

Developing Graduate Attributes Through Competitive Gameplay and Learning Theories

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Abstract: The term competitive gameplay or gaming is predominantly associated with esports. Esports, a synonym, or abbreviation for electronic sports is an industry that has a global outreach with a lucrative market. This is accentuated by the event driven, business model focus and organised competitive events, often involving sponsorship. These additional characteristics associated with esports is what distinguishes it from traditional or casual gaming. Though esports games can be played individually, they are predominantly viewed as a team activity. Beyond the debate as to whether esports can be classified as a sport, it is an area that has attracted a significant amount of academic research. Research areas have often included esports psychology, esports player health and nutrition and esports management. Some research studies have also reviewed how esports have the potential to equip esports players with relevant 21st century skills such as critical and lateral thinking. One area where esports appears to be under researched is in the relationship between competitive gameplay and learning theories. It can be argued that this is an important consideration when delivering esports from an educational perspective. The aim of this paper is to provide a scoping review of the esports literature identifying empirical research associated with competitive gaming and graduate attributes. Esports game genres will be explored from a gameplay perspective demonstrating via learning theory examples how these games can facilitate graduate attributes in players. Exploring the domain of esports game genres, learning theories and meta-skills, the paper presents a conceptual model illustrating the interrelationship between these areas. The paper also has practical value to educators, who may be as yet unfamiliar with esports, informing them of the subject's educational benefits from a graduate attribute and employability perspective.

Keywords: Esports, Game Genres, Competitive Gaming, Gameplay, Learning Theories, Graduate Attributes.

1. Introduction

Esports is a global phenomenon that attracts wide ranging audience. It is estimated that by 2025, the esports market in terms of people engaged in esports events and competitions will be over 318 million worldwide. It has also been stated that 322.7 million people will become viewers of esports by 2025 (statista, n.d.). Esports, as a concept, has proved difficult to define as it is a discipline that emits multiple perceptions dependent upon perspective. In comparison to traditional or casual gaming, esports is sometimes perceived as competitive multi-player gaming. Whilst it can be argued that most games are competitive and provide a sense of challenge to the player, it is the organised, event and business model driven nature of esports that distinguishes it from traditional gaming. Regardless of their genre and application, the immersive qualities and engagement factor of video games are supported by the concepts of gameplay and game mechanics.

Whilst a game may be unique in terms of gameplay, game genres have certain universal game mechanics that define and distinguish them. There are various perspectives regarding what constitutes gameplay. Gregory, (2014, p. 847) defines the concept as *"the overall experience of playing a game"*. According to Adams (2014, p. 9) gameplay consists of *"The challenges that a player must face to arrive at the object of the game"* and *"The actions that the player is permitted to take to address those challenges"*. In contrast to gameplay, de Byl (2012, p. 206) states that the term *"game mechanic"* refers to *"designed game/player relationships that facilitate and define the game's challenges"*. The learning potential of video games and how they can prepare adolescents for learning relevant 21st century skills for employability success has been documented in the academic literature (Yanes et al., 2023). The work of Prensky (2006) articulates the concept of the *"Digital Native"* referring to someone who has grown up with digital technology. It has often been argued that video games have the potential to positively enhance learning through gameplay (Gee, 2007).

In the context of education and how digital natives learn, empirical research has shown that the application of game-based learning (GBL) and serious games have the potential to inform and educate students on a wide range of topics (Baxter et al., 2021, Yallihep and Kutlu, 2020). According to Videnovik et al., (2023, p.2) *"Game-based learning involves designing and incorporating educational content within a game format, where players actively participate and interact with the game mechanics to acquire knowledge or develop skills"*. For example, empirical research related to games-based learning has focused on how it can be applied to provide students

with critical thinking and problem-solving skills (Qian and Clark, 2016). GBL has also been used as an educational approach to inform students about skills required for undertaking academic research (Abbott, 2019), enhance communication skills (Bodnar and Clark, 2017) and the development of generic graduate attributes (Barr, 2020). Dörner et al., (2016, p.3), define serious games as “...a digital game created with the intention to entertain and to achieve at least one additional goal (e.g., learning or health). These additional goals are named characterizing goals”. Research has also indicated that serious games can support the development of higher order thinking skills (Van Voorhis and Paris, 2019) and future skills (Gurbuz and Celik, 2022). It appears evident that educational games have the potential to assist students in learning relevant 21st century meta-skills for the world of work. The salient aim of this paper is to explore the applicability of esports in the context of competitive gameplay towards enhancing graduate attributes for employability purposes.

2. Defining eSports

Various definitions and perspectives of esports exist in the academic literature. According to Wagner (2006, p.3) “eSports” is an area of sport activities in which people develop and train mental or physical abilities in the use of information and communication technologies”. When defining esports, debates appear to be articulated around the use of the letter “e” in esports and whether esports can be considered a sport (Hamari, and Sjöblom, 2017). Various perspectives abound regarding this debate with esports considered to be a “... manifestation of sportification” (Heere, 2018, p. 21). The phrase esports emits different meanings to stakeholders associated with the industry. It is sometimes seen as a “polymorphic domain” defined by some as an “intellectual exercise”, as a “physical activity” or as a “business activity” (Chap et al., 2022). Esports is viewed as a multi-faceted activity also requiring a wide-ranging degree of skill sets in the context of competitive gaming. According to Zhouxiang (2022, p.1), when compared to traditional sports, competitive gaming necessitates “...skill, strategy, tactics, concentration, communication, coordination, teamwork and intensive training”. The socio-cultural dynamics of esports in the area of competitive gaming are related to the structured approach of the discipline where competitions are organised in leagues and tournaments allowing for the engagement of individual and team competitions (Werder, 2022).

3. Competitive Gameplay and eSports Genres

Similarly to traditional gaming or when engaging with social, casual, and mobile games, esports games also encompass various game genres. In the domain of competitive gaming several popular esports genres exist that consist of differing elements of gameplay and mechanics. It has been articulated in the literature that when engaging in the playing of esports, there are various performance indicators that are taken into account. Examples include cognitive, sensorimotor, and physiological that may vary dependent upon different game genres (Toth et al., 2021). Esports titles, when played competitively, are divided by “tiers” where tier-level esports are associated with prize pool amounts, hours watched and impact of viewings via social media (Migliore, 2021). Hence the perception that esports are viewed as “organized video game competitions” (Jenny et al., 2016, p.4). It has been argued that what drives esports players are the gaming motivations of interactivity and competition. Interactivity is defined as “... the opportunity to communicate and cooperate with other gamers in the online environment, and competition is the mechanism by which gamers can compare themselves to each other” (Bányai et al., 2019). Esports game genres are predominantly classified into five types played globally in events running online and offline: fighting games, first person shooter games (FPS), real time strategy games (RTS), sport video games (SVGs) and multiplayer online battle arena games (MOBA), (Qian et al., 2020).

Table 1: Provides an overview of the some of the salient esports’ genres and characteristics (table by authors).

Esports Game Genre	Definition/Description	Characteristics of Genre	Game Examples
Fighting Games	“... a fighting game is usually a one-on-one combat game, often themed with two humanoid characters punching and kicking each other, and usually seen from a side view” (Burgun, 2013, p. 117).	Player-controlled characters engage in combat in fixed-space, close-quarters setting, sideways, 2D viewpoint (Migliore, 2021).	Street Fighter 6, Tekken 8, Mortal Kombat 1
First Person Shooter Games (FPS)	“FPS games are played from the first-person (egocentric) perspective of a single protagonist who is generally charged with combating enemies while navigating through a three-	Played from subjective experience, camera becomes avatar, emphasises presence,	Counter-Strike 2, Tom Clancy’s Rainbow Six Siege

Esports Game Genre	Definition/Description	Characteristics of Genre	Game Examples
	dimensional environment" (Dobrowolski et al., 2014, p. 60).	sensorially immediate, very immersive (Rehak, 2008).	
Real Time Strategy Games (RTS)	"... viewed as simplified military simulations. Several players struggle over resources scattered over a 2D terrain by setting up an economy, building armies, and guiding them into battle in real-time" (Buro, 2003, p. 1).	RTS' based on strategy, tactical decision making. Play can be turn-based or real-time, use of multiple avatars, resources collected to develop units and structures (Migliore, 2021).	StarCraft II, Warcraft III, Age of Empires II
Sport Video Games (SVGs)	Sometimes referred to as sports simulation games though viewed as "Games which are adaptations of existing sports or variations of them" (Wolf, 2008, p. 272)	Usually have various roles player can engage in (e.g., acting as a player, coach, manager over period of years), (Adams, 1999).	NBA2K, EA Sports FC, NHL
Multiplayer Online Battle Arena Games (MOBA)	"... MOBA games are a subgenre of real-time strategy games in which two teams, typically consisting of five players each, compete against each other with each player controlling a single character" (Mora-Cantalops and Sicilia, 2018, p. 128).	Focus on combat tactics, involves metagaming, individual character development, combat, cooperative team play ((Mora-Cantalops and Sicilia, 2018).	Defense of the Ancients (Dota), League of Legends (LoL)

4. eSports Genres and Graduate Attributes

There are various research studies that have been associated with esports as an activity that relate to developing learning and skills enhancement (Rusk and Ståhl, 2022, Zhong et al., 2022). Similar to traditional gaming, there are commonalities with competitive gaming in terms how game mechanics can facilitate esports players' skill sets for employability purposes and the world of work. Game mechanics such as game spaces, the aspect of time (e.g., turn-based or racing games), decision making through the use of objects in a game (e.g., characters, props, tokens), the embedding of basic and strategic actions, the rules of the game, the aspect of skill (e.g., physical, mental, social), (Burgun, 2013, Schell, 2020, Fullerton, 2019) are prevalent mechanics esports players engage in through gameplay. It can be argued that esports as discipline has a correlation to the graduate attribute and employability literature. Though there are differing definitions regarding the concept of employability within higher education, it can be perceived as "... the development of a range of attributes and skills at university that can be transferred into situations beyond university study" (Gunn, Bell and Kafmann, 2010, p.1). Despite at times being programme specific, graduate attributes can be transferable and generic (Green, Hammer and Star, 2009). Figure 1 provides a conceptual overview of some of the salient graduate attributes obtained through competitive gameplay and the engagement of game mechanics.

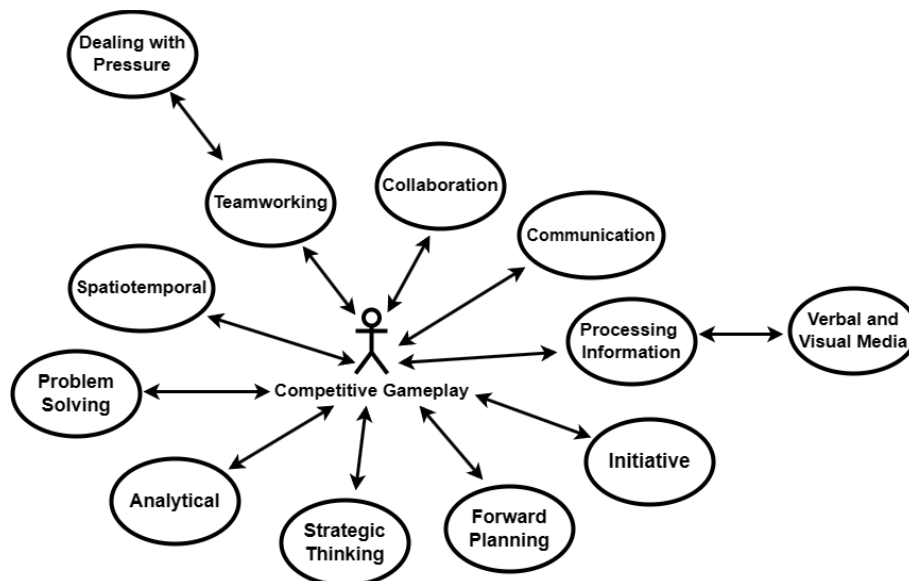


Figure 1: Graduate attributes examples gained through competitive gameplay (figure by authors).

According to Smithies et al., (2020, p.2), esports players possess a range of “*specialized skills and experiences*” with attributes that include: digital intelligence, experience in computer human interaction, communication and enriched cognitive capabilities. Success within an esports team is often dependent upon team members having proficient communication and teamworking skills. Esports players, in certain game genres, have predefined team roles. This is prevalent in MOBAs where teams are formed of five players with differing roles, sometimes consisting of a champion, with the intention of optimising team performance (Buchan and Taylor, 2016). FPS games can, through their unique gameplay, accommodate and support the ability to adapt and learn, metacognition and reflective practice in addition to skills such as “... *attention, visual short-term memory, spatial cognition, and decision-making*” (Neri et al., 2021). Tactical and strategical skills are also important in addition to the skill of sensory-motor control (Toth et al., 2021) such as skills of movement resulting in enhancement of player performance and actions. A study by Reynaldo et al., (2021) found that RTS players outperformed FPS players in relation to cognitive flexibility. RTS players often require skills associated with problem solving, decision making, tactical and reactive control which relates to macro and micromanagement. Macro management refers to “...*long term planning, like strategies conducted in the early game, technology upgrading, and scouting*”. Micromanagement, on the other hand, is associated with the player’s ability to “...*control a group of units in combat or other skirmish scenarios to minimize unit loss and maximise damage to opponents*” (Liu et al., 2014, p. 1). From an employability and graduate attributes perspective, competitive gaming can provide students with a platform to learn, develop and enhance meta skills for the world of work.

5. eSports Genres and Learning Theories

Within the domain of esports, research into the area of learning appears to be “...*an immature research field*” (Ye et al., 2021, p. 363). Academic research has evidenced how esports can facilitate and support the development of meta-skills among esports players (Zhong et al., 2022). However, there appears to be little published research relating to how esports game genres and gameplay can accommodate different learning theories. Meta-cognitive experiential learning is one learning theory that has applicability regarding how esports players learn towards improving their abilities. Experiential learning theory (ELT) identifies learning as “*the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience*” (Kolb, 1984, p.41). For example, the immediate or concrete experiences from having played a game can allow esports players and teams to reflect upon their experiences, conceptualise these and test the implications of these reflections to improve performance in future gaming scenarios.

Social learning theory (SLT), is associated with observational learning, learning from others and also from the direct experience of an individual’s environment (Hong and Craig, 2023). The concept of social learning theory supports learning in esports teams especially when reviewing gameplay from prior tournaments, analysing their performance, collectively providing feedback and advice on how to enhance performance. The theory of social learning also involves cognitive processes where “... *learners internalise and make sense of what they see in order to reproduce the behaviour themselves*” (Horsburgh and Ippolito, 2018, p. 2). The learning theories of constructivism, cognitive and social, are also both directly relevant to aiding learning and enhancing meta-skills from an esports gameplay perspective. Constructivism is associated with the premise that learners devise or construct new knowledge or understanding by engaging through experience or social discourse. It can be argued that constructivism can be related to solving real-world problems through active learning in context. Constructivism also involves learners applying new knowledge to improve upon new or current scenarios with feedback and self-reflection part of the learning activity (Yoders, 2014). New knowledge acquired in mastering various techniques or roles in a game (e.g., a MOBA) through active learning can aid an esports players self-determination and self-efficacy.

Connectivism, a learning theory based on distributive knowledge, also has the potential to facilitate learning in an esports setting. In the context of connectivism, “*Connective knowledge is created by interactions with people who are linked to various networks and thus is distributed across a web of individuals*” (Jung, 2019, p.50). When engaged in MOBA games, esports teams, through network connectivity, can share new knowledge they have learnt through prior matches, this can sharpen decision making in real-time play and allow networked learning to collectively develop and enhance both player and team performance. Table 2 provides an example of five learning theories that can support the learning of meta skills in an esports concept.

Table 2: Examples of learning theories and how they facilitate meta skills through competitive gameplay (table by authors).

Learning Theory	Main Characteristics	Relation to Graduate Attributes and eSports
Experiential Learning (Kolb, 1984)	Learning through experience, learning can occur in any context, process of learning begins in a four-step experiential learning cycle: experiencing (concrete experience), reflecting (reflective observation), thinking (abstract conceptualisation) and acting (active experimentation).	Esports players or teams can learn something new when engaged in a particular game (e.g., a new technique that enhances performance), reflect upon this experience, make sense of it with a plan of action for improvement in addition to testing new ideas.
Social Learning Theory (Bandura, 1977)	Learning viewed as a cognitive process, occurs in social contexts through an observational learning process leading to imitation and enhanced self-efficacy.	Esports players or teams can observe and analyse their performance individually or collectively, learn and reinforce their learning from the behaviours of team members through positive feedback.
Constructivism (Piaget, 1964)	Learners actively construct new knowledge based on their previous experiences and interactions, individuals build a repository of experiences from which they learn.	Massively Multiplayer Online Games (MMOGs), via their design principles can provide scope for a constructivist learning environment (Muñoz Rosario and Widmeyer, (2009), Bonk and Denner, (2005).
Social Constructivism (Vygotsky, 1978)	Learning and knowledge is formed via social interaction through communication, dialogue with peers when engaged in real life tasks. Associated with 'Zone of Proximal Development', 'Intersubjectivity', and 'Enculturation' (Woo and Reeves, 2007).	Enhancement of player performance can be achieved through interaction with coaches, esports team members through collective peer and teacher inquiry, providing guidance through dialogue and feedback.
Connectivism (Siemens, 2005)	Learning viewed as a "network phenomenon", adheres to concept of distributed knowledge, impacted by technology and socialisation (Goldie, 2016).	Esports players can communicate and coordinate strategies through a network of knowledge and expertise, share instructions and enable quick strategic decision making.

6. Conceptual Model: eSports, Learning Theories, Meta Skills

The conceptual model presented provides a theoretical overview of the integration of learning theories deemed applicable to supporting the development and enhancement of meta-skills through the engagement of competitive gameplay. The model commences with the concept of self-determination theory (SDT) (Deci and Ryan, 1985) which encompasses two associated theoretical principles of intrinsic and extrinsic motivation. Intrinsic motivation results in the overall satisfaction and enjoyment of a particular task where the psychological requirements of competence (having the knowledge or skill to perform the task), relatedness (sense of belonging to others), and autonomy (ownership of one's behaviour and decisions), (Mills et al., 2018). Extrinsic motivation relates to when an activity is undertaken to obtain an outcome that is external to the activity being performed. In the context of competitive gaming, esports players can be intrinsically motivated to gameplay concepts such as immersion, challenge, improvement of skill, competing against other players, online engagement whereas extrinsic motivation relates more to entering tournaments to gain notoriety among players or for the aspect of tournament prize money. Via the five esports game genres exemplified in the model, some of the salient skill sets esports players can acquire through competitive gameplay are outlined. How learning is supported through competitive gameplay via salient learning theories applicable to esports leading to the acquirement of meta-skills and graduate attributes are shown as being interrelated.

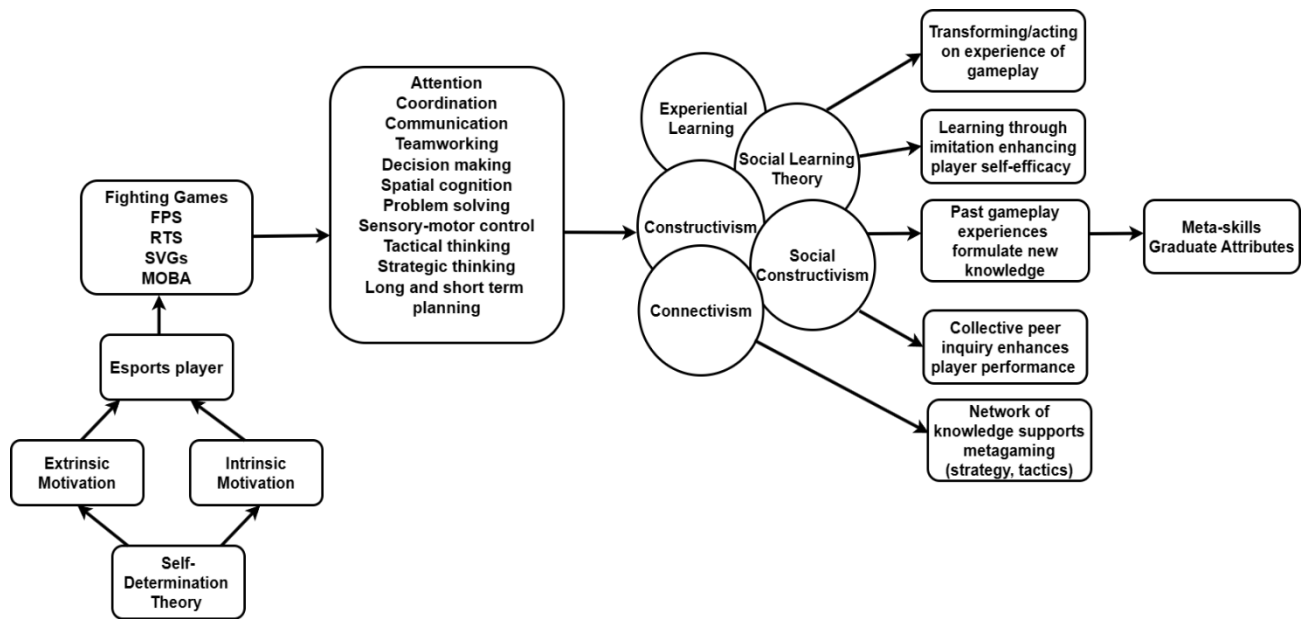


Figure 2: Interrelationship between esports, learning theories and meta-skills (figure by authors).

7. Limitations and Future Directions

The aim of this paper was to provide a preliminary scoping review of esports from a competitive gameplay perspective with a view to articulating how the underpinning of learning theories are naturally inherent in esports game genres. From a theoretical and conceptual standpoint, it has been argued that when utilised constructively and strategically, the learning and accumulation of knowledge that coincides with competitive gameplay can lead to the attainment of meta-skills, preparing graduates for the world of work. The theoretical foundations of the research are still at an early stage with more work required from an empirical standpoint to substantiate the ideas articulated in this paper. It is acknowledged that additional esports game genres in relation to additional learning theories accommodate competitive gaming require to be explored. Moving the research forward, a systematic literature review will be performed searching relevant academic databases that the authors have subscription to via their academic library. Preliminary search terms will include: (“esports” OR “electronic sports” OR “competitive gaming” OR “online gaming” OR “FPS” OR “RTS” OR “MOBAs” OR “MMORPG” OR “fighting games” OR “SVGs” OR “genres”) which will be refined and expanded to include additional esports game genres. Terms impacting and influencing the acquirement of graduate attributes through gameplay will include: AND (“skills” OR “graduate” OR “meta-skills” OR “attributes” OR “learning” OR “education” OR “outcomes” OR “enhancement” OR “motivation” or “engagement”).

At present, the primary limitation of the of the research is the lack of empirical evidence to substantiate the theoretical propositions proposed in the paper. Though still in the preliminary stages of the research design, it is intended that the research will adopt a parallel mixed methods design (Tashakkori et al. 2021) utilising data gathering techniques that will include questionnaires, semi-structured interviews and focus groups. The aim in doing so will be to obtain a breadth of opinion and perspective from various esports stakeholders (e.g., educationalists, esports players) to assess and evaluate viewpoints about the learning potential of esports as an academic discipline and if it can equip graduates with meta-skills. It is intended that the research will benefit the wider esports community and educators considering whether to introduce an esports programme within their academic institutions. The proposed conceptual model, which is in a very rudimentary stage of development, will also need to be refined. The dilemma is whether to focus on one specific learning theory as an amalgamation of several may be too wide ranging in academic scope.

References

- Abbott, D. (2019) Game-based learning for postgraduates: an empirical study of an educational game to teach research skills. Vol. 4, No. 1, pp. 80-104, DOI: 10.1080/23752696.2019.1629825
- Adams, E. (1999) The Designer’s Notebook: Designing and Developing Sports Games. Game Developer. Available at: <https://www.gamedeveloper.com/design/the-designer-s-notebook-designing-and-developing-sports-games> (Accessed: 19 April 2024).

- Adams, E. (2014) *Fundamentals of Game Design*. 3rd edn. New Riders.
- Bandura, A. (1977) Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*. Vol. 84, No. 2, pp. 191-215.
- Bányai, F., Griffiths, M.D., Király, O. and Demetrovics, Z. (2019) The Psychology of Esports: A Systematic Literature Review. *Journal of Gambling Studies*. Vol. 35, pp. 351-365. DOI: <https://doi.org/10.1007/s10899-018-9763-1>
- Barr, M. (2020) A cross-sectional study of video game play habits and graduate skills attainment. *Research in Learning Technology*. Vol. 28, 2326, DOI: <http://dx.doi.org/10.25304/rlt.v28.2326>
- Baxter, G., Hainey, T., Savorelli, A., and Ivanova, R.R. (2021) Teaching History and Brining the past back to life with Serious Games. Proceedings of the 15th European Conference on Game Based Learning 2021. University of Brighton, UK, 24th-25th September 2021, pp. 99-107. DOI:10.34190/GBL.21.007
- Bodnar, C.A. and Clark, R.M. (2017) Can Game-Based Learning Enhance Engineering Communication Skills? *IEEE Transactions on Professional Communication*. Vol. 60, No. 1, pp. 24-41, doi: 10.1109/TPC.2016.2632838
- Bonk, C. J., and Dennen, V. P. (2005) *Massively Multiplayer Online Gaming: A Research Framework for Military Training and Education*, Technical Report 2005- 1, Advanced Distributed Learning Initiative, Office of the Under Secretary of Defense for Personnel and Readiness.
- Buchan, A. and Taylor, J. A (2016) Qualitative Exploration of Factors Affecting Group Cohesion and Team Play in Multiplayer Online Battle Arenas (MOBAs). *The Computer Games Journal*. Vol. 5, pp. 65–89. <https://doi.org/10.1007/s40869-016-0017-0>
- Burgun, K. (2013) *A New Philosophy for Understanding Games*. CRC Press.
- Buro, M. (2003) Real-time strategy games: a new AI research challenge. *IJCAI'03: Proceedings of the 18th international joint conference on Artificial intelligence*. August 2003, pp. 534–1535
- Chap, W., Rao, A.C. and Pandey, P.K. (2022) A Technological Review on Rise of Esports in World Economy. *ICIMMI'22: Proceedings of the 4th International Conference on Information Management & Machine Intelligence*. December 2022, Article No: 79, pp. 1-8, DOI: <https://doi.org/10.1145/3590837.3590916>
- Creswell, J.W. (2022) *A Concise Introduction to Mixed Methods Research*. 2nd edn. Thousand Oaks, Calif; London: SAGE.
- Deci, E.L. and Ryan, R.M. (1985) The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*. Vol. 19, No. 2, pp. 109-134. DOI: [https://doi.org/10.1016/0092-6566\(85\)90023-6](https://doi.org/10.1016/0092-6566(85)90023-6)
- Dobrowolski, P., Hanusz, K., Sobczyk, B., Skorko, M. and Wiatrow, A. (2015) Cognitive enhancement in video game players: The role of video game Genre. *Computers in Human Behavior*, Vol. 44, pp. 59-63, DOI: <http://dx.doi.org/10.1016/j.chb.2014.11.051>
- Dörner, R., Göbel, S., Effelsberg, W. and Wiemeyer, J., (2016) 'Introduction', in Dörner, R., Göbel, S., Effelsberg, W. and Wiemeyer, J., (ed.) *Serious Games: Foundations, Concepts and Practice*. Springer International Publishing Switzerland, pp. 1-34
- de Byl, P. (2012) *Holistic Game Development with Unity*. Focal Press.
- Fullerton, T. (2019) *Game design workshop: a playcentric approach to creating innovative games*. 4th edn. Boca Raton, FL: CRC Press.
- Gee, J.P. (2007) *What video games have to teach us about learning and literacy*. Revised and updated edition. Palgrave Macmillan.
- Gregory, J. (2014) *Game Engine Architecture*. 2nd edn. CRC Press.
- Green, W., Hammer, S. and Star, C. (2009). Facing up to the challenge: why is it so hard to develop graduate attributes? *Higher Education Research & Development*. Vol.28, No. 1, pp. 17-29. DOI: <https://doi.org/10.1080/07294360802444339>
- Gunn, V., Bell, S. and Kafmann, K. (2010) Thinking strategically about employability and graduate attributes: Universities and enhancing learning for beyond university. *Graduates for the 21st Century: Integrating the Enhancement Themes*. The Quality Assurance Agency for Higher Education, pp. 1-6
- Gurbuz, S.C. and Celik, M. (2022) Serious games in future skills development: A systematic review of the design approaches. *Computer Applications in Engineering Education*. Vol. 30, Issue 5, pp. 1591-1612, DOI: <https://doi.org/10.1002/cae.22557>
- Goldie, J.G.S. (2016) Connectivism: A knowledge learning theory for the digital age?, *Medical Teacher*. Vol. 38 No. 10, pp. 1064-1069, DOI: 10.3109/0142159X.2016.1173661
- Hamari, J. and Sjöblom, M. (2017) What is eSports and why do people watch it?, *Internet Research*, Vol. 27 No. 2, pp. 211-232. <https://doi.org/10.1108/IntR-04-2016-0085>
- Heere, B. (2018) Embracing the sportification of society: Defining e-sports through a polymorphic view on sport. *Sport Management Review*. Vol. 21, No. 1, pp. 21-24, DOI: <https://doi.org/10.1016/j.smr.2017.07.002>
- Horsburgh, J., and Ippolito, K. (2018) A skill to be worked at: using social learning theory to explore the process of learning from role models in clinical settings. *BMC Medical Education*. Vol. 18, No. 156, pp. 1-8. DOI: <https://doi.org/10.1186/s12909-018-1251-x>
- Jenny, S. E., Manning, R. D., Keiper, M. C., and Olrich, T. W. (2016). Virtual(ly) Athletes: Where eSports Fit Within the Definition of "Sport." *Quest*, 69(1), 1–18. <https://doi.org/10.1080/00336297.2016.1144517>
- Jung, I. (2019) Connectivism and Networked Learning. In: Jung, I. (eds) *Open and Distance Education Theory Revisited*. SpringerBriefs in Education(). Springer, Singapore. DOI: https://doi.org/10.1007/978-981-13-7740-2_6
- Kolb, D.A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice Hall.

- Kolb, A.Y. and Kolb, D.A. (2009) The Learning Way: Meta-cognitive Aspects of Experiential Learning. *Simulation & Gaming*. Vol. 40, No. 3, pp. 297-327, DOI: <https://doi.org/10.1177/1046878108325713>
- Li, S., Hong, Y.C. and Craig, S.D. A Systematic Literature Review of Social Learning Theory in Online Learning Environments. *Educational Psychology Review*. Vol. 35, No. 108. pp. 2-29. DOI: <https://doi.org/10.1007/s10648-023-09827-0>
- Li, S., Hong, Y.C. and Craig, S.D. A Systematic Literature Review of Social Learning Theory in Online Learning Environments. *Educ Psychol Rev* 35, Vol. 108 (2023). <https://doi.org/10.1007/s10648-023-09827-0>
- Liu, S., Louis, S.J. and Ballinger, C. (2014) Evolving effective micro behaviors in RTS game, *2014 IEEE Conference on Computational Intelligence and Games*, Dortmund, Germany, pp. 1-8, doi: 10.1109/CIG.2014.6932904.
- Migliore, L. (2021) What Is Esports? The Past, Present, and Future of Competitive Gaming. In: Migliore, L., McGee, C., Moore, M.N. (eds) *Handbook of Esports Medicine*. Springer, Cham. https://doi.org/10.1007/978-3-030-73610-1_1
- Mills, D.J., Milyavskaya, M., Mettler, J., and Heath, N.L. (2018) Exploring the pull and push underlying problem video game use: a Self-Determination theory approach. *Personality and Individual Differences*. Vol. 135, pp. 176-181. DOI: <https://doi.org/10.1016/j.paid.2018.07.007>
- Mora-Cantalops, M. and Sicilia, M.A. (2018) MOBA games: A literature review. *Entertainment Computing*. Vol. 26, pp. 128-138. DOI: <https://doi.org/10.1016/j.entcom.2018.02.005>
- Muñoz Rosario, R. A. and Widmeyer, G. R. (2009) An Exploratory Review of Design Principles in Constructivist Gaming Learning Environments. *Journal of Information Systems Education*. Vol. 20, No. 3, pp. 289-300.
- Neri, F., Smeralda, C.L., Momi, D., Sprugnoli, G., Menardi, A., Ferrone, S., Rossi, S., Rossi, A., Di Lorenzo, G. and Santaronechi, E. (2021) Personalized Adaptive Training Improves performance at a Professional First-Person Shooter Action Videogame. *Frontiers in Psychology*. Vol. 12, Article 598410, pp. 1-14. DOI: <https://doi.org/10.3389/fpsyg.2021.598410>
- Piaget, J. (1964) Cognitive Development in Children: Development and Learning. *Journal of Research in Science Teaching*. Vol. 2, pp. 176-186. DOI: <http://dx.doi.org/10.1002/tea.3660020306>
- Prensky, M. (2006) "Don't Bother Me Mom – I'm Learning". Paragon House.
- Qian, T.Y., Wang, J. J., Zhang, J.J., and Lu, L.Z. (2020) It is in the game: dimensions of esports online spectator motivation and development of a scale. *European Sport Management Quarterly*. Vol. 20, No. 4, pp. 458-479. DOI: <https://doi.org/10.1080/16184742.2019.1630464>
- Qian, M. and Clark, K.R. (2016) Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior*. 63, pp. 50-58. DOI: <https://doi.org/10.1016/j.chb.2016.05.023>
- Rehak, B. (2008) *Genre Profile: First-Person Shooting Games in M.J.P. Wolf (ed.) The Video Game Explosion: A History from PONG to PlayStation and Beyond*. Westport, Connecticut, London: Greenwood Press, pp. 187-195.
- Reynaldo, C., Christian, R., Hosea, H., and Gunawan, A.A.S. (2021) Using Video Games to Improve Capabilities in Decision Making and Cognitive Skill: A Literature Review. *Procedia Computer Science*, Vol. 179, pp. 211-211.
- Rusk, F. and Ståhl, M. (2022) Coordinating teamplay using named locations in a multilingual game environment - Playing esports in an educational context. *Classroom Discourse*. Vol. 13, No. 2, pp. 164-187. DOI: [10.1080/19463014.2021.202444](https://doi.org/10.1080/19463014.2021.202444)
- Schell, J. (2020) *The art of game design: a book of lenses*. 3rd edn. Boca Raton, FL: CRC Press.
- Seth J.E., Manning, D. R., Keiper, M.C. and Olrich, T.W. (2017) Virtual(ly) Athletes: Where eSports Fit Within the Definition of "Sport". *Quest*. Vol. 69, No.1, pp. 1-18, DOI: [10.1080/00336297.2016.1144517](https://doi.org/10.1080/00336297.2016.1144517)
- Siemens, G. (2005). *Connectivism: A learning theory for the digital age*. *International Journal of Instructional Technology & Distance Learning*. Vol. 2, pp. 3-10.
- Smithies, T.D., Toth, A.J., Conroy, E., Ramsbottom, N., Kowal, M. and Campbell, M.J., (2020) Life After Esports: A Grand Field Challenge. *Frontiers in Psychology*. Vol. 11, Article 883, pp. 1-5. DOI: [doi: 10.3389/fpsyg.2020.00883](https://doi.org/10.3389/fpsyg.2020.00883)
- Statista (n.d.) *eSports audience size worldwide from 2020 to 2025, by type of viewers (in millions)* Available at: <https://www.statista.com/statistics/490480/global-esports-audience-size-viewer-type/> (Accessed: 24 March 2024).
- Tashakkori, A., Johnson, R.B. and Teddlie, C. (2021) *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. 2nd ed. Thousand Oaks, California: SAGE Publications Inc.
- Toth, A.J., Conroy, E., and Campbell, M.J. (2021) Beyond action in video games: Differences in gameplay and ability preferences among gaming genres. *Entertainment Computing*. Vol. 38, pp. 1-8. DOI: <https://doi.org/10.1016/j.entcom.2021.100408>
- Toth, A.J., Ramsbottom, N., Constantin, C., Milliet, A. and Campbell, M.J. (2021) The effect of expertise, training and neurostimulation on sensory-motor skill in esports. *Computers in Human Behavior*. Vol. 121, pp. 1-13. DOI: <https://doi.org/10.1016/j.chb.2021.106782>
- Videnovik, M., Vold, T., Kiønig, L., Bogdanova, A.M. and Trajkovik, V. (2023) Game-based learning in computer science education: a scoping literature review. *International Journal of STEM Education*. 10, 54, pp. 1-23, DOI: <https://doi.org/10.1186/s40594-023-00447-2>
- Voorhis, V.V. and Paris, B. (2019) Simulations and Serious Games: Higher Order Thinking Skills Assessment. *Journal of Applied Testing Technology*. Vol. 20(S1), pp. 35-42
- Vygotsky, L.S. (1978) *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

- Wagner, M.G. (2006) On the Scientific Relevance of eSports. Proceedings of the 2006 International Conference on Internet Computing & Conference on Computer Games Development, ICOMP 2006, Las Vegas, Nevada, USA, June 26-29.
- Werder, K. (2022) Esport. *Business Information Systems Engineering*. Vol. 64, No. 3, pp. 393-399. DOI: <https://doi.org/10.1007/s12599-022-00748-w>
- Wolf, M.J.P. (2008) Video Games Genres in M.J.P. Wolf (ed.) *The Video Game Explosion: A History from PONG to PlayStation and Beyond*. Westport, Connecticut, London: Greenwood Press, pp. 187-195.
- Woo, Y., and Reeves, T.C. (2007) Meaningful interaction in web-based learning: A social constructivist interpretation. *The Internet and Higher Education*. Vol. 10, No. 1, pp. 15-25. DOI: <https://doi.org/10.1016/j.iheduc.2006.10.005>
- Yallihep, M. and Kutlu, B. (2020) Mobile serious games: Effects on Students' understanding of programming concepts and attitudes towards information technology. *Education and Information Technologies*. 25, pp. 1237-1254, DOI: <https://doi.org/10.1007/s10639-019-10008-2>
- Yanes, N., Bououd, I., Jamel, L., and Alturki, N. (2023) Serious gaming for graduates employability enhancement. *Frontiers in Psychology*. 14:1324397, pp. 1-14. doi: 10.3389/fpsyg.2023.1324397
- Ye, J. N., Ye, J. H., Wang, C. M., and Hong, J. C. (2021). Development of 5 Cs Educational Value Scale for esports games. *International Journal of Technology in Education and Science (IJTES)*. Vol. 5, No.3, pp. 362-374. <https://doi.org/10.46328/ijtes.215>
- Yoders, S. (2014) Constructivism Theory and Use from a 21st Century Perspective. *Journal of Applied Learning Technology*. Vol. 4, No. 3, pp. 12-20.
- Zhong, Y., Guo, K., Su, J., and Kai Wah Chu, S. (2022) The impact of esports participation on the development of 21st century skills in youth: A systematic review. *Computers & Education*. Vol. 191, pp. 2-20. DOI: <https://doi.org/10.1016/j.compedu.2022.104640>
- Zhouxiang, L. (2022) *A History of competitive gaming*. New York, NY: Routledge.