that allow avatars to travel between them (Savin-Baden & Burden, 2024). Any OpenSim© world connected to the Internet can be on the Hypergrid simply by configuring that setting (Porat et al., 2023). OpenSim© is a software platform generated for biomechanical modeling (think hologram), simulation, and analysis.

Emerging Technology in Education

Emerging technology in education will directly impact the future of learning, which may include the application and/or combination of augmented reality, virtual reality, artificial intelligence, 3D printing, robotics, adaptive learning algorithms, live streaming, social learning, gaming, and simulations, asynchronous learning and microlearning, and many more applications (Almufarreh & Arshad, 2023; Heick, 2023; Rotolo et al., 2015; Simsek, 2024; Zulfiqar et al., 2024). (Figure 1).

Games and Gamification

One helpful educational training and motivation tool includes gameplay (Kumar & Nirala, 2023; UWaterloo, 2024). Game based learning integrates digital and online games into higher educational curricula by designing learning activities (game characteristics and principles) within the learning activities. Examples of game-

based learning are:

- iThinkSmart™, a simulation game to enhance learner's critical thinking skills (Agbo et al., 2023).
- An interactive fictional game between historic Colonial Williamsburg, VA, and the University of Florida utilizing the geography, culture, and characters of Williamsburg (Kumar & Nirala, 2023).
- A university and hospital utilizing the technology VitalSims™, developing games for nursing students with real life scenarios (Kumar & Nirala, 2023).

Gamification is a software application that applies game-like elements and principles in non-game contexts. Integrating these interactive aspects of games in learning models enhances user engagement, motivation, and participation (Dahalan et al., 2024; Kumar & Nirala, 2023). Gamification simulations provide immersive experiences similar to real-world scenarios. Navigating through these scenarios is a way to learn proficiency in new skills or practice in quiet, risk-free environments. Users explore different outcomes and learn from interactive feedback in a simulated space.

- Duolingo™ is a language learning application that uses gaming elements as rewards for completing lessons (Alenezi et al., 2023).
- Khan Academy is considered a gamification app the amplifies learning experiences by providing rewards for completing exercises (Dahalan et al., 2024).
- Quizlet employs a match application that pairs terms that users must complete in a timed exercise.

Future Technology in Education

Quantum computing, when harnessed as an educational instructional platform, has the power to transform complex data analysis at unprecedented speeds. Its advanced capabilities in data analysis, modeling, and simulations can revolutionize how students learn profound concepts, ushering in a new era of education (Alenezi et al., 2023; Simsek, 2024).

The integration of technology platforms and higher education infrastructures contributes to reshaping education. Changes emphasize teachers' adaptability, flexibility, and competency as paradigms are introduced (Kumar et al., 2023). At the same time, students must develop their digital abilities to participate effectively and intelligently in today's cyber world. A balanced blending of human knowledge and technological breakthroughs will open the door for a comprehensive and empowered learning environment as education changes (Menekse, 2023).

Students are demonstrating learning by participating in collaborative online activities, peer-to-peer mentoring, higher education online class discussions, building virtual presentations, and collaborative online meetings (Zoom and Microsoft Teams™) (Menekse, 2023). Advanced technology (generative AI) enhances learning retention by providing objective and consistent feedback (Kumar et al., 2023).

Neuromorphic computing technology uniquely enhances advanced cognitive computing and builds systems that can learn and adapt continuously, which is a promising educational tool. Its real-time learning capabilities hold the potential to significantly enhance the educational learning process based on a current program design (Alenezi et al., 2023; Almufarreh & Arshad, 2023).

Biometric quantum computing has the potential to revolutionize education technologies, such as facial recognition and fingerprint scanning, and enhance security in educational institutions. By integrating these protective technologies to prevent unauthorized access to devices and learning materials, institutions can protect sensitive information and educational resources, ensuring a safe and secure learning environment (Alenezi et al., 2023; Heick, 2023).

Conclusions

Emerging technologies are reshaping the landscape of education, and educators and institutions are the architects of this transformation. With the aid of AI technology, they are enabling personalized learning and meaningful interactions in online learning experiences. The ready accessibility of educational information via computers and smart devices is changing the way we learn. The main challenge for educators and institutions is to learn, adapt, acquire, and apply technology to keep pace with the rapid innovations in teaching. One pedagogical strategy is

learning by teaching, which can be implemented digitally through educational software.

Eliminating external distractions AR/VR creates a learning environment that captivates students. Simulations provide an effective learning method when the conceptual elements serve as a practical benefit. Another benefit of AR is the provision of increased personalization via virtual training rooms, where learners interact with peers or online teachers in real-time.

Consider the benefits of real-time AR/VR: Lessons become real, learning is dynamic and accessible through video simulations. Including any imaginable multidimensional images and creating attention-grabbing animations, learning lessons lead to robust lectures that capture classroom interest. These creative presentations spark curiosity and drive learners to participate in lessons proactively, increasing motivation to continue learning.

References

Agbo, F. J., Olaleye, S. A., Bower, M., & Oyelere, S. S. (2023). Examining the relationships between students' perceptions of technology, pedagogy, and cognition: The case of immersive virtual reality mini games to foster computational thinking in higher education. Smart Learning Environments, 10(16), 1-22. https://doi.org/10.1186/s40561-023-00233-1

Aithal, P. S., & Maiya, A. K. (2024). Innovations in higher education industry – Shaping the future. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7*(4), 283-311. Available at SSRN: https://ssrn.com/abstract=4674658

Ahmed, K. K., & Al-Jumaili, A. A. (2024, March). Adopting video assignments as a tool to improve first-year pharmacy students class engagement. *Annales Pharmaceutiques Françaises, 82*(2), 263-270. https://doi.org/10.1016/j.pharma.2024.01.003

Alam, A., & Mohanty, A. (2023). Learning on the move: A pedagogical framework for state-of-the-art mobile learning. In: N. Sharma, A. Goje, A. Chakrabarti, & A. M. Bruckstein (Eds.), *Data management, analytics and innovation. Lecture notes in networks and systems,* (v. 662, pp. 978-981). Springer. https://doi.org/10.1007/978-981-99-1414-2_52

Alario-Hoyos, C., Kloos, C. D., & Moreno-Marcos, P. M. (2023, May). Promoting student interaction in online educational environments with Engageli. *The Asian Conference on Education and International Development.* https://doi.org/10.22492/issn.2189-101X.2023.10

Alenezi, M., Wardat, S., & Akour, M. (2023). The need of integrating digital education in higher education: Challenges and opportunities. *Sustainability, 15*(4782). https://doi.org/10.3390/su15064782

Almufarreh, A., & Arshad, M. (2023). Promising emerging technologies for teaching and learning: Recent developments and future challenges. *Sustainability*, 15(8), p. 6917. https://doi.org/10.3390/su15086917

Boniface-Chang, G. (2024). Live collaboration, a new way for teams to work together on videos. https://www.synthesia.io/post/live-collaboration-launch

Calongne, C. (2024, April 12). Finding educator freebies in the Metaverse Lyr Lobo. Workshop and presentation 29th Annual TCC Hawai'i Worldwide Online Conference. https://www.slideshare.net › Education

Chugh, R., Turnbull, D., Cowling, M. A., Vanderburg, R., & Vanderburg, M. A. (May, 2023). Implementing educational technology in higher education Institutions: A review of technologies, stakeholder perceptions, frameworks and metrics. Education and Information Technologies, 28(5), 16403–16429. https://doi.org/10.1007/s10639-023-11846-x

Costa, K. (2023). *99 tips for creating simple and sustainable educational videos: A guide for online teachers and flipped classes*. Routledge. https://doi.org/10.4324/9781003442691

Crawford, J., Allen, K. A., Sanders, T., Baumeister, R., Parker, P., Saunders, C., & Tice, D. (2024). Sense of belonging in higher education students: An Australian longitudinal study from 2013 to 2019. *Studies in Higher Education*, 49(3), 395-409. https://doi.org/10.1080/03075079.2023.2238006

Dahalan, F., Alias, N. & Shaharom, M.S.N. (2024). Gamification and game-based learning for vocational education and training: A systematic literature review. *Education and Information Technologies, 29*, 1279–1317. https://doi.org/10.1007/s10639-022-11548-w

Eimicke, W., Kachani, S. & Stepan, A. (2023). *Leveling the learning curve: Creating a more inclusive and connected university*. Columbia University Press. https://doi.org/10.7312/eimi20384

Elsamanoudy, A. Z., Al Fayz, F., & Hassanien, M. (2020). Adapting blackboard-collaborate ultra as an interactive online learning tool during the COVID-19 pandemic. *Journal of Microscopy and Ultrastructure*, 8(4), 213-215. https://doi.org/10.4103/JMAU.JMAU_26_20

Engageli: Revolutionize the way you teach and learn online. (2024). https://www.engageli.com/

Ferreira, R., Sabino, C., Canesche, M., Neto, O.P.V., & Nacif, J. A. (2024). AIoT tool integration for enriching teaching resources and monitoring student engagement. *Internet of Things, 26*(101045), 1-17. https://doi.org/10.1016/j.iot.2023.101045

Hasas, A., Sadaat, S. N., Hakimi, M., & Quchi, M. M.(2024). Interactive learning in Afghanistan: Feasibility of implementing IoT connected devices in classrooms. *American Journal of Smart Technology and Solutions (AJSTS), 3*(1), 1-10. https://doi.org/10.54536/ajsts.v3i1.2342

Heick, T. (2023). The future of learning: What are the best examples of emerging education technology? 10 specific examples of emerging education technologies. *TeachThought Staff* https://www.teachthought.com/the-future-of-learning/emerging-education-technology/

Holeem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers, 3*(2022), 275-285. https://doi.org/10.1016/j.susoc.2022.05.004

InVideo AI. (2024). Create videos with text prompts: Student engagement by supplementing an LMS with a learning commons communication tool. *Active Learning in Higher Education*, 25(2), 303-316. https://invideo.io/

Iqbal, M. Z., Mangina, E., & Campbell, A. G. (2022). Current challenges and future research directions in augmented reality for education. *Multimodal Technologies and Interaction, 6*(75), 1-29. https://doi.org/10.3390/mti6090075

Kahu, E. R., Thomas, H. G., & Heinrich, E. (2024). A sense of community and camaraderie: Increasing student engagement by supplementing an LMS with a Learning Commons Communication Tool. *Active Learning in Higher Education*, 25(2), 303-316. https://doi.org/10.1177/14697874221127691

Kemp, A., Palmer, E., Strelan, P., & Thompson, H. (2024). Testing a novel extended educational technology acceptance model using student attitudes towards virtual classrooms. *British Journal of Educational Technology, 55*(5), 1833-2418. https://doi.org/10.1111/bjet.13440

Kiran, D. R. (2019). Internet of Things. *Production planning and control: A comprehensive approach.* (p. 495-512). Elsevier. https://doi.org/10.1016/B978-0-12-818364-9.00035-4

Kitcharoen, P., Howimanporn, S., & Chookaew, S. (2024). Enhancing teachers' AI competencies through artificial intelligence of things professional development training. *International Journal of Interactive Mobile Technologies (IJIM), 18*(2), 4–15. https://doi.org/10.3991/ijim.v18i02.46613

Koumpouros Y. (2024). Revealing the true potential and prospects of augmented reality in education. *Smart Learning Environments, 11*(2), 1-62. https://doi.org/10.1186/s40561-023-00288-0

Kuhlmann, S. L., Plumley, R., Evans, Z., Bernacki, M. L., Greene, J. A., Hogan, K. A., Berro, M., Gates, K., & Panter, A. (2024). Students' active cognitive engagement with instructional videos predicts STEM learning. *Computers and Education, 216,* 1-20. https://doi.org/10.1016/j.compedu.2024.105050

Kumar, D., Hague, A., Mishra, K., Islam, F., Mishra, B. K., & Ahmad, S. (2023). Exploring the transformative role of

artificial intelligence and metaverse in education: A comprehensive review. *Metaverse Basic and Applied Research, 2*(55),

1-12. https://doi.org/10.56294/mr202355

Kumar, D. & Nirala, S. (2023). Emerging skills and technologies for teaching and learning. *International Journal of Creative Research Thoughts (IJCRT), 11*(10), 1-10. https://doi.org/10.1729/Journal.36389

LinkedIn. (2024). Creating video training. https://www.linkedin.com/learning/topics/video-2

Matovu, H., Ungu, D. A. K., Won, M., Tsai, C.-C., Treagust, D. F., Mocerino, M., & Tasker, R. (2023). Immersive virtual reality for science learning: Design, implementation, and evaluation. *Studies in Science Education, 59*(2), 205-244. https://doi.org/10.1080/03057267.2022.2082680

McClure, C. D., & Williams, P. N. (2021). Gather.Town™: An opportunity for self-paced learning in a synchronous, distance-learning environment. *Compass: Journal of Learning and Teaching*, 14(2), 1-19. https://doi.org/10.21100/compass.v14i2.1232

Medical Holography™. (2024). Deep perception™ live holography. https://realviewimaging.com/medical/

Mhlongo, S., Mbatha, K., Ramatsetse, B., & Dlamini, R. (2023). Systematic review and meta-analysis: Challenges, opportunities, and prospects of adopting and using smart digital technologies in learning environments: An iterative review. *Heliyon, 9*(6), e16348. https://doi.org/10.1016/j.heliyon.2023.e16348

Nordgren, L. & Schonthal, D. (2022). *The human element: Overcoming the resistance that awaits new ideas.* (1st ed.). Wiley.

Pei, L., Poortman, C., Schildkamp, K., & Benes, N. (2024). Teachers' and students' perceptions of a sense of community in blended education. *Education and Information Technologies*, 29(2), 2117-2155. https://doi.org/10.1007/s10639-023-11853-y

Porat, E., Shamir-Inbal, T., & Blau, I. (2023). Teaching prototypes and pedagogical strategies in integrating Open Sim-based virtual worlds in K-12: Insights from perspectives and practices of teachers and students. *Journal of Computer Assisted Learning, 39*(4), 1141-1153. https://doi.org/10.1111/jcal.12786

Riparbelli, V. (2024, February 29). *Introducing live collaboration. Synthesia.io.* https://linkedin.com/events/7163832649692729346/

Rotolo, D., Hicks, D., & Martin, B. R. (2015). What is emerging technology? *Research Policy, 44*(10), 1827-1843. https://doi.org/10.1016/j.respol.2015.06.006

Savin-Baden, M., & Burden, D. (2024). *The Metaverse for learning and education* (1st ed.). Chapman and Hall/CRC. https://doi.org/10.1201/9781003413875

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education, 18*(54), 1-23. https://doi.org/10.1186/s41239-021-00292-9

Shabir, M. (2024). Does financial inclusion promote environmental sustainability: Analyzing the role of technological innovation and economic globalization. *Journal of the Knowledge Economy*, *15*(1), 19-46. https://doi.org/10.1007/s13132-022-01035-5

Simsek, A. (2024). How will education look like in the future? *Contemporary Educational Technology*, *16*(3), ep518, 1-14. https://doi.org/10.30935/cedtech/14794

Synthesia. (2024). Turn text to video in seconds. Faculty Training and Development University of Phoenix Video creation workshop. https://www.synthesia.io/

UCAT: Emerging technologies and their impact on higher education. (2024). *UCAT Utah College of Applied Technology.* https://www.ucats.org/emerging-technologies-and-their-impact-on-higher-education.html

UWaterloo: Gamification and game-based-learning. (2024). *Centre for Teaching Excellence.* University of Waterloo. https://uwaterloo.ca/centre-for-teaching-excellence/catalogs/tip-sheets/gamification-and-game-based-learning

Wang, Q., & Li, Y. (2024). How virtual reality, augmented reality and mixed reality facilitate teacher education: A systematic review. *Journal of Computer Assisted Learning, 40*(3), 1276-1294. https://doi.org/10.1111/jcal.12949

Yi, S., Zhang, Y., Lu, Y., & Shadiev, R. (2024). Sense of belonging, academic self-efficacy and hardiness: Their impacts on student engagement in distance learning courses. *British Journal of Educational Technology, 55*(4), 1703-1727. https://doi.org/10.1111/bjet.13421

Zhang, Z., Wen, F., Sun, Z., Guo, X., He, T., & Lee, C. (2024). Artificial intelligence-enabled sensing technologies in the 5G/Internet of Things era: From virtual reality/augmented reality to the digital twin. *Advanced Intelligent Systems, 4*(2100228). https://doi.org/10.1002/aisy.202100228

Zhao, X., & McClure, C. D. (2024). Gather.Town™: A gamification tool to promote engagement and establish online learning communities for language learners. *RELC Journal, 55*(1), 240-245. https://doi.org/10.1177/00336882221097216

Zulfiqar, F., Raza.R., Khan, M. O., Arif, M., Alvi, A., & Alam, T., (Member, IEEE). (2024). Augmented reality and its application in education: A systematic survey. *ISEEE Access, 11,* 143250-143271. https://doi.org/10.1109/ACCESS.2023.3331218