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A Historical and Modern Perspective on the Role of Play and (Digital) Games in Pedagogy

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ABSTRACT

This article discusses the historical and contemporary role of play and games in pedagogy, from ancient civilisations to modern educational practices. It shows how play has been used as a learning tool across cultures and centuries, highlighting its developmental importance and the pedagogical value. Moreover, the importance of both analogue and digital games in early childhood education is addressed, discussing their impact on the development of cognitive, social and motor skills. The article also looks at the integration of play in primary and secondary education, including the use of educational robots and digital games. Finally, the benefits and challenges of incorporating different forms of play and games into formal educational settings are shown. By bringing together historical perspectives with current practice, insights into the continuing importance of play-based learning and its potential applications across different educational levels are provided.

KEYWORDS

play-based learning; educational games; digital game-based learning; historical overview; education; challenges and benefits

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1. Playing to Learn: An Evolutionary Journey from Ancient Civilizations to Modern Pedagogy

1 The concept of playing as a method of learning can be traced back to the beginning of civilization. Even as mankind evolved, play emerged not merely as a recreational pastime but as a crucial mechanism for survival as through play, early humans experimented with their surroundings, understood cause and effect, and acquired critical life skills. This function of play can still be seen with animals that learn in their early days mostly through playing – be it hunting or hiding.

2 The ancient civilizations recognized the value of play as a medium for learning. The Egyptians, for instance, utilized board games such as Senet to impart lessons on strategy and fate. Similarly, in ancient Greece, children's toys such as dolls, spinning tops, and knucklebones were more than mere amusements; they were instruments that mirrored adult activities, preparing the young for societal roles. Plato, one of the most influential philosophers of all time, endorsed the educational potential of play. In his seminal work, *The Laws*, he stated that children should grow into learning through games, which would instill a sense of pleasure and love for learning, ultimately benefiting the state. However, Plato also had a critical view of playing when stating that he saw it as irrational and morally questionable.[1] Aristotle too concurred, emphasizing that play, being a natural activity for children, should be harnessed for educational purposes.

3 Ancient civilizations, despite vast geographical and cultural divides, displayed an intrinsic understanding of the role of play in personal and societal growth. Play served multifaceted roles: entertainment, ritual, societal preparation, and importantly, education. The civilization along the Nile River, one of history's earliest, had a rich tradition of games. The Game of Senet, for instance, dates back to 3100 bc. Played on a rectangular board with squares, *Senet* was deeply symbolic, echoing themes of life, death, and fate.[2] Beyond recreation, the game mirrored and taught strategies essential for navigating the unpredictable nature of life. Another game, *Mehen*[3], named after a snake deity, was played on a coiled, round board and is believed to have ritualistic significance. These games, often buried with the dead, were seen as essential tools for the afterlife, indicating their profound societal value.

1 D'Angour, Armand (2013). Plato and Play. Taking Education Seriously in Ancient Greece. American Journal of Play, 5(3), 293–307.

2 Piccione, Peter A. (1990). The historical development of the game of Senet and its significance for Egyptian religion [Dissertation, University of Chicago, Chicago].

3 Crist, Walter, Voogt, Alex de, & Dunn-Vaturi, Anne-Elizabeth (2016). Facilitating Interaction: Board Games as Social Lubricants in the Ancient Near East. Oxford Journal of Archaeology, 35(2), 179–196. https://doi.org/10.1111/ojoa.12084

4 The Indian subcontinent also has a rich history of board games. Perhaps the most famous, *Chaturanga*[4], is considered a precursor to modern chess. Played on an 8x8 grid, it mirrored the four divisions of the ancient Indian army: infantry, cavalry, elephants, and chariots. By playing, participants honed their strategic skills and understood the importance of each division's role. In a more spiritual vein, the game of self-knowledge, was symbolic of life's journey, intertwined with Hindu philosophy.[5] It functioned as a teaching tool, educating players about the human experience's spiritual nature, emphasizing virtues, vices, and destiny. Board games like *Liubo*[6], with its complex rules and intricate boards, were popular in Ancient China. Archaeological findings indicate its significance in rituals and divination, showing the interplay between game, morality, and spirituality. Confucian thought, deeply embedded in Chinese culture, emphasized the importance of rites and proper conduct. Games and play often acted as conduits for these teachings. By participating in certain games, children would internalize societal values, understand their roles, and learn the nuances of human relationships, vital for harmony in a Confucian society.

5 By the time of the Medieval era, there was a shift towards more formalized learning structures, with monastic schools and later, universities, emphasizing rote memorization and strict discipline.[7] However, the innate human understanding of the value of play never disappeared entirely. Within the confines of these institutions, there were often moments of recreational learning, as demonstrated by the proliferation of strategy-based board games like chess and the widespread interest in theatrical performances, both of which engaged the mind and fostered critical thinking. Morality plays and mystery plays served dual roles. While they provided entertainment, they were deeply pedagogical, teaching Christian morals and stories from the Bible to a largely illiterate population. Tournaments and Jousts, while showcasing martial prowess, also had elements of theatricality and play. Knights would assume personas, and their actions in the tournament ground often mirrored chivalric tales, thereby providing both entertainment and moral lessons.

6 The Renaissance period witnessed a resurgence in the appreciation of play as a learning tool. Thinkers like Erasmus and Montaigne highlighted the importance of play and curiosity as natural pedagogical techniques.[8] The period's emphasis on humanism

4 Averbakh, Yuri, & Kasparov, Garry (2013). A History of Chess: From Chaturanga to the Present Day. Russell Enterprises.
5 Shimkhada, Deepak (1983). A Preliminary Study of the Game of Karma in India, Nepal, and Tibet. Artibus Asiae, 44(4), 308. https://doi.org/10.2307/3249615
6 Shimizu, Yasuji (2014). The development and regional variations of liubo. Board Game Studies Journal(8), 1–25.
7 Begley, Ronald B., & Koterski, Joseph W. (2005). Medieval Education. Fordham Series in Medieval Studies, No. 4. Fordham University Press.
8 Charlton, Kenneth (1965). Education in renaissance England. Routledge library editions. History of education: v. 1. Routledge.

and individual growth further pushed educators to explore holistic learning methods, re-introducing play as an essential component. The Renaissance saw the creation of more sophisticated toys, including automatons and intricate board games. These not only entertained but also served to teach societal norms, logic, and strategy.[9] The Renaissance is often synonymous with artistic expression. Theatre, particularly in places like Italy and later England, became a central cultural activity. Plays by Shakespeare and his contemporaries, while offering critique and comedy, were also educational, touching upon themes of politics, humanity, and philosophy.

7 The late 19th and 20th centuries saw the emergence of various educational theories advocating for play as a central mode of learning. Friedrich Froebel, often heralded as the father of the kindergarten system, believed that play was the purest form of child-centric learning. For Froebel, toys (or gifts as he called them) were tools that unlocked understanding and stimulated cognitive development[10]. Following in this lineage, Maria Montessori emphasized the role of the environment and hands-on, play-based activities in child learning. Her Montessori method[11], which prioritizes self-directed exploration and discovery, continues to influence educational practices globally.

8 Later, Jean Piaget's theory of cognitive development[12] underscored the integral relationship between play and learning. Piaget asserted that children construct knowledge by interacting with their environment, with play serving as the primary mode of this interaction during the early stages of development. Because of these findings by Piaget, several efforts have been undertaken to integrate play into school curricula – mostly however for children at kindergarten.[13] Vygotsky, another towering figure in the realm of developmental psychology, posited that play was the leading source of development during early childhood. For Vygotsky, the imaginary situations created during play provided children with new perspectives and understanding, fostering cognitive and social development.[14]

9 Mechling, Jay, & Sutton-Smith, Brian (1987). Toys as Culture. The Journal of American Folklore, 100(397), 350. https://doi.org/10.2307/540344

10 David, Tricia, Goouch, Kathy, & Powell, Sacha (2016). The Routledge international handbook of philosophies and theories of early childhood education and care. The Routledge international handbook series. Routledge.

11 Lino, Dalila Maria, & Parente, Cristina (2018). Play and Learning in Early Childhood Education. In C. A. Huertas-Abril & M. E. Gómez-Parra (Eds.), Advances in early childhood and K-12 education (AECKE) book series. Early childhood education from an intercultural and bilingual perspective (pp. 147–163). IGI Global, Information Science Reference. https://doi.org/10.4018/978-1-5225-5167-6.ch010

12 Ginsburg, Herbert P., Opper, Sylvia, Kober, Hainer, & Hanenberg, Georgia (2004). Piagets Theorie der geistigen Entwicklung (9. Aufl.). Klett-Cotta.

13 Pellegrini, A. D. (2009). The role of play in human development. Oxford University Press.

14 Nicolopoulou, Ageliki (1993). Play, Cognitive Development, and the Social World: Piaget, Vygotsky, and Beyond. Human Development, 36(1), 1–23. https://doi.org/10.1159/000277285

2. The Role of Games in (Early) Childhood Education

9 Analogue games, those free from digital components, hold a critical place in early childhood education. Their traditional, hands-on nature offers a range of tactile learning experiences, crucially shaping a child's cognitive, social, and motor development. A significant advantage of analogue games for young learners lies in their ability to deliver sensory experiences. As Hursen and Salaz[15] found out, authentic childhood games have a positive impact on learning English vocabulary. Games like building with blocks, puzzles, or bead-threading activities prompt children to physically interact with objects. This hands-on engagement allows them to understand different material properties while improving their motor skills, hand-eye coordination, and spatial understanding. Take block-based play as an example. Beyond the joy of building, arranging and balancing, these blocks require considerable thought. When a structure falls, children naturally think about the reasons, promoting early problem-solving and analytical thinking.

10 Similarly, puzzles, even the simpler ones designed for early learners, challenge children to recognize patterns and different shapes and colors. Successfully placing pieces together enhances their spatial skills[16] and boosts their confidence, highlighting the importance of achieving goals. Group games, like *Duck, Duck, Goose* or *Simon Says*, are essential in teaching foundational social behaviors. These collective activities introduce children to structured play, emphasizing the importance of rules and taking turns. Such group engagements develop key social skills, highlighting the value of teamwork and providing an introduction to group dynamics. Additionally, physically active analogue games play a pivotal role in developing a child's gross motor skills. Activities such as *Ring Around the Rosie* or *Hopscotch* might seem purely recreational, but they significantly aid in improving balance and body coordination. It's also vital to recognize the emotional aspects of analogue games. Within the boundaries of the game, children experience a range of emotions—from the happiness of success to the disappointment of failure. These experiences introduce them to understanding and managing their emotions, forming the early stages of emotional intelligence.

15 Hursen, Cigdem & Salaz Dursun (2016). Investigating the Effects of Authentic Childhood Games in Teaching English. Cypriot Journal of Educational Sciences, 11(2), 58-62.

16 Munoz-Rubke, Felipe, Will, Russel, Hawes, Zachary & James, Karin H. (2021). Enhancing spatial skills through mechanical problem solving. Learning and Instruction 75.

11 When it comes to easy board games, children can practice various skills regarding language, mathematics[17], and (social) sciences[18] but these games also help when it comes to social, emotional, and cultural understanding as O'Neill and Holmes[19] found in their literature review. Board games are not only used within families in a more recreational setting but also by teachers in formal education. Board games are indispensable tools for hands-on learning across all age groups. Beyond their immersive environment, they establish a playful yet competitive setting, making content exploration more engaging. Errors in gameplay become insightful, highlighting areas for deeper understanding.

12 The game board itself acts as a visual anchor, connecting diverse information. Through game elements and group discussions, learning is enhanced. Well-designed games weave in repetition subtly, ensuring retention. They present challenges that urge players to apply their knowledge, transforming abstract ideas into tangible lessons. Team-based gameplay ensures collective comprehension, and board games cater to varied learning preferences, from concrete examples to overarching narratives. Moreover, these games don't just sharpen cognitive skills. They bolster communication and collaboration, emphasizing the power of teamwork. In professional contexts, such games can even rejuvenate working dynamics.[20]

13 The advent of technological advancements has integrated digital games into children's daily experiences, prompting rigorous academic discourse around their implications during the formative years of early childhood. This period, characterized by significant cognitive, social, and emotional growth, becomes crucial when evaluating the potential influence of digital interfaces. Through a critical examination of the advantages and challenges of digital gaming during these pivotal years, we can gain insights into their developmental implications.

14 Digital games, having become an integral part of children's free time activities as studies prove[21,] have the capability to provide individualized learning encounters. Contemporary gaming platforms often incorporate adaptive algorithms that modulate the dif-

17 Gasteiger, Hedwig & Moeller, Korbinian (2021). Fostering early numerical competencies by playing conventional board games. Journal of Experimental Child Psychology, 204

18 Robinson, Guy M., Hardman, Michael & Matley, Robert J. (2021). Using games in geographical and planning-related teaching. Serious games, edutainment, board games and role-play. Social Sciences & Humanities Open, 4(1).

19 O'Neill, Daniela K., & Holmes, Paige E. (2022). The Power of Board Games for Multidomain Learning in Young Children. American Journal of Play, 14(1), 58–98.

20 Treher, Elizabeth N. (2011). Learning with board games: Tools for Learning and Retention. http://destinagames.com/pdf/board_games_tlkwhitepaper_may16_2011r.pdf

21 Medienpädagogischer Forschungsverbund Südwest (Ed.). (2023). KIM-Studie 2022. Kindheit, Internet, Medien. https://www.mpfs.de/studien/kim-studie/2022/

ficulty based on the child's interaction, effectively situating the child within Vygotsky's zone of proximal development22. This is a domain where optimal learning transpires as tasks strike a balance between simplicity and complexity. Moreover, the multimodal elements embedded in these games – ranging from visual animations to auditory cues – align with diverse learning modalities, potentially facilitating cognitive engagement and retention. On the interpersonal skill development front, certain digital platforms promote essential non-cognitive skills. Specific games necessitate adherence to rules, strategizing, or even delayed gratification, potentially promoting cognitive flexibility, patience, and strategic planning. The rise of collaborative online gaming platforms also introduces children to virtual teamwork, communication, and conflict resolution, as they collaboratively navigate goals and virtual group dynamics. Educational digital games can thus be useful and effective teaching tools as they are usually motivating and providing an alternative way of presenting educational content.[23]

15 However, concerns have been expressed regarding the extensive use of digital games for children. The foremost being the health implications of prolonged screen interaction[24,] which might promote sedentary behavior patterns and consequent health concerns. Another significant consideration is the challenge of content appropriateness. The expansive digital realm can inadvertently expose children to content that might not be developmentally suitable, posing potential cognitive and emotional risks.[25] Another dimension of this discourse highlights the potential overshadowing of traditional tactile learning experiences by digital interactions. Conventional play methodologies, involving tangible tools and toys, are instrumental in fostering fine motor skills, creativity, and spatial awareness. These experiences, rooted in physicality, offer developmental benefits that may not be entirely replicable on digital platforms.

16 While playing and games is of great importance in primary school education, the use of digital games is not that widely spread. The reasons for that are varied – depending on personal characteristics of teachers[26] as well as their beliefs about the achievements

22 Shabani, Karim, Khatib, Mohamad, & Ebadi, Saman (2010). Vygotsky's Zone of Proximal Development: Instructional Implications and Teachers' Professional Development. English Language Teaching, 3(4), 237–248.

23 Manesis, Dionysios (2020). Digital Games in Primary Education. In I. Deliyannis (Ed.), Game Design and Intelligent Interaction (pp. 87–96). IntechOpen.

24 Männikkö, Niko, Mendes, Liliana, Barbosa, Fernando, & Reis, Luis Paulo (2014). Health determinants related to digital game playing: A systematic review. Journal of Health Science, 4(3), 53–63.

25 Stoilova, Mariya, Livingstone, Sonia, & Khazbak, Rana (2021). Investigating Risks and Opportunities for Children in a Digital World: A rapid review of the evidence on children's internet use and outcomes. https://www.end-violence.org/sites/default/files/paragraphs/download/investigating-risks-and-opportunities-for-children-in-a-digital-world.pdf

26 Rüth, Marco, Birke, Adrian, & Kaspar, Kai (2022). Teaching with digital games: How intentions to adopt digital game-based learning are related to personal characteristics of pre-service teachers. British Journal of Educational Technology, 53(5), 1412–1429. https://doi.org/10.1111/bjet.13201

with digital games[27] or limited availability of technical infrastructure in schools. In contrast to digital games, the use of educational robots in primary schools is gaining importance. Primary school children are naturally curious, adaptable, and drawn to play. Within this stage of development, educational robots provide a possibility to link playful activities with formal learning experiences[28]. A key advantage of educational robots is their physical presence. Unlike digital tools that are exclusively screen-based, robots offer tangible interaction. This hands-on engagement resonates with primary school children who benefit from kinesthetic learning, which involves understanding through physical activity and touch. By programming and working with robots, children engage in a type of play that stimulates both their senses and their minds. Moreover, working with robots enhances the social aspect of learning. When children work in groups or pairs with robots, they often communicate, cooperate, and work together to achieve a common goal. This playful interaction fosters skills such as teamwork, effective communication, and problem-solving. Hence, robots are not just tools for learning but also catalysts for developing interpersonal skills.[29] In terms of curriculum integration, robots are versatile tools and thus also more widely accepted by teachers. For example, in math, students can explore geometry and spatial concepts by programming robot movements. In language subjects, robots can be used to enhance storytelling, while in science, their sensors can assist in simple experiments and data collection.

3 The role of play and games in secondary education

17 In lower secondary education, play serves as a bridge between the play-intensive primary years and the more structured and discipline-focused higher secondary years. As students in this bracket are typically in early adolescence, they are still in the process of forming their identities, establishing independence, and solidifying peer relationships. Play provides a safe environment for experimentation and self-expression. For instance, role-playing scenarios can allow students to explore various social situations, understand different perspectives, and develop empathy.[30] Simultaneously, team

27 Beavis, Catherine, Rowan, Leonie, Dezuanni, Michael, McGillivray, Christie, O'Mara, Joanne, Prestridge, Sarah, Stieler-Hunt, Ccolleen, Thompson, Roberta, & Zagami, Jason (2014). Teachers' Beliefs about the Possibilities and Limitations of Digital Games in Classrooms. E-Learning and Digital Media, 11(6), 569–581. https://doi.org/10.2304/elea.2014.11.6.569

28 Anwar, Saira, Bascou, Nicholas Alexander, Menekse, Muhsin, & Kardgar, Asefeh (2019). A Systematic Review of Studies on Educational Robotics. Journal of Pre-College Engineering Education Research (J-PEER), 9(2). https://doi.org/10.7771/2157-9288.1223

29 Malvezzi, Monica, Alimisis, Dimitris, & Moro, Michele (Eds.). (2021). Education in & with Robotics to Foster 21st-Century Skills: Proceedings of Eurorobotics 2020. Springer.

30 Kraus, Anja (2008). Das „performative Spiel" als didaktischer Weg zur Körperlichkeit des Kindes in der Sekundarstufe I : Das „performative Spiel" als ein didaktischer Weg zur Körperlichkeit des Heranwachsenden. Vierteljahresschrift für Wissenschaftliche Pädagogik, 84(2), 167–178.

sports or group games can foster collaboration, leadership, and group dynamics, essential skills as they gear up for more complex social interactions in the coming years.

18 Moreover, the academic pressures begin to mount in lower secondary years, with students facing new subjects, examination formats, and increased workload. Play in their free-time (analogue as well as digital games) can serve as a stress-reliever, providing necessary mental breaks that can enhance concentration and memory retention when they return to their studies. It's also during these years that students begin to develop advanced cognitive abilities, including abstract thinking and problem-solving. Strategically designed games or puzzles can nurture these skills, allowing students to apply theoretical knowledge in practical, playful contexts. When it comes to school, analogue games are used in sports lessons or drama but their frequency and importance for cognitive learning are decreasing. Digital games are used in form of quizzes like Kahoot to teach or test knowledge.[31]

19 Moving to higher secondary education, the nature of play becomes even more nuanced. The focus shifts from free play to structured, purposeful activities that resonate with their emerging adult identities and future aspirations. At this stage, play takes the form of simulations, debates, mock events, or even entrepreneurial endeavors. For example, a business simulation game can offer students insights into market dynamics, financial planning, and strategic decision-making, all within a playful, risk-free environment. Similarly, digital games that align with curriculum topics can provide an engaging platform to delve deep into subjects, ensuring comprehensive understanding and application. Socially, as students form more mature relationships and grapple with complex emotional experiences, play in the form of theater, group projects, or community service can offer outlets for expression, reflection, and connection. These experiences not only enhance interpersonal skills but also contribute to personal growth and self-awareness.

4 Digital Game-Based Learning

20 While defining the general concept of game can be challenging[32], the term Digital Game-Based Learning – often also referred to as game-based learning – is relatively

31 Sotola, Lukas K., & Crede, Marcus (2021). Regarding Class Quizzes: A Meta-analytic Synthesis of Studies on the Relationship Between Frequent Low-Stakes Testing and Class Performance. Educational Psychology Review, 33(2), 407–426. https://doi.org/10.1007/s10648-020-09563-9

32 Stenros, Jaakko (2017). The Game Definition Game. Games and Culture, 12(6), 499–520. https://doi.org/10.1177/1555412016655679

straightforward: it pertains to the use of digital games, whether on computers, consoles, mobile devices, or browsers, to achieve learning and teaching objectives. Different approaches can be adopted for this purpose. One method involves the use of Serious Games, which are games primarily designed for purposes other than entertainment.[33] Over recent decades, various subcategories of Serious Games have emerged which include educational games designed for instructional purposes, Games for Health aiming to enhance players' health awareness, and Games for Change that intend to induce changes in attitude or behavior. Another approach is the use of Commercial-off-the-Shelf-Games, which are primarily for entertainment. These games can also be incorporated into instructional settings whereby their primary advantage is their engaging design, which immerses players more profoundly into the game world. Another way to integrate digital games into education is by having students create their own games using appropriate programming environments like Scratch or Alice. James Paul Gee, a leading expert on Digital Game-Based Learning, observes a profound similarity between learning and digital games, stating, games and learning, (if games are well-designed) engage humans at a deep level of pleasure.[34] Furthermore, Gee[35] explored how well-designed computer games can effectively initiate learning processes. From his initial set of in summary 13 learning principles, he groups them into three categories: The first category is summarized as empowering learners: Here, the emphasis is on granting learners autonomy and responsibility which also aligns with self-determination theory. Self-Determination Theory (SDT) by Edward Deci and Richard Ryan[36] is a comprehensive framework for understanding human motivation and personality. At its core, it delves into the intrinsic and extrinsic factors that influence individuals' behavior and decisions. The theory emphasizes the significance of three intrinsic psychological needs: autonomy, competence, and relatedness. Autonomy emphasizes the importance of self-regulation and the freedom to make choices without external pressures or influences. In the realm of education, this translates to students having agency over their learning processes. Competence is about mastering skills and gaining expertise, which in educational settings means students being able to grasp concepts and achieve mastery over their subjects. Relatedness pertains to the need to feel connected and have meaningful relationships with others, suggesting that learning is a communal activity, and students learn best when they feel a sense of belonging and connection to

33 Michael, David R., & Chen, Sandra L. (2005). Serious games: Games that educate, train, and inform. Muska & Lipman.

34 Gee, James Paul (2008). Learning and games. In K. Salen (Ed.), The Ecology of Games: Connecting Youth, Games and Learning. (pp. 21–40). The MIT Press.

35 Gee, James Paul (2007). Good video games + good learning: Collected essays on video games, learning and literacy. New literacies and digital epistemologies: Vol. 27. Peter Lang. 2008.

36 Ryan, Richard M., & Deci, Edward L. (2000). Self-determination theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. American Psychologist, 55(1), 68–78.

their peers and educators. Drawing a connection between SDT and digital game-based learning provides insightful perspectives. Digital games often offer environments where players can exercise autonomy, making choices that influence game outcomes. They allow players to progressively build competence, offering challenges that match players' skill levels and allowing for skill acquisition at a comfortable pace. Furthermore, multiplayer games and collaborative learning platforms promote relatedness, as players or learners collaborate, compete, or simply interact, forging virtual bonds and relationships. Incorporating the principles of SDT into digital game-based learning can elevate the educational experience. When learners feel that they are in control (autonomy), are presented with challenges that they can overcome (competence), and can collaborate or compete with their peers in meaningful ways (relatedness), they are more likely to be motivated and engaged. This harmonization of intrinsic needs and digital game mechanics has the potential to revolutionize educational methodologies, making learning a more personalized, immersive, and socially enriching experience.

21 Apart from autonomy, Gee[37] also mentions some more elements that are used to empower learners in digital games. Characteristics of good games in this category bolster players' sense of efficacy. Co-Design suggests that players should feel their actions influence the game. Choices made alter the course and, by extension, the outcome. Similarly, Customization allows players to tailor gameplay to their learning style. Games often accommodate this by offering varying difficulty levels or alternative solutions. However, this occurs in a protected environment where the in-game consequences of failure are minimal. Identity in games is about assigning players new roles, making them understand the reasons behind their in-game training and tasks. Finally, Manipulation refers to the significant influence players have over the game environment, leading them to feel more aligned with their in-game characters.

22 The category problem-based learning emphasizes solving problems rather than rote memorization. Digital games fundamentally consist of intriguing problems addressed with specific tools. Players receive constant feedback on their actions, training them to tackle these challenges. The game design ensures that obstacles or problems progressively intensify. Gee also mentions the concept of pleasantly frustrating[38] which means that challenges should be manageable to maintain engagement without leading to excessive frustration. Ideally, this results in a state of flow.[39] What is more, games

37 Gee (2007)

38 Gee, James Paul (2004). Learning by design: Games as learning machines. Interactive Educational Multimedia(8), 15–23.

39 Beard, Karen Stansberry (2015). Theoretically Speaking: An Interview with Mihaly Csikszentmihalyi on Flow Theory Development and Its Usefulness in Addressing Contemporary Challenges in Education. Educational Psychology Review, 27(2), 353–364. https://doi.org/10.1007/s10648-014-9291-1

also often require players to master specific tasks before introducing new elements which means information is provided either when needed for a task or upon a player's request. There are two more concepts in the category problem-solving: the fish tank concept means that games initially reduce complexity, introducing more elements gradually and, finally, the sandbox concept allows players to explore without fear of consequences. Additionally, games excel in emphasizing the reasons behind practicing certain skills. The third and last category, deep understanding, comprises two concepts. System thinking highlights the increasing prevalence of complex systems in the world, such as environmental pollution, economics, or immigration. These systems consist of numerous interacting variables. Games themselves are complex systems, helping thus lay the groundwork for systematic thinking. Moreover, games provide a context where learning through experience takes precedence over mere verbal explanations.

23 With all these concepts in mind, it seems that digital games make a good learning tool for schools. Since the beginning of the 21st century, there have been many approaches to bringing videogames into education. Several research projects and pilot projects as well as meta-studies have been carried out to prove their use for learning in general, learning languages[40], nurture creativity[41], science and mathematics[42] and so on. However, the efficacy of digital games in facilitating desired learning outcomes hinges on multiple factors. Careful consideration and integration of these elements can significantly augment the learning experience, ensuring that games are not just recreational, but also pedagogically sound. First and foremost, alignment with learning objectives is essential. Games used in educational settings should be purposefully designed or chosen to complement the curriculum's goals. A game's content and challenges must resonate with the learning outcomes intended for the students. When this alignment is clear, games can effectively reinforce or introduce concepts, aiding in comprehension and retention. Another pivotal factor is the quality of game design. A well-designed game not only engrosses the player but also ensures that the learning process is seamless and intuitive. High-quality games incorporate elements that cater to diverse learning styles, enabling learners to engage with content in a manner most resonant with their individual preferences. The aesthetics, storyline, and mechanics of the game

40 Acquah, Emmanuel O., & Katz, Heidi T. (2020). Digital game-based L2 learning outcomes for primary through high-school students: A systematic literature review. Computers & Education, 143, 103667. https://doi.org/10.1016/j.compedu.2019.103667

41 Behnamnia, Najmeh, Kamsin, Amirrudin, & Ismail, Maizatul Akmar Binti (2020). The landscape of research on the use of digital game-based learning apps to nurture creativity among young children: A review. Thinking Skills and Creativity, 37, 100666. https://doi.org/10.1016/j.tsc.2020.100666

42 Chen, Pei-Ying, Hwang, Gwo-Jen, Yeh, Su-Yin, Chen, Yi-Ting, Chen, Ting-Wei, & Chien, Chih-Hsuan (2022). Three decades of game-based learning in science and mathematics education: An integrated bibliometric analysis and systematic review. Journal of Computers in Education, 9(3), 455–476. https://doi.org/10.1007/s40692-021-00210-y

play a critical role in determining its pedagogical potential. The balance of challenge and skill within a game is also vital. A game that is too easy might fail to engage the students, leading to decreased motivation and learning. Conversely, an overly challenging game can induce frustration and disengagement. The ideal game offers challenges that are commensurate with the skills of the player, thereby providing a conducive environment for flow[43], a state where learners are wholly immersed and engaged. Equally important are the technical aspects of the game. Seamless functionality, user-friendly interfaces, and minimal technical glitches are essential to ensure that the learning process is uninterrupted. Technical difficulties can deter students and disrupt the flow of learning, detracting from the overall educational experience. Moreover, teachers are not likely to use digital games again if they experience too many technical challenges. Teachers generally play a crucial role when it comes to digital game-based learning as their role comprises guiding students, providing context, and bridging the gap between game content and curricular objectives.[44] Their active involvement ensures that games are not isolated tools but integrated components of a holistic learning strategy. This leads to the necessity of integration into teaching. Games should be part of a well-thought didactic scenario, fitting into the teaching methodology, and serving as complements to traditional instructional techniques. Their use should be purposeful, strategically timed, and tailored to the specific learning needs of the students. Lastly, time management is a pivotal consideration. While games can be engaging, there's a risk of students spending disproportionate amounts of time on them at the expense of other vital learning activities. Striking a balance is essential to ensure that games remain productive educational tools and not mere distractions. The essential role of the teacher does not only relate to the transfer of knowledge or skills to other domains but to being game administrator, game tutor, subject matter expert, lecturer, debriefer, and classroom supervisor[45].

5 Challenges Regarding the Use of Digital Games in Schools

24 One of the most pressing pedagogical concerns is the alignment of game content with existing curricula. Commercial games are primarily designed for entertainment which means that their learning objectives might not always resonate with educational goals. This potential misalignment can sometimes make students focus more on the game's

43 Beard (2015)

44 Hayak, Merav, & Avidov-Ungar, Orit (2023). Knowledge and planning among teachers integrating digital game-based learning into elementary school classrooms. Technology, Pedagogy and Education, 32(2), 239–255. https://doi.org/10.1080/1475939X.2023.2175719

45 Berg Marklund, Björn & Alklind Taylor, Anna-Sofia (2015). Teachers' Many Roles in Game-Based Learning Projects. Porceedings of the 9th European Conference on Games Based Learning, 359-367.

entertainment aspects than on its educational value. Furthermore, the dynamic nature of games poses challenges in assessment.[46] Traditional evaluation methods, which rely on linear progress and individual performance, might not capture the essence of learning within the nonlinear and collaborative gaming environment. This calls for the design of innovative assessment tools attuned to the specifics of game-based learning. Additionally, the multifaceted stimuli of games, which can be both visual and auditory, risk causing cognitive overload[47,] particularly for students less acquainted with the gaming milieu.

25 Yet, the challenge is not solely in the realm of pedagogy. Infrastructural issues often surface, especially regarding the hardware and software requirements of modern games. Many educational institutions might find themselves ill-equipped to support the technical demands of such games. Moreover, the digital nature of these tools means regular maintenance and updates are essential, adding to operational complexities. In tandem with hardware and software considerations, a robust and high-speed internet connection becomes essential, especially for multiplayer or online games. However, such network infrastructures may be lacking in numerous educational settings.

26 On the social front, the question of equity and accessibility might provide another challenge. The digital divide is palpable, with not all students having equivalent access to quality digital devices or stable internet connections. This disparity can lead to an uneven learning experience. Beyond access, the immersive world of online games brings with it potential distractions, such as in-game chats and advertisements. There's also the concern of gaming addiction, students' psychological well-being and social dynamics. Coupled with these issues is the imperative of representation and diversity. Commercial games may not always depict an inclusive range of cultures, genders, or abilities, inadvertently fostering stereotypes or feelings of exclusion.

27 Economic concerns are equally critical. The procurement of high-quality educational games calls for significant investment. Schools must weigh the potential educational benefits against the financial spendings. Licensing restrictions further complicate the scenario, as many games might not accommodate classroom or multi-user environments, creating both legal and financial impediments. Reliance on external vendors for game sourcing, updates, and upkeep might also result in unforeseen costs or shifts in

46 Ifenthaler, Dirk, Eseryel, Deniz, & Ge, Xun (2012). Assessment for Game-Based Learning. In Assessment in Game-Based Learning (pp. 1–8). Springer, New York, NY. https://doi.org/10.1007/978-1-4614-3546-4_1

47 Chang, Chi-Cheng, Warden, Clyde A., Liang, Chaoyun, & Lin, Guan-You (2018). Effects of digital game-based learning on achievement, flow and overall cognitive load. Australasian Journal of Educational Technology, 34(4). https://doi.org/10.14742/ajet.2961

service terms. Finally, the integration of games in schools presents cultural and ethical dilemmas. Cultural sensitivity is important, and games designed within one cultural context may inadvertently offend or misrepresent students from another background. Furthermore, the content in many commercial games might not be age-appropriate or could contain violent themes. However, ensuring suitability for educational settings is crucial. The overarching issue of data privacy also emerges, as online games often track user behaviors. In the context of education, safeguarding students' data privacy becomes a priority.

6 Trends and Implications of Digital Game-Based Learning

28 In recent years, the integration of digital games into educational settings has gained substantial traction[48]. Several factors contribute to this trend. Firstly, the ubiquity of digital devices and the inherent familiarity of younger generations with digital interfaces have made the integration process more seamless. Games, being interactive and immersive by nature, align with the experiential learning paradigm, emphasizing active student engagement over passive content consumption. Contemporary educators recognize that digital games can cater to diverse learning styles. Visually compelling narratives and challenges can enhance cognitive engagement, while multiplayer or collaborative games can foster teamwork and communication skills. Furthermore, the adaptability of many digital games, which adjust their difficulty based on user performance, provides personalized learning experiences, catering to individual strengths and areas for improvement.

29 Peering into the future, several emergent technologies hint at the further evolution of digital games in education. The integration of Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) in the context of educational gaming is reshaping the contours of classroom learning. As technology advances, it becomes evident that these tools have the capacity to profoundly influence the pedagogical landscape.

30 Augmented Reality, by overlaying virtual elements onto the physical environment, has the ability to enhance students' interaction with their surroundings[49]. This immersive blending of the real and the digital has seen applications in diverse subjects. For example, in history lessons, AR can bring ancient civilizations to life right in the class-

48 Lengyel, Piroska S. (2020). Can the Game-Based Learning Come? Virtual Classroom in Higher Education of 21st Century. International Journal of Emerging Technology in Learning 15. 112-126.

49 Yu, Jiaqi, Denham, André R. & Searight, Empress (2022). A Systematic Review of Augmented Reality Game-Based Learning in STEM Education. Educational Technology Research and Development 70. 1169-1194.

room, transforming static textbook images into dynamic, three-dimensional entities. Similarly, in science lessons, complex cellular processes can be visualized in real-time, offering students a more tangible grasp of intricate concepts. On the other hand, Virtual Reality transports its users to a completely simulated environment[50]. This deep immersion can be especially beneficial in subjects that require a spatial understanding or where real-world exploration might be challenging. Imagine a geography lesson where students can traverse the Amazon rainforest or climb the peaks of the Himalayas. Not only does this make learning more engaging, but it also offers a sense of presence that traditional teaching tools might lack. While AR and VR redefine how content is presented[51], Artificial Intelligence transforms the underlying pedagogical methods[52]. AI's ability to analyze individual student data means that educational games can be tailored to fit each student's learning pace and style. If a game recognizes a student struggling with a particular math problem, it can adapt itself, offering hints or changing its difficulty level. Furthermore, AI can simulate realistic interactions within games, enabling students to engage in meaningful dialogues with virtual characters, further enhancing their learning experience.

31 However, the application of AR, VR, and AI in educational gaming is not without challenges. Cost implications, the need for specialized hardware, and potential health concerns associated with prolonged VR usage are hurdles to be navigated. Additionally, the effectiveness of these technologies in genuinely enhancing learning outcomes, as opposed to just offering novel experiences, remains a topic of ongoing research. In contemplating the future, it's conceivable that as these technologies mature and become more accessible, they could become as ubiquitous in schools as traditional textbooks are today. The promise they hold to make learning more interactive, personalized, and immersive, could redefine the ethos of education. However, it is imperative that as we embrace these technologies, a balanced approach is maintained, ensuring that they serve to complement, rather than replace, the foundational aspects of teaching and learning.

50 Oyelere, Solomon S., Bouali, Nacir, Kaliisa, Rogers, Obaido, George, Yunusa, Abdullahi A. & Jimoh, Ebunayo R. (2020). Exploring the Trends of Educational Virtual Reality Games: A Systematic Review of Empirical Studies. Smart Learning Environments 7.

51 Chen, Chih-Hung (2020). Impacts of Augmented Reality and a Digital Game on Students' Science Learning with Reflection Prompts in Multimedia Learning. Education Tech Research Dev 68. 3057-3076.

52 Dyulicheva, Yulia Y. & Glazieva, Anastasia O. (2022). Game Based Learning with Artificial Intelligence and Immersive Technologies: An Overview. CEUR Workshop Proceedings 3077. 146-159.

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