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Review Article

Technology Enhanced Learning Environments: Reflecting on the 21st Century Learning

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Abstract: Teaching and learning in the 21st Century has undergone transformation. Notably, the incorporation of modern technology into teaching and learning has created learning environments where learners are empowered with digital resources that have innovative, collaborative, and participatory opportunities besides many other dynamic learning capabilities. However, there is a need to explore the pedagogical developments around the incorporation of such technology into teaching and learning. This paper examines peer-reviewed research that explores the quality of the framework around technology-enhanced learning environments (TELE's), their applications, significance, and challenges. The study aims at shaping the understanding of the state of research on technology enhanced learning environments, how it is changing over time and advances a conceptual - driven argument regarding the future of learning in the 21st Century.

Keywords: Learners, technology, learning environment, and learning theory.

INTRODUCTION

The concept of Technology Enhanced Learning Environments (TELE's) focuses on learning that amplifies education environments to real –life applicability. Dawley and Dede [1], in their analysis of learning in virtual worlds states that a technologically enhanced learning environment is any learning space, physical location, context, and learning culture that uses technology to optimize the ability of students to learn. In this regard, learners are not only equipped with the knowledge and skill to as a form of personal development but also as future contributors to the current and future society [1]. Beer, Clark, and Jones [2] expound on the need for such environments stating that Technology Enhanced Learning Environments encourage students to explore their own interests and capabilities using modern equipment. These equipment include but are not limited to open online courses, learning management systems, social networks, game-based learning, augmented reality, and virtual world environments among other specific outcome-specific resources.

Given the vast catalogue of technology-enhanced resources, Bronack [3] highlights the need to identify the most efficient and effective tools. Arguably, there is no unique standard for the most efficient technologically enhanced learning environment. Groff [4], suggests that technology-enhanced learning environments are the most promising when they integrate technology in the pedagogy of teaching and learning with considerations for of its disruptive properties to conventional learning. TELE's facilitate and enhance the applicability of efficient e-learning models where learners use technology to develop and build their knowledge, skills, and competencies.

The 21st Century, being a technology-driven generation, learning environments have moved from the actual physical environment to virtual, remote, indoor, or even outdoor; meaning that it is not necessarily a place at all. Waheed and Kaur [5] state that the establishment of efficient technologically enhanced learning environment considers the help of the tutors or facilitators that are well versed with the technological resources and learning support tools. Evidently, there is a significant trend in the recouping capacity of such centered technological involvement. According to Chen-wen and Jung-Tsung [6], technology-enhanced learning environments have shown superiority over the traditional learning method since the use of technology comes with flexibility, affordability, and accessibility.

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Furthermore, it does not have temporal or spatial limitations.

There are developing issues around the use of TELEs more so on the student's ability to self-regulate, and in other cases, leverage their ability to apply self-regulated learning (SRL) to acquire knowledge. On one hand, the rapid development and advancement of technologies such as the wide-area networks, computer devices offer students the opportunity to be at the center of modern learning pedagogies [7]. On the other hand, e-Learning platforms, computer-based, virtual classrooms, social media, simulation, augmented reality, learning management systems (LMSs), and complemented techniques are key contributors to fast technological adoption, familiarization, and utilization among the students. With increased complexities that technology exhibits, pedagogies must evolve to maximize the benefits that come with the innovations surrounding teaching and learning.

The purpose of this study's exploration of Technology Enhanced Learning Environments and 21st Century learning is to increase literature on the developing impact of teacher-guided and student-centered instructional advancement on the process of students' conceptual developments. Increased knowledge on the theoretical basis of Technology Enhanced Learning Environments heightens the understanding of possible expansion in the field. Additionally, an understanding of such learning environments is fundamental in exploring the future of learning and its contribution to more futuristic societal growth and development. The specific consideration of the teacher (tutor) perception and their contribution to the efficient adaptation of Technology Enhanced Learning Environments helps future researchers understand the evolving role of the teacher in the 21st Century. This study explores the opportunities and challenges offered to tutors. The literature review section below considers the theoretical and practice considerations behind student-centered learning, a brief history, and their chronological development through Technological Enhanced Learning Environments.

THEORY AND PRACTICE

Basis for Technology-Enhanced Learning and Technology- Enhanced Learning Environments

As the human understanding of technology-enhanced learning evolves with the digital age, it is also important for societies to appreciate the fundamental significance of learning theories that guided the practical questions. Harasim [8] states that the basis for technology-enhanced learning stems from the increased use of ICT in different contexts, objectives, and forms in various platforms for teaching and learning. Notably, the study into Technology Enhancing Learning is an interdisciplinary and dynamic field [8]. The subject connotation undergoes significant modification as new technologies emerge and their niche in education widens. However, despite the influx, there are predominant learning paradigms on Technology Enhancing Learning [9]. Kondo and Mselle [10] add that such paradigms include the catalytic effect of computer technologies for societal change, and the presumed fit between the current society and the future societies using ICT as the major link. Evidently, theoretical, and epistemological exploration of Technology Enhanced Learning filter use of technology in re-designing and facilitating research of technology-enhanced learning environments.

According to Wong and Bakar [11], most education systems aim at producing students with good grades but fail to emphasize on the quality of those results. The traditional system encourages:

"*mindless memorization and regurgitation of facts and figures, some of which they do not know their application"* [11].

The mode of learning is slowly shifting from the traditional system to the embrace of technology-enhanced learning. Higgins, Xiao, and Katsipataki [12], conducted an empirical study on the difference between education with technology and education without technology. The difference is evident in the range of applicability and ease of adaptability by students that have undergone the former. Tabu and Leonard [13], add that technology has become part of a students' daily life since it enables learners to access content in a new, exciting way. Additionally, leaners can connect and interact with resources such as videos, games, images and foster collaboration and communication.

In the past decade's most countries, invested in digital technologies for learning. It became inevitable for various major sectors, including education, to exist outside technology. However, the challenge on the amount of technology used quickly peaked [10]. Consequently, there rose the need to manage the developed learning content using a management system. Christopher [14] explains that technology used for learning takes either the form of supervised or unsupervised machine learning. Unsupervised machine learning includes tools such as the use of electronic technology, the internet, satellite broadcasts, audio and videoconferencing, bulletin boards, chat rooms, webcasts, and presentations among many others. On the other hand, supervised machine learning for education technology used for learning encompasses related terms, such as supervised online learning and web-based learning that includes internet or computer-based learning restricted to the use of computers including laptops, tablets, smartphones, and many other regulated digital devices [15]. The realization of a technology-centered management system aims at integrating the evolving Technology-Enhanced Learning resources

with more efficient Technology- Enhanced Learning Environments to improve learner experience.

A study by Zitter and Hoeve [16], on the development of hybrid learning environments focuses on how schools be transformed to become environments of teaching and learning that make individuals lifelong learners and prepare them for the 21st Century. The authors arguments was similar to OECD focusing on the technology-rich innovative learning environment. Groff [4] states that through the introduction of new and emerging technologies, teaching, and learning in education has been conceptualized to match the 21st Century competencies. From the various common and emerging education-based technology-rich innovative environments, Groff [4] divides them into two groups as shown in the table below: -

Table-1: Common and emerging education-based technology-rich innovative environments

First-Order Innovations	Second-Order Innovation
Blogs, wikis	AR – Augmented reality
Social networking sites	Simulation
Virtual learning environments	Digital games
Interactive whiteboards	Console games
Devices – Laptops, tablets etc.	Remote systems
Digital cameras, scanners, and projectors	Handheld computing
e-Learning	Pico projectors
Digital portfolios	Electronic books

First-order innovations are implemented under the notion that by using those tools together, a different education climate will be produced. in this case, other technologies are more disruptive kinds of innovations and they appear on the periphery of the educational landscape [4]. According to Groff [4], the 'second-order' innovations are slowly gaining attention and traction in the field of education and will likely see increased development and application over the next decade. Nevertheless, Wang and Hannafin [7], point out that for both levels of technologies to be successful, they must rely on design-based research that enhances applicability of these technologies to the learning spaces. In their argument, they point out that these technologies must undergo iterative analysis, design, development, and implementation based on collaboration among researchers and practitioners in the real-world setting [7]. Both Groff [4] and Wang and Hannafin [7] conclude through stating that there is a need to conduct more research on the contextual-sensitive design principles guiding the theories of technology-enhanced learning.

Many of the first-order innovations fall in the category of Web 2.0 technologies, which represent the online learning tools that facilitate collaboration, communication, and engagement [17, 4, 18]. Online learning tools and applications are suitable for different learning styles. For instance, collaborative Wikis are probably among the most diverse educational interventions and are defined as web services with version control on the internet, in which learners without additional tools or HTML knowledge can create and modify web pages, link them as hypertexts and are informed about content changes on request [19].

E-learning has grown tremendously over the years and it offers a great opportunity for both students and instructors to engage electronically with each other and with learning materials such as soft-copies, multimedia, video clips, audio, podcasts, visual presentation etc. [14]. Good examples of e-learning platforms are MOOCs (Massive Open Online Courses) and learning management systems (LMS). MOOCS are worldwide viewed-online learning incorporating a very large number of people with an internet connection. Christensen *et al*. [14] considers the growth of these platforms as a "budding revolution" to education, especially higher education. However, their main concern revolves around what the industry stands to gain from its worldwide adoption especially to individuals that may have lacked access to formal forms of education. Hew [9], identified several advantages of MOOCs which includes problem-centric learning approach, instructor passion and accessibility, and increased peer interaction. In addition, there are elements of active learning, and that the course resources address participants' learning needs [9]. MOOCs have generally eliminated geographical barriers to education although lack of internet access may to a larger extent impact its adoption [21, 20].

Adaptable Learning Theory Framework for Technology Enhanced Learning

Learning theories are tested suppositions over the process learners receive, process, and retain knowledge during learning. Currently, the cognitive, emotional, and environmental influences determine the prevalent learning process. There are three predominant theories of learning. These include Behaviorism, Constructivism, and Cognitivism. Despite their unique application, these theories pose overlapping tendencies in their independent pursuits to explore holistic humanistic learning processes. Constructivism as an educational theory posits that learning processes serves to enrich student's thinking. Learner's earner constructs

knowledge independently. Much of the framework behind Technology Enhanced Learning has strong bearing on influencing the learner to construct their knowledge independently as they work with the new technologies.

Constructivism is a learning theory that holds that people actively construct or make their own knowledge. According to Harasim [8], constructivism theory holds that people learn by constructing their own understanding and knowledge of the world through experience and reflecting upon that experience. Different to didactic approach (instructional) of knowledge acquisition by behaviorism and cognitivism, Harasim [8] argues that the central idea of constructivism is that human learning is constructed, and learners build new knowledge upon the foundation of previous learning. Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories. Harasim [8] argues that the understanding that decisions based on rapidly altering foundations drives this theory.

Cognitive theorists look at the psychological processes invoked in the teaching process and assert that effectiveness pertains to the processes involved in transforming content knowledge into instruction notes. Cognitive theory stresses on the acquisition of knowledge as well as mental growth and development. It focuses on how learning takes place in a student's mental structure from receiving of information, processing of information and the process of retrieving information [13, 8]. Behaviorist theorists equate learning with changes in either the form or repetitions of controlled and observable performance. According to Ertmer and Newby [13], learning happens when a proper response occurs following the presentation of a specific environmental stimulus. Skinner [22] explains that behaviorists assume that learners are practically passive and often respond to environmental stimuli. According to Watson [23], first the learner starts with a clean slate of behavior molded by positive and/ or negative reinforcements. These reinforcements increase the possibility that the antecedent behavior will occur. On the same note, Karpickle [24] argues that behaviorist theory assists in the understanding of student behavior as well as providing an insight on how teachers can gradually shape student behaviors to better their studying.

Information Processing and Knowledge Acquisition

Knowledge acquisition involves the recipient absorbing and storing new information. A successful knowledge acquisition process is realized when the recipient can retrieve the memory. Research on information processing and knowledge acquisition shows that it is much easier to absorb and retrieve information that is well organized and represented. Information processing is crucial in the 21st Century learning as it is the role of presenting information or to provide learning environments for learners, is not only defined by the teachers by several other stakeholders in the industry. A study by Bi *et al*. [25] on improving knowledge acquisition through employing adaptive multimedia in third level technology enhanced learning stem education realizes that it is crucial for learning system seeking to improve learning satisfaction, to increase knowledge gain improvement using various multimedia adaptation. The bulk of information available to learners might overwhelm them and influence the learning satisfaction achieved.

Multimedia adaptation tools used in learning environments include but are not limited to video streaming devices that enable sharing of e-learning content over the Internet. LMSs such as Canvas, Moodle and Blackboard are eLearning platforms or virtual learning environments that provide an unprecedented opportunity to harness captured data relating to student engagement and learning [2]. In addition, they store vast amounts of data on student behavior and social development used to inform and improve online student engagement. The presentation of the vast amount of data influences individual leaner's knowledge acquisition as it is tied to how the mind organizes and represents information. The presentation provided by LMS environment has influenced pedagogy in many ways while at the same time changing the rules of engagement. Learning is enhanced by considering the fundamental properties of human knowledge, and the ultimate function of the desired information. The study report by OECD concludes that the main significance of various e-Learning platform is that it offers great opportunity to both learners and instructors to engage electronically with each other and with learning materials that promotes meaningful learning and development of skills [4]. The ability to centrally develop courses and update them in MOOCs and LMS whenever the need arises, hence, the cost of replacing outdated course materials and retraining teachers and instructors drops significantly Koller and Magnotta [15].

Social Media Learning

Social media tools are the most popular technology-enhanced environments that are transforming the face of interaction in this 21sst Century [26]. The environments offered on social media facilitate the creation and sharing of information, ideas, career interests and other forms of expression via virtual communities and networks [27]. In addition, they have features that allow interaction, engagement, and collaboration. For example, Facebook which is the most used social network has features that provide the opportunity for sharing of course materials, instant messaging, and opportunity to upload files, discussions, and instant notifications [28]. In particular, the discussion tool has been significantly useful in sharing

files, videos, presentations, sheets, and websites. Kalelioglu [29] argues that all these features provide meaningful collaborative learning and development of skills such as critical thinking and problem solving.

Game-based Learning

The inspiration behind the use of game-based learning stems from the need to motivate learners. Motivation is a fundamental aspect of effective learning however it also needs to be sustained through reflection, feedback responses and active involvement for the designed learning to take place [30]. Game-based learning approaches heavily taps onto the learner's involvement, interest, and motivation while at the same time widening the range of learning styles supported [31]. Like other learning environments, a game-based environment promotes collaboration, critical thinking and reasoning while enhancing student-centered learning. According to Patton, the main advantage of game learning is that it offers prompt feedback and allows for "dramatic improvements in engaging the students and their information retention" [32]. Educational games impact students' motivation in various ways. First, gaming offers the player a sense of challenge, learner control, game realism, and opportunity to explore or make informational discoveries. On the other hand, game players are less inclined to read and spend less time with friends. According to a study by Tobia, Fletcher and Wind [33], such students have lower self-concepts and self-esteem, and scored lower on all indices of school learning and achievement. However, despite its favorable aspects, the use of online gaming resources in teaching and learning is limited. According to De Freitas's [34] findings, one of the main barriers of adopting gaming in school is the lack of access to equipment and particularly, the availability of up-to-date video cards/graphics hence making it difficult for the teachers to fully utilize gaming as a learning platform.

Augmented Reality

Current literature shows that augmented reality can increase the level of interaction in classes and allow learners to focus more on practice instead of just theory. Augmented Reality (AR) literary bridges the real and virtual worlds together [3, 35]. The use of augmented reality has widened the learning spheres to the extent where virtual objects used for learning coexists with real environments and this gives the learners an opportunity of viewing abstract concepts and complex spatial relationships, more so, experience phenomena not present in real life [36]. Klopfer and Squire, 2008 add that, just like a game, the use of, augmented reality tools has the characteristics of increasing the level of motivation, interaction, and collaboration. Prior technologies around learning spaces revolved around head mounted display through which the learners could receive virtual information. However, the recent technological evolution has seen the change in terms of its outlook and mode of application to the extent that handheld computers are now being used to relay AR such as mobile devices [37].

There are various developing types of augmented reality resources. Some of the currently available applications of AR include computer simulations, physical models, virtual laboratories, and 3D objects [38, 6]. Broll *et al.,* [39], explores the use of mobile devices in enhancing pervasive capabilities such as location restriction to schools and learning spaces. AR technologies have enhanced the learning experience especially where authentic exploration of both real and virtual objects is involved, for instance, learners are now able to explore scientific phenomena, solar systems, and 3D constructs, among many other virtual possibilities, on their classroom tables [40]. Even with this enhanced learning experience, its utilization and adoption as a learning tool is still a challenge given the expensive nature of the high-end electronics and tools sophistication [3]. Numerous technological issues have been reported by both the learners and students over the application of AR in teaching and learning. Such challenges include the increased risk of device failure especially where multiple devices and functions such as GPS are in use [24, 41]. There are other inherent failures that stem from the specific AR systems under use.

Virtual World Environments

Virtual world learning environments incorporate instructional design for educational purposes. Institutions of learning have become more open to the use of virtual world environments as they deliver assorted courses in a safe environment away from potential real harm and dangers [42]. According to Dawley and Dede [1], virtual worlds such as "Second Life" are designed to create a compelling, participatory, and collaborative experience to the users and often contain a variety of features that are never experienced in the real world. These features include teleporting between sites, aeronautical training, game-based activities, experimentation, role-play, co-creation, critical incident involvement, immersion, and modeling among other practices.

Virtual worlds are not only known for their ability to enhance engagement and learning but also reach diverse groups from different parts of the world [43]. Virtual world environments enhance engagement and learning. Additionally, these virtual worlds shape the cognitive processes that underpin learning, more so when technology-use is being culturally mediated. Technologically mediated learning (via asynchronous learning networks) is necessarily shaped discursively by the practices around technology privileged in a particular cultural milieu [1]. However, just like many other emerging technologies, Dawley & Dede [1] argue that there are some challenges associated with these

environments in that most trainers lack the technical skills and ability, which in turn lowers the motivation to integrate these learning environments in the classroom.

CONCLUSION

As reviewed above, current research affirms that whereas the future is tentative, it is evident that education systems can find assurance in their generated pathway if it navigates towards effective learning technologies evident from the above literature. The alignment of TELE (Technology Enhanced Learning Environments) need not restrict its adaptation to traditional learning pedagogies but on the benefits drawn from the supportive visual and interactive multimedia, self-assessment tools, and instructional guidance. These tools offer more advanced considerations over on the purpose of the learning environment in the 21st Century learning space. The quality of the framework around technology-enhanced learning environments (TELE's) is forthcoming. Evidently, much like other teaching and learning pedagogies, it faces criticism over its applications, significance, and challenges. The understanding of the state of research on the technology enhanced learning environments proves that it is changing over time with most researchers affirming of the development of a conceptual -driven argument regarding the future of learning in the 21st Century.

There is a concern for both educators and policymakers on whether the kind of education offered equips young people with essential skills to enable them cope with modern challenges. The current technological advancement is exceedingly promising for educators, thus opening more opportunities for peer- sharing and continuous development of educators. As technology continues to advance, the concept of TELE is increasingly getting accepted in many developed and developing countries. Technology is widely implemented as a descriptive and inoffensive technique to educational, social, and technological change. While researchers are continuously giving in-depth analysis and drawing insights on the scientific and technological analysis of the modern learning theories, others are exploring the problematic links of TELE for failing to investigate ontological biases. As a result, Beer, Clark, and Jones [2] recommend the need for a more critical approach when dealing with technology and its subsequent impact on education systems. It is evident that the achievement of students differs based on geographical locations because of varying instructional resources and co-curricular activities among the rural, suburban, and urban schools note Kalelioglu [29]. Nonetheless, this analysis realizes that technology-enabled learning environments can close the gap existing between different learning environments. Moreover, such environments not only combine strengths of online learning and face to face environments, but also blend other different learning techniques with the promise of offering equal and better educational opportunities for all students.

REFERENCES

1. Dawley, L., & Dede, C. (2014). Situated learning in virtual worlds and immersive simulations. In Papers, No. 81. *OECD Publishing (NJ1)*.
2. Beer, C., Clark, K., & Jones, D. (2010). Indicators of engagement. *Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney*, 75-86.
3. Bronack, S. C. (2011). *The role of immersive media in online education*. Journal of Continuing Higher Education, 59(2), 113–117.
4. Groff, J. (2013). Technology-rich innovative learning environments. *OECD CERI Innovative Learning Environment project*, 1-30
5. Waheed, M., & Kaur, K. (2019). Students' perceptual quality standards for judging knowledge quality: *Development and validation of a perceived e-learning knowledge quality scale*. Information Development, *35*(2), 319-332.
6. Sutherland, J. (2019). Applying modern virtual and augmented reality technologies to medical images and models. *Journal of digital imaging*, *32*(1), 38-53.
7. Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational technology research and development*, *53*(4), 5-23.
8. Harasim, L. (2017). *Learning theory and online technologies.* Taylor & Francis.
9. Hew, K. F. (2016). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCS. *British Journal of Educational Technology*, *47*(2), 320-341.
10. Kondo, T. S., & Mselle, L. J. (2013). Deploying Technology-Enhanced Learning Environments in Tanzanian Secondary Schools. *International Journal of Computer Applications*, *975*, 8887.
11. Wong, S. L., & Bakar, K. A. (2010). Enriching quality of self-regulated learning through technology-enhanced learning environments. In *IGI Global*.
12. Higgins, S., Xiao, Z., & Katsipataki, M. (2012). The impact of digital technology on learning: A summary for the education endowment foundation. *Durham, UK: Education Endowment Foundation and Durham University*.
13. Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, and constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, *26*(2), 43-71.
14. Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. (2013). The MOOC phenomenon: *who takes massive open online courses and why?* Available at SSRN 2350964.
15. Koller, V., Harvey, S., & Magnotta, M. (2006). *Technology-based learning strategies.* Washington, DC: US Department of Labor. Retrieved from http://www.doleta.gov/reports/papers/tbl_paper_final.pdf

16. Zitter, I., & Hoeve, A. (2012). Hybrid Learning Environments: Merging Learning and Work Processes to Facilitate Knowledge Integration and Transitions. OECD Education Working
17. Bennett, S., Bishop, A., Dalgarno, B., Wayfcott, J., & Kennedy, G. (2012). Implementing Web 2.0 technologies in higher education: A collective case study. *Computers & Education*, *59*(2), 524-534.
18. Harris, A. L., & Rea, A. (2019). Web 2.0 and virtual world technologies: A growing impact on IS education. *Journal of Information Systems Education*, *20*(2), 3.
19. Honegger, J., Ernemann, U., Psaras, T., & Will, B. (2007). Objective criteria for successful transsphenoidal removal of suprasellar nonfunctioning pituitary adenomas. A prospective study. *Acta neurochirurgica*, *149*(1), 21-29.
20. Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *International Review of Research in Open and Distributed Learning*, *15*(1), 133-160.
21. Guzdial, M. (2013, August). Exploring hypotheses about media computation. In *Proceedings of the ninth annual international ACM conference on International computing education research* (pp. 19-26).
22. Skinner, B. F. (2011). About behaviorism. *Vintage.*
23. Watson, J. B. (2013). *Behaviorism*. Worcestershire: Read Books Limited.
24. Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive
25. Bi, D., Li, B., Liu, S., Yi, W., Jiang, M., & Lin, Z. (2019). Influence of pyrolysis and torrefaction pretreatment temperature on the pyrolysis product distribution. *BioResources*, *14*(1), 1185-1197.
26. Bozkurt, A. (2018). Social network sites for communication and learning purposes in a blended learning course. In *Proceedings of the 16th International Symposium Communication in the Millennium* (pp. 274-279).
27. Vurdien, R., & Puranen, P. (2020). Enhancing Students' Intercultural Competence and Learner Autonomy via Facebook Telecollaboration. In *Multicultural Instructional Design: Concepts, Methodologies, Tools, and Applications* (pp. 646-666). IGI Global.
28. Mahmud, M. M., & Wong, S. F. (2018). Facebook and collaborative learning: An empirical study on online assessment. *International Journal of Learning and Teaching*, *4*(2), 107-113.
29. Kalelioglu, F. (2017). Using Facebook as a Learning Management System: Experiences of Pre-Service Teachers. *Informatics in Education*, *16*(1), 83-101.
30. Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & gaming*, *33*(4), 441-467.
31. Freina, L., & Ott, M. (2015, April). A literature review on immersive virtual reality in education: state of the art and perspectives. *In the International Scientific Conference eLearning and Software for Education* (Vol. 1, No. 133, pp. 10-1007).
32. Patton, C. M. (2015). Employing Active Learning Strategies to Become a Facilitator, Not the Authoritarian: A Literature Review. *Journal of Instructional Research*, *4*, 134-141.
33. Tobias, S., Fletcher, J. D., & Wind, A. P. (2014). *Game-based learning*. In Handbook of research on educational communications and technology (pp. 485-503). Springer, New York, NY.
34. De Freitas, S. (2006). *Learning in immersive worlds*: A review of game-based learning. Google Scholar.
35. Klopfer, E., & Squire, K. (2008). Environmental detectives: *the development of an augmented reality platform for environmental simulations.* Educational Technology Research and Development, *56*(2), 203–228.
36. Arvanitis, T. N. (2009). Human factors and qualitative pedagogical evaluation of a mobile augmented reality system for science education used by learners with physical disabilities. *Personal and Ubiquitous Computing*, 13(3), 243–250.
37. Fung, M. (2000). An Internet- based learning portfolio in resident education: the KOALA™ multicenter program. *Medical education*, *34*(6), 474-479.
38. Martín-Gutiérrez, J., Mora, C. E., Añorbe-Díaz, B., & González-Marrero, A. (2017). Virtual technologies trends in education. *EURASIA Journal of Mathematics Science and Technology Education*, *13*(2), 469-486.
39. Broll, W., Lindt, I., Herbst, I., Ohlenburg, J., Braun, A. K., & Wetzel, R. (2008). Toward next-gen mobile AR games. *Computer Graphics and Applications*, IEEE, 28(4), 40–48.
40. Johnson, L. F., Levine, A., Smith, R. S., & Haywood, K. (2010a). *Key emerging technologies for elementary and secondary education.* Education Digest, 76(1), 36–40.
41. Lebeck, K., Kohno, T., & Roesner, F. (2019, February). Enabling multiple applications to simultaneously augment reality: Challenges and directions. In *Proceedings of the 20th*
42. Saleeb, N., & Dafoulas, G. A. (2011). Effects of virtual world environments in student satisfaction:
43. Joseph, B. (2007). *Global Kids, Best Practices in using Virtual Worlds for Education.* Second Life Education Workshop, SL Community Convention, Chicago: WordPress, 7-14.

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