

LEARNING BY PLAYING: A CASE STUDY OF THE EDUCATION IN PHOTOGRAPHY BY DIGITAL GAMES

ZDENKO MAGO

Department of Digital Games, Faculty of Mass Media Communication
University of Ss. Cyril and Methodius in Trnava
Námestie J. Herdu 2, 917 01 Trnava, Slovak Republic
E-mail address: zdenko.mago@ucm.sk
ORCID: <https://orcid.org/0000-0001-5182-4016>

ŁUKASZ P. WOJCIECHOWSKI

Department of Mass Media Communication
Faculty of Mass Media Communication
University of Ss. Cyril and Methodius in Trnava
Námestie J. Herdu 2, 917 01 Trnava, Slovak Republic
E-mail address: lukasz.wojciechowski@ucm.sk
ORCID: <https://orcid.org/0000-0002-8608-6225>

MAGDALÉNA BALÁŽIKOVÁ

Department of Digital Games, Faculty of Mass Media Communication
University of Ss. Cyril and Methodius in Trnava
Námestie J. Herdu 2, 917 01 Trnava, Slovak Republic
E-mail address: magdalena.balazikova@ucm.sk
ORCID: <https://orcid.org/0000-0001-7544-0148>

AMIEE J. SHELTON

School of Humanities, Arts and Education
Department of Media+Design+Communication, Roger Williams University
One Old Ferry Road, Bristol, RI, 02809, United States of America
E-mail address: ashelton@rwu.edu
ORCID: <https://orcid.org/0000-0001-8270-5992>

ABSTRACT

Aim. The study aims to explore the current state of digital game-based learning to reflect the extent, possibilities, opportunities, and limitations of its implementation in the specific field of education as visual art, especially photography.



Method. The explorative study employed the method of theoretical analysis of available literature and other secondary sources related to the issue, and subsequently applied the method of an illustrative (descriptive) case study.

Results. Photo modes of commercially available digital games, originally intended to increase the players' retention and participation, have led to the birth of a new art form, virtual photography. The technology of photo modes in a larger variety of recent games has made virtual photography available to significantly more players. Photo modes provide artistic control and creative options alongside a whole catalogue of lenses, camera parameters, and other features, reducing the financial burden associated with the purchase of photographic equipment. Furthermore, photo modes offer more than just a substitutable alternative to traditional photography, as added artistic value is found within virtual worlds.

Conclusions. Despite some limitations regarding the overall implementation of digital game-based learning in photography classrooms, photo modes of commercially available digital games are a suitable tool for educational efforts in photography through both self-development and measurement of outcome-based learning.

Key words: digital games, education, game-based learning, photo mode, photography, serious games, virtual photography.

INTRODUCTION

While some topics regarding the psychology of digital games are under-researched, it is certainly not the case regarding the educational impact of the virtual world. Azita Iliya Abdul Jabbar and Patrick Felicia (2015) published an extensive meta-analysis regarding papers covering the topic of game-based learning during the period of 2003 to 2013 and identified more than three thousand academic papers dedicated to engagement and learning within educational games. Since then, we can only imagine that with the advancement of gaming technology and the continuous digitalisation of our society the interest in the educational potential of games has only increased. Moreover, the overall digitalisation in the field of education, and integration of digital technologies into classrooms, has been a research topic in society for a longer period with gradually increasing importance. According to Marianna Vivitsou, during the period of 2015-2018, "digitalisation was constructed as an ultimate purpose and an all-encompassing matter in education ... In this way, digitalisation emerges as a new hegemony in education, with narratives that are more and less directly referential" (2019, p. 117). The COVID-19 pandemic has significantly changed the status quo resulting in the need for rapid digitalisation of education. This accelerated the practical implementation of digital learning practices and new tools (some of which educational institutions had already been working on) and ultimately made digital learning more effective (Frattini, 2021). At the same time, it led to a more extensive integration of digital games into education processes, as they have been proven an effective tool for learning (see Krouska et al., 2022; Wati & Yuniawatika, 2020).

By means of secondary source analysis, the presented study aims to explore the current state of digital game-based learning in general, while specifically considering various aspects related to the issue, as well as reflecting on the extent, possibilities, opportunities, and limitations of its implementation in the specific field of visual art education. This discourse is subsequently illustrated by the descriptive case study of the utilisation of digital games within the discipline of photography.

The importance, as well as the extent of integration of games into education, has grown from just general entertaining games to include specific educational games. Game-based learning is now seen as an interconnected role and thus represents a starting point for the implementation of various types of games for educational purposes. Johannes Breuer and Gary Bente (2010) state several educational concepts integrating games and digital games to various degrees. Based on an analysis of the characteristics of these various concepts they determined that utilising any type of game distinguishes game-based learning from general entertainment education. Along these lines, serious games are a specific part of game-based learning that partially intersect with eLearning, and Breuer and Bente (2010) further specify that digital game-based learning and classical edutainment games are within that intersection. The area of edutainment via video games has recently expanded to utilize live-action role-playing (LARP) (see Mochocki, 2013; Vanek & Peterson, 2016), even including a LARP crossing gamification [LARP is a type of an interactive role-playing game in which the participants portray characters through physical action, often in costume and with props] (see Kukumbergová & Kabát, 2020).

This gamification of education represents a new construct between entertainment education, game-based learning, and eLearning. Unlike game-based learning, gamification does not use entire games for their educational properties but implements only specific elements from games, as well as digital games principles (e.g., body, badges, leader boards), into the educational process to increase engagement, motivation, and performance of learners (see Chem, 2015; Lee & Hammer, 2011; Nah et al., 2014). Figure 1 illustrates interconnections between the concepts mentioned above.

The theoretical framework of this explorative study is based on the concept of digital game-based learning, combining digital “games with a wide variety of educational content, achieving as good or better results as through traditional learning methods” (Prensky, 2001, pp. 145-146). It is also understood as a section of serious games, primarily with an educational purpose (Breuer & Bente, 2010). The concepts of the game type and its complexity (Chem, 2015) are paramount as keeping players in the flow state simultaneously concerning both the game and the learning is one of the biggest challenges of this educational concept (Prensky, 2001). David R. Michael and Sandra L. Chen define serious games as games “in which education (in its various forms) is the primary goal, rather than entertainment” (2005, p. 17) in accordance with Clark C. Abt (1975), who argued

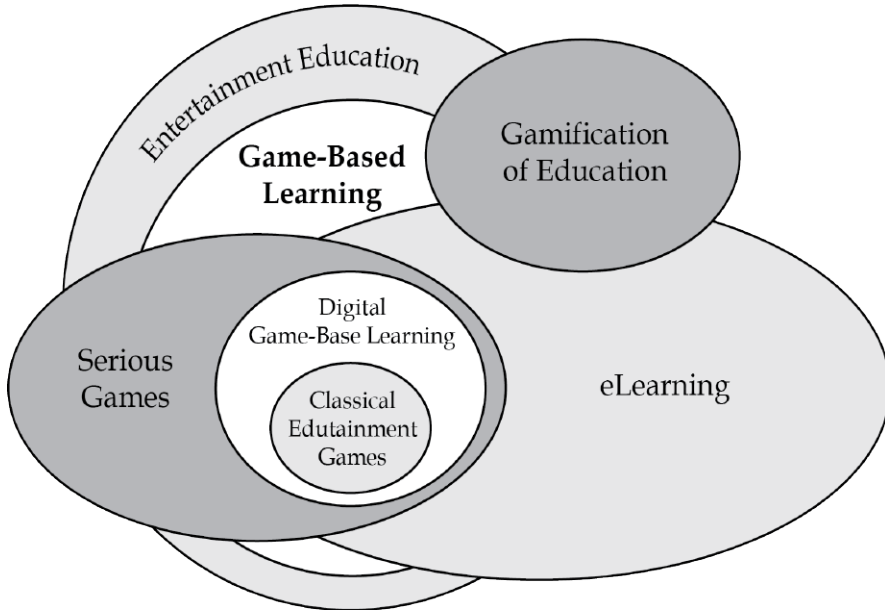


Figure 1

Interconnections between game-based learning and related educational concepts

Source. Authors' elaboration based on the model from "Why so serious? On the relation of serious games and learning", by J. Breuer, & G. Bente, 2010, *Eludamos: Journal for Computer Game Culture*, 4(1), p. 11.

that an explicit educational purpose of serious games predominates their amusement aspects yet does not diminish the importance of their entertainment function. Serious games are applied in various markets that deal with education (e.g., the military, the government, corporations, healthcare) and where the overall acceptance of games as educational tools is growing. However, their general utilisation can still be hardly considered universal (Michael & Chen, 2005).

SELECTED ASPECTS OF DIGITAL-GAME-BASED LEARNING

When debating the educational function of digital games, various aspects such as the topic and setting or gaming context as well as the acceptance of game-based learning are as important as the psychological and pedagogical implications. The topic (not every game mechanic is suitable for every topic), and setting or gaming context (playing at home vs. playing at school, playing alone vs. playing with other people, or playing in the classroom with the instructor providing additional guidance and input) should be taken into consideration as digital games can create a meaningful and oth-

erwise inaccessible context in users (e.g., space exploration, ancient civilisation). For example, an educational game *Playing History 2 – Slave Trade* (Serious Game Interactive, 2013), targeted at elementary and middle school children, created a heated debate in 2015 because of its segment where players had to play Tetris (Pajitnov, 1984) with slaves placed in boxes inside of a ship (Thomas, 2015). The main critique was directed toward treating human beings as objects and the fact that this notion is in direct contrast to the game's educational purpose.

A less discussed but equally important aspect of game-based learning is the acceptance of digital game-based learning. When designing a digital game-based learning tool or opportunity, acceptance by students, teachers, and parents should be considered. A key consideration regards the age of the student being educated by the means of a game. Other variables such as the learners' access to technology (hardware, software, peripheral devices, internet connection), gaming experience, related time spent learning how to operate the game, if the game will be played during a single session or multiple sessions, and learners' potential disabilities (Whitton, 2010) should also be considered

In general, game mechanics and the overall design should be subjected to the educational purpose of the game (e.g., learning outcome). The purpose/learning outcome can take a multitude of forms (see Balážiková, 2023):

- gaining (factual) knowledge (e.g., about mathematics, and evolution);
- gaining skill (e.g., surgeons learning how to perform laparoscopic operations);
- training to overcome certain disabilities (e.g., training motor skills after the stroke, using digital games to treat lazy eye) (see Dale & Green, 2015);
- improving soft skills (teamwork and cooperation, communication skills, negotiation skills, organisational skills, critical thinking, and problem-solving, and management skills including self-management, time management, stress management, project management, work ethics, etc.);
- learning by the means of identification with another person or an idol (e.g., learning empathy, and social skills);
- learning to adopt a certain social role (e.g., the mayor of the game *Sim-City* [Maxis Emeryville, 2013] or parent in the game *The Sims 4* [Maxis, 2014]).

Furthermore, educational games can be aimed at achieving attitudinal changes towards products (see Mago, 2017), or behavioural changes (e.g., recycling). However, the innate persuasion found in these games does not necessarily lead to a change in behaviour; and behavioural change does not necessarily result in attitude change (Jacobs, 2021). It should also be noted that educators should not be limited solely to creating our own specific games from scratch. While harvesting the educational potential of digital

games opens a new window into learning, possibilities to modify existing games or use commercial educational games to meet learning outcomes exist. Both commercial entertainment games (see Mago & Magová, 2016,) and virtual world games (see Alföldiová, 2020) are fun and engaging and can be broadly purchased for educational purposes even if the game does not fully correspond with specific pedagogical intentions.

In recent discourse surrounding the educational benefits of gaming, there has been a notable shift from the question of whether games designed for fun have educational benefits to questions regarding the extent and conditions of such benefits. Nonetheless, there remain attitudes that games with complex interfaces may discourage people less experienced with gaming or that the complex environment of these games may overly exhaust players' cognitive resources (e.g., attention). Thus, both psychological and pedagogical implications should be considered regarding the educational function of digital games. Both clients and creators in the gaming industry should understand the principles of games influencing the learning and acquisition of novel skills. What follows is a brief discussion of the elements that aid learning from digital games as media from psychological and pedagogical standpoints.

Digital games as media incorporate elements that aid learning, *particularly adaptive difficulty*. This is where a challenge too difficult leads to frustration and the potential end of playing. However, a challenge too easy leads to boredom (Dale & Green, 2015). In an educational context, a related concept is called "The Zone of Proximal Development" by Lev Vygotsky (1978, as cited in Plass et al., 2015). To overcome this potential imbalance between skill and required difficulty, games usually incorporate several means of restoring the balance between the player's abilities and the game's difficulty such as tutorials, side quests, difficulty settings, etc. Several games evaluate the player's progress and react when the player is struggling for a long time. For example, in *God of War III* (Santa Monica Studio, 2010), when the player is repeatedly dying at the same spot, the game will offer an option to change the difficulty to easier; or multiple repetitions of the same part can cause spawning of the Aku Aku mask or a closer checkpoint box in *Crash Bandicoot N. Sane Trilogy* (Naughty Dog, 2017). Furthermore, video games of this type allow the gamer overall control over the pace and schedule of learning (Bowman, 1982, as cited in Dowel, 2007). Interaction and feedback are important determinants of experiential learning. Experiential learning, most accurately described as a learning by doing is spontaneous, continuous, and unlimited (Dowel, 2007, p. 1). The individual has an active role within a learning process and reflects upon the experience itself (Whitton, 2010). Important to note, doing something does not necessarily lead to deep cognitive processing (Westera, 2015).

Game attributes such as the complexity, narrative, visual appeal, and music in the game are additional key elements that aid learning. For example, the narrative provides significant learning context and an emotional

release for players while visual and auditory information presented simultaneously is considered to enhance information processing (Annetta, 2010, as cited in Jacobs, 2021). The emotional components of gameplay, such as fun, novelty, and satisfaction that stem from finishing a task, lead to the desire to play in the first place (Wright et al., 2012; Dowel, 2007). Whereas the ability to rehearse until the required or desired level of performance is reached allows for measurable achievements that prolong playtime. In addition, the principles of operational learning/conditioning are found within video games through positive and negative reinforcements and punishments.

Overall, video games are adaptable, engaging, and provide a flexible learning environment with constant feedback (Dale & Green, 2015). Interaction can be understood as a feature of a game or as a social component within a game. Social aspects of gameplay include participation in communities, building friendships, reaching collective goals, social learning, competition/collaboration, sharing progress, tips, impressions, and collaborative learning.

Each of these attributes also has been found to act as a motivational component leading to training that can be distributed within a long period of time (weeks, months, or even years of playing a particular title). According to Gillian Dale and C. Shawn Green (2015), distributed training leads to better learning and transfer of knowledge. Closely related to distributed training is the variability of training found in video games, which generally contributes to the ability to transfer knowledge, skills, and abilities to different areas beyond what was trained for (Dale & Green, 2015). Furthermore, the practice of skills or knowledge within the complex scenarios in the safe environment of video games contributes to the variability of training and function as engaging elements.

This overview presents selected aspects of the learning potential of digital game-based learning primarily from a psychological perspective but include the key components of game mechanics and the overall design. To fully comprehend the topic, it is essential to combine knowledge from various distinct areas such as pedagogy, media literacy, computer-human interaction, game design, and user experience (see e.g., Farkaš, 2021; Magová, 2020; Škripcová, 2022; Švecová et al., 2021). In addition, the design of some digital games addresses a wide spectrum of applications in multiple educational segments. An example is the sandbox game *Minecraft* (Mojang, 2009). The game's outstanding potential for implementation in education regarding the skills development system called STEM (Science, Technology, Engineering, and Mathematics), led to the creation of the game's Education Edition in 2016 (see Allsop, 2017; Mills, 2017). According to Omar Alawajee and Jonathan Delafeld-Butt, *Minecraft's* accessible and creative character enables teachers to customise its versatile use to create conditions for productive learning and at the same time, the game "can facilitate communication and interaction between the learner players and learning content" (2021, p. 49).

CASE STUDY: UTILISATION OF DIGITAL GAMES WITHIN THE EDUCATION IN PHOTOGRAPHY

As mentioned above, digital game-based learning concepts have already been implemented in various disciplines in education, but not all those areas are usually discussed within the literature with the same frequency. One uncommon area is the various disciplines found within art, despite the recognition of digital games as artworks by the National Endowment for the Arts, which formally added video games to its grant scheme in 2011 (Droege, 2011). The creation of digital games involves many aspects of art, especially visual art – which encompasses graphic design, illustration, modelling, animation, and lighting design. Thus, digital games are an ideal tool that can be used in the customisation of visual arts education efforts specifically within the area of virtual photography.

The idea of shared gaming experiences emerged in the mid to late 2000s, with games such as *The Elder Scrolls III: Morrowind* (Bethesda Game Studios, 2002), which allowed players to create postcards from virtual worlds. Later, more sophisticated game cameras brought games even closer to the art of film. Today, *virtual photography*, which has been operating under various names for more than a decade, is considered an emerging art form. Furthermore, gameplay immersion has been expanded by new components like the capability to pause the game at any point (usually apart from cut-scenes), free-roaming the still environment, and the ability to explore different techniques, angles, and scenery that were not possible in past games, all of which have aided the recognition of video games as art.

Virtual photography is a creative endeavour that can function as a substitute for classic photography training. Like many other creative arts, virtual photography often starts as an amateur hobby. Like other non-committal creative pursuits, photography can develop into an immersive activity that sparks passion in people and can lead to more serious, semi-professional, and even professional works. Virtual photographers (also called screenshotters or screenarchers) are most often represented by a group of gamers who do not work directly in game development but are enthusiasts who through the visual art of games present their impressions of the game as well as visual interpretations through their own digital art. These digital photographers manifest their impression of the game by adjusting the image, the choice of the environment, the placement of the character or its expression, and the overall composition of the game. They also disseminate subjective impressions of the game through genre classifications and visual potential of the game's progression and story based on individual aesthetic preferences. This transfer of training (from gaming environments to real-life conditions) accepts that the more similar the process of creating a photograph in a game is to the real-life process, the more transfer of training can be anticipated. However, this is a highly debated idea within art education today (see e.g., Madigan, 2015).

Increased recognition of virtual photographers can be attributed to the increase in recent years of triple-A digital games (or AAA is the gaming industry's equivalent of the word blockbuster), which offer *photo modes* that allow players to capture memorable moments of their virtual adventures through individual in-game shots. The various camera tools found in photo modes allow players to investigate any nook and cranny in the game. Through a virtual camera in a virtual space with virtual objects, and within a set camera radius, there are an infinite number of possibilities for the players creators or artists to develop. According to Chris Taljaard: "Having more control of things like tilt control and in-game weather is what pulled me towards virtual photography in the first place. The more control, the more creative freedom you have to express yourself" (as cited in Quillfeldt, 2021, para. 56). The increasing incorporation of photo modes into digital games has expanded the practice of virtual photography. Photo modes in games provide creative freedom to compose and capture unique images, most often without the need for additional hardware or software.

Additional independent tools such as the Universal Unreal Unlocker (UUU) have been recently developed. This tool allows players to invoke photo mode in any game created by Unreal Engine 4. It gives the player freedom in capturing the right moments, even during cut-scenes, and allows traveling through the virtual world using the *noclip* feature (originally a game cheat). There is also an option to impersonate a ghost, which can appear virtually anywhere even in places where from a standard gameplay perspective, developers never expected it. A good photographer (both virtual and traditional) after finding and taking a picture of a scene is used to turning it into an appealing image. Most people can look at something



Figure 2

Virtual photography containing a glitch from the game Days Gone

Source. The screenshot from the game *Days Gone* (Bend Studio, 2019) taken by Zdenko Mago.

but not be aware of the added quality of that space. These new game tools allow the player to learn to *see* the environment, and the space around them, which is a key educational component. Additionally, digital game environments also contain unintentional development errors that can significantly affect the visual perception of space and add new values to an image. These anomalies are called *glitches* in gameplay (Figure 2):

Glitch represents an unexpected event, an occurrence during which the system swings away from planned operation or behavior ... Pure glitch uncovers something important to an unsuspecting user – it reveals otherwise invisible parts of the system hidden within the functional user interface. (Wojciechowski, 2018, p. 77)

Camera simulators and lens simulators found in video games also provide important lessons about how to approach the craft or what makes a good shot. Photography simulations allow for manual adjustment of a variety of camera settings to see how each one will fine-tune the resulting image, without the necessity to purchase professional photographic equipment. The latest photographic modes in games mimic real photographs by incorporating the same controls physical cameras have. Features such as focal length, aperture, exposure, and colour grading allow photographers to use many of the same techniques and principles as in the real world to compose in-game images. As a function of the photography mode, through the substitution of locating and tilting simple light sources, games such as *Marvel's Spider-Man: Miles Morales* (Insomniac Games, 2020) and *Star Wars Jedi: Fallen Order* (Respawn Entertainment, 2019), offer greater control over lighting by adding customisable spotlights. Other examples include colour grading in *Days Gone* (Bend Studio, 2019), controlling a character's pose, grimace, and positioning in *Cyberpunk 2077* (CD Projekt Red, 2020), adding



Figure 3

Virtual photography from the game Star Wars Jedi: Fallen Order

Source. The screenshot with postproduction effects from the game *Star Wars Jedi: Fallen Order* (Respawn Entertainment, 2019) taken by Łukasz P. Wojciechowski.

a smile to the main character in *God of War* (Santa Monica Studio, 2018), controlling the environment in *Ghost of Tsushima* (Sucker Punch Productions, 2020), and motion blur effect tools in *The Last of Us Part II* (Naughty Dog, 2020). These elements, which do vary from game to game, are used by various YouTubers in published courses in which they lecture and explain the rules of virtual photography (Figure 3) including applications to physical photography (see e.g., *How*, 2021). Photo modes, other independent tools, glitches, and camera simulators, therefore, add an additional dimension to traditional physical photography education.

OPPORTUNITIES AND LIMITATIONS OF DIGITAL GAME-BASED LEARNING IN PHOTOGRAPHY

The educational process is linked to the creative process, which often results in new and original productions. Creativity can be a solution to a scientific problem, a technical solution, or a creation of a work of art, including digital photography from a game. Creativity is a process of constructing or generating new ideas and/or concepts in response to set tasks or needs such as producing new images, reliving new experiences, responding to specific needs (cognitive, emotional, etc.), and solving problems. Thus, the use of the photo modes represents creative activity development, socialisation or even competitiveness within a teaching process.

The main limitation of the application of digital game-based learning in the field of education in photography is essentially the same as it is for other educational domains – the insufficient level of IT equipment in educational institutions, although in this case it is also higher specs for hardware and software required to run modern games containing photo modes. Another limitation may be the relatively high price of commercial game titles. Unlike serious games where it is usually possible to implement one game in a certain general subject area, research focused on the qualities of digital games' photo modes to approach universal usage of one (or at least a few) specific games has yet to be determined.

On the other hand, the common availability of these games on both the market and gaming platforms, combined with an intrinsic motivation to play and the current trend of the in-game photo modes integration, results in the assumption that learners own or have access to at least one game title containing photo mode. It means that even if the implementation of such games in the classroom would not be possible (for any reason, e.g., available hardware), game could more than suitably serve as both an expanding learning tool for gaining practical experience with photographic techniques and practices, and even self-development tool in this field of art outside of an educational institution.

CONCLUSIONS

For the most part, The COVID-19 pandemic contributed to the worldwide acceleration of the implementation of digitalisation processes and tools, naturally creating more space for the implementation of game-based learning, and specifically digital game-based learning. The study aimed to explore the current state of this modern educational concept in general, illustrating its current reach/impact by a case study focused on the less frequent area of applying digital game-based learning to photography education

As the case study indicated, digital games are becoming more immersive and allow players to engage on another level by using in-game photo mode to capture game images from their own perspective. Using the photo mode also simply represents a fun hobby – enjoying snapshots as a virtual tourist. Screenshotting can be a soothing, engaging, and rewarding way to enjoy a game beyond its core gameplay experience. It is also a way to reiterate the original visual language, by creating custom shots of virtual landscapes, portraits, wildlife, still life, and architecture, all the parts of a complex environment in which the player exists.

What developers initially intended as a new method to increase the players' retention and participation, led to the birth of a new art form. Thanks to the hyperrealism of modern digital games that now provide thousands of individual facial animations and random environmental events, game worlds have evolved to become truly spontaneous, life-like landscapes that photographers can capture. Additionally, these animations and events play out slightly differently with each immersion, leading to hours of innovative play.

As art evolves with the technology defining the age in which it was created, virtual photography has grown into recognised visual art. The technology of photo modes in a variety of games has made virtual photography available to significantly more players. This democratisation of tools inevitably leads to more content spreading across the internet, as music production tools have shown. Such tools provide users with artistic control and creative possibilities. Most photographic modes have similar mechanics. In the digital world, users can adjust the focal length or angle of the shot and select the aperture and depth of field. Usually, the brightness of the scene can also be adjusted by adjusting the exposure or contrast. Special effects such as adding flashes and/or lighting effects (by selecting the time of day), extensive scene composition with animated effects (such as fire, flying birds, and butterflies), as well as virtually setting the entire scene to the player's liking (including weather and lighting) can customise the artistic vision.

This work reflects that many technical skills found in traditional photography education are present in digital education, specifically with games with photo modes and games with the camera as an integral part and/or the main tool of the narrative. These tools allow the player-student to choose from a variety of lenses and camera parameters from which one can verify

the properties of the different lenses and cameras and the optical laws of physics. These skills can be learned without financial investments that may preclude traditional photography practice. Virtual photography allows democratisation and egalitarian access to technical facilities, creation, and the overall educational process in this field. Institutional access to technical equipment at educational facilities, higher prices of game titles containing photo mode, or the yet unexplored potential universality of utilising one or a few specific titles may represent limits for the overall implementation of digital game-based learning in photography classrooms. Nonetheless, we conclude that it is a suitable tool for educational efforts in photography through both self-development and measurement of outcome-based learning.

ACKNOWLEDGMENT

The study is a partial outcome of the scientific project supported by Cultural and Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic (KEGA) No. 023UCM-4/2020, titled "The development of digital game studies and design". The study is a partial outcome of the scientific project supported by Cultural and Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic (KEGA) No. 018UCM-4/2021 "Art in mass media – ambient media".

REFERENCES

- [1] Abdul Jabbar, A. I., & Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. *Review of Educational Research*, 85(4), 740-779.
- [2] Abt, C. C. (1975). *Serious games*. Viking Compass.
- [3] Alawajee, O., & Delafeld-Butt, J. (2021). Minecraft in education benefits learning and social engagement. *International Journal of Game-Based Learning*, 11(4), 19-56.
- [4] Alfordiová, A. (2020). Educational use of second life. In Z. Hudíková, L. Škripicová, & N. Kaňuková (Eds.), *Quo vadis massmedia* (pp. 2-10). FMK UCM.
- [5] Allsop, Y. (2017). Computer science: Silent 'C' in 'STEM'. In S. Humble (Ed.), *Creating the coding generation in primary schools* (pp. 119-128). Routledge.
- [6] Baláziková, M. (2023). *Vybrané kapitoly pôsobenia digitálnych hier* [Selected chapters of digital games effects]. FMK UCM.
- [7] Bend Studio. (2019). *Days Gone* [Video game]. Sony Interactive Entertainment.
- [8] Bethesda Game Studios. (2002). *The Elder Scrolls III: Morrowind* [Video game]. Bethesda Softworks.
- [9] Breuer, J., & Bente, G. (2010). Why so serious? On the relation of serious games and learning. *Eludamos: Journal for Computer Game Culture*, 4(1), 7-24.
- [10] CD Projekt Red. (2020). *Cyberpunk 2077*. [Digital game]. CD Projekt.
- [11] Chem, Y. S. (2015). *Games-to-teach or games-to-learn: Unlocking the power of digital game-based learning through performance*. Springer.
- [12] Dale, G., & Green, S. C. (2015). Video games and cognitive performance. In R. Kowert, & T. Quandt (Eds.), *The video game debate: Unravelling the physical, social, and psychological effects of video games* (pp.131-151). Routledge.

- [13] Dowel, J. (2007). *Digital games and learning gains*. OECD. <https://www.oecd.org/education/ceri/39414809.pdf>.
- [14] Droege, C. B. (2011). *NEA: video games are an art form*. (2011). Icrontic. <https://icrontic.com/article/nea-video-games-are-an-art-form>.
- [15] Farkaš, T. (2021). Being digital with my daughter: A continual search for positive effects of digital games. In M. Prostináková Hossová, J. Radošinská, & M. Solík (Eds.), *Megatrends and media: Home officetainment* (pp. 500-515). FMK UCM.
- [16] Frattini, F. (2021). The acceleration of digitalisation within education as a result of COVID-19. *Global Focus Magazine*, 15(1). <https://www.globalfocusmagazine.com/the-acceleration-of-digitalisation-within-education-as-a-result-of-covid-19/>.
- [17] Insomniac Games. (2020). *Marvel's Spider-Man: Miles Morales* [Video game]. Sony Interactive Entertainment.
- [18] Jacobs, R. (2021). Serious games: Play for change. In R. Kowert, & T. Quandt (Eds.), *The video game debate 2: Revisiting the physical, social and psychological effects of video games* (pp. 19-40). Routledge.
- [19] Krouska, A., Troussas, C., & Sgouropoulou, C. (2022). Mobile game-based learning as a solution in COVID-19 era: Modelling the pedagogical affordance and student interactions. *Education and Information Technologies*, 27(1), 229-241.
- [20] Kukumbergová, A., & Kabát, M. (2020). Is LARP the answer to the gamification of events and education? A case study of the ongoing implementation of quests and coins to the core of the festival. *Ad Alta: Journal of Interdisciplinary Research*, 10(2), 224-227.
- [21] Lee, J. J., & Hammer, J. (2011). Gamification in education: What, how, why bother? *Academic Exchange Quarterly*, 15(2), 146-151.
- [22] Madigan, J. (2015). *Getting gamers: The psychology of video games and their impact on the people who play them*. Rowman & Littlefield Publishers.
- [23] Mago, Z. (2017). Seriózne a edukatívne hry v marketingovej komunikácii [Serious and educational games in marketing communication]. *Analýza a výskum v marketingovej komunikácii*, 5(1), 27-34.
- [24] Mago, Z., & Magová, L. (2016). Didaktické možnosti využitia digitálnych hier [Didactic possibilities of using digital games]. In E. Poláková (Ed.), *Ľudské práva a prosociálna výchova: metodická príručka pre učiteľov základných škôl* (pp. 61-75). Belianum.
- [25] Magová, L. (2020). The development of ethical education through digital games: The butterfly effect implementation. *Acta Ludologica*, 3(1), 32-45.
- [26] Maxis. (2014). *The Sims 4* [Video game]. Electronic Arts.
- [27] Maxis Emeryville. (2013). *SimCity* [Video game]. Electronic Arts.
- [28] Michael, D. R., & Chen, S. L. (2005). *Serious games: Games that educate, train, and inform*. Thomson Course Technology PTR.
- [29] Mills, J. (2017). Minecraft as a framework for engagement. In S. Humble (Ed.), *Creating the coding generation in primary schools* (pp. 138-148). Routledge.
- [30] Mochocki, M. (2013). Larping the past: Research report on high-school edu-larp. *International Journal of Role-Playing*, 4, 132-149.
- [31] Mojang. (2009). *Minecraft* [Video game]. Mojang.
- [32] Nah, F. F.-H., Zeng, Q., Telaprolu, V. R., Ayyappa, A. P., & Eschenbrenner, B. (2014). Gamification of education: A review of literature. In F. F.-H. Nah (Ed.), *HCI in business* (pp. 401-409). Springer.
- [33] Naughty Dog. (2017). *Crash Bandicoot N. Sane Trilogy*. [Video game]. Sony Interactive Entertainment.
- [34] Naughty Dog. (2020). *The Last of Us Part II* [Video game]. Sony Interactive Entertainment.
- [35] Pajitnov, A. (1984). *Tetris* [Video game]. A. Pajitnov.
- [36] Plass, J., Homer, B., & Kinzer, C. (2015). Foundations of game-based learning. *Educational Psychologist*, 50(4), 258-283.
- [37] Prensky, M. (2001). *Digital game-based learning*. McGraw-Hill.
- [38] Quillfeldt, T. (2021). *Virtual photographers prove that video games are art*. Laced Records. <https://www.lacedrecords.co/blogs/news/virtual-photographers-prove-that-video-games-are-art>.
- [39] Respawn Entertainment. (2019). *Star Wars Jedi: Fallen Order* [Video game]. Electronic Arts.
- [40] Santa Monica Studio. (2018). *God of War* [Video game]. Sony Interactive Entertainment.

- [41] Santa Monica Studio. (2010). *God of War III* [Video game]. Sony Interactive Entertainment.
- [42] Serious Game Interactive. (2013). *Playing History 2 – Slave Trade* [Video game]. Serious Game Interactive.
- [43] Sucker Punch Productions. (2020). *Ghost of Tsushima* [Video game]. Sony Interactive Entertainment.
- [44] Škripcová, L. (2022). Media literacy in digital games. *Media Literacy and Academic Research*, 5(1), 131-140.
- [45] Švecová, M., Kačincová Predmerská, A., & Kaňuková, N. (2021). Digital skills and the awareness of seniors about virtual reality. *Media Literacy and Academic Research*, 4(2), 119-131.
- [46] Thomas, D. (2015). *I played 'Slave Tetris' so your kids don't have to*. Los Angeles Times. <https://www.latimes.com/entertainment/herocomplex/la-et-hc-played-slave-tetris-kids-20150904-htmlstory.html>.
- [47] ThreeOuttaFive. (2021, November 28). *How to take ADVANCED shots in photo mode – Marvel's Spider-Man: Miles Morales (PS4/PS5)* [Video]. YouTube. <https://www.youtube.com/watch?v=gYRZboqOLQk>.
- [48] Vanek, A., & Peterson, A. (2016). Live action role-playing (LARP): Insight into an underutilized educational tool. In K. Schrier (Ed.), *Learning, education and games. Volume Two: Bringing games into educational contexts* (pp. 219-240). ETC Press.
- [49] Vivitsou, M. (2019). Digitalisation in education, allusions and references. *Center for Educational Policy Studies Journal*, 9(3), 117-136.
- [50] Wati, I. F., & Yuniawatika (2020). Digital game-based learning as a solution to fun learning challenges during the Covid-19 pandemic. In A. P. Putra, N. L. S. Nuraini, P. S. Cholifah, E. Surahman, D. A. Dewantoro, T. A. Rini, R. F. Pradipta, K. M. Raharjo, D. Prestiadi, I. Gunawan, & A. Prastiawan (Eds.), *Proceedings of the 1st international conference on information technology and education (ICITE 2020)* (pp. 202-210). Atlantis Press.
- [51] Westera, W. (2015). Games are motivating, aren't they? Disputing the arguments for digital game-based learning. *International Journal of Serious Games*, 2(2), 4-17.
- [52] Whitton, N. (2010). *Learning with digital games: A practical guide to engaging students in higher education*. Routledge.
- [53] Wojciechowski, Ł. P. (2018). The game is out there. *Acta Ludologica*, 1(2), 76-77.
- [54] Wright, T., Blakely, D. P., & Boot, W. R. (2012). The effect of action video game play on vision and attention. In J. Gakenbach (Ed.), *Video game play and consciousness* (pp. 65-82). Nova Science Pub Inc.