Driving innovation together

The concept of Game-Based Learning

Shaping the present and future of learning

Authors: Pablo Andrés Ortiz de Zaldumbide & Gül Akcaova
Version: 1
Date of publication: 1st October 2024

This publication is licensed under a Creative Commons Attribution 4.0 International.

Contents

Executive summary 3

1 Introduction 4

1.1 Structure and approach 5
Interviews 5

2 What is Game-based learning? 6

2.1 Game and play 6
2.2 Serious games and gamification 6
2.2.1 Serious games 6
2.2.2 Gamification 7
2.3 The Gaming industry 7

3 Why learning game-based? 7

3.1 Motivation and engagement 8
3.2 Safe learning environment 8
3.3 Applications of Game-Based Learning 9
3.3.1 Deal Hero Game at the Erasmus University Rotterdam 9
3.3.2 REAL game at Tilburg University 9

4 Futures of learning 10

4.1 More immersed learning environments and experiences 10
4.2 Game-based vs play-based 10

Sources 11

Appendix: Game-Based Learning theoretical models 12

Executive summary

As technological advancements such as Artificial Intelligence (AI) and Extended Reality (XR)[1] continue to revolutionise education, Game-Based Learning (GBL) emerges as a compelling approach that offers personalised, immersive learning experiences. By integrating digital and analogue technologies, GBL enhances student engagement, motivation, and overall well-being.

This whitepaper explores GBL as a transformative educational method, grounded in a thorough literature review and supported by practical case studies. These examples illustrate GBL's potential to cultivate key skills and create enriching learning environments. The findings highlight that GBL not only boosts learner motivation but also facilitates personalised learning pathways tailored to individual needs, enabling students to progress at their own pace while fostering essential skills such as critical thinking and resilience.

Despite its promise, GBL faces challenges stemming from its fragmented identity across various sectors, leading to ambiguity in terminology and participation. However, numerous associations, government initiatives, and collaborative programmes—such as CIIIC and OASIS—are creating opportunities for GBL to expand and play a vital role in shaping the future of education.

Ultimately, this whitepaper serves as a call to action for educators, innovators, policymakers, and educational leaders—particularly in Europe and the Netherlands—to engage with GBL and explore its practical applications. By embracing GBL, stakeholders can help cultivate more engaging, learner-centred educational experiences that integrate personalised learning, student well-being, and cutting-edge technology.

[1] XR is an umbrella term for augmented reality (AR), mixed reality (MR) and virtual reality (VR)

1 Introduction

For a few years, education in the Netherlands has been set to give head to complex challenges concerning the students' well-being and success. Before the COVID-19 pandemic, students' wellbeing was already addressed as a concern and made it into the administrative agreement on higher education and science in 2022.

> "By focusing on student success, universities of applied sciences express the importance of students' broader personal development, which, in addition to qualification for a profession, is an essential part of their preparation for the future. We want to combat unnecessary dropouts and delays, which are a waste of talent" – vh.nl

> "[…] in this past period, in addition to the importance of mental well-being, the focus on other aspects of student well-being such as physical and social well-being was strengthened. Also, the fact that student well-being is closely linked to the design of education, study climate, communication and the student's personal situation became more apparent" – unl.nl

Besides the students' well-being and success, it is known to society that the attention span is shortening, and a generation (alpha/beta) is growing up with smartphones and tablets since their birth. This also pushed educators and innovators to explore (new) learning methods such as Game-Based Learning. Furthermore, the impact of the COVID-19 pandemic put the adaptability of educational institutions to the test. Nevertheless, despite the hardships caused by the recent pandemic period, the digitalisation of learning experiences provided an important boost to learning technologies.

To this day, an extensive body of literature and various examples bring proof of Game-Based Learning's (GBL) effectiveness in building meaningful and rewarding learning experiences. Within the field of education, GBL can offer learning environments where students practice and master skills as they overcome engaging challenges, follow narratives, collaborate, explore learning material in interactive ways, and master skills through practice in controlled-risk settings. Experts and researchers on the topic suggest weaving stronger relationships between researchers, educators, industry leaders and policymakers in education (Hamari J. et al., 2016, p.177). This is to explore the influence GBL may have on entire curriculums, programs and other educational systems. On this note, Karl M. Knapp appeals for further GBL explorations by saying "the time for wondering whether [games, gamification and simulations] are appropriate for learning has passed; the time to implement these solutions is now" (Kapp K. 2014, p.2).

These developments made us wonder:

Could Game-Based Learning be the future of learning?

1.1 Structure and approach

In this whitepaper, we aim to:

1. Bring clarity on what is known, and unknown, to date about GBL.
2. Illustrate current practical implementations and practices (state-of-the-art).
3. Gather perspectives about the role GBL has, and will have tomorrow, in the Netherlands.
4. Define relevant insights about GBL's role in shaping the future of education in the Netherlands.

Ultimately, this whitepaper aims to provide educators, policymakers, and stakeholders with insights to grasp the potential of GBL.

Interviews

To better understand the role GBL currently plays in the education landscape and visions, it is we have gathered the viewpoints from some of its most influential stakeholders of the Dutch education context. The experts are listed hereafter:

- Michaël Bas, co-founder and former CEO of &ranj
- Lindy Damen, CEO and founder of EVRgreen Studio
- Daria Ilishkina, researcher at ErasmusX
- Emily Jacometti, entrepreneur and board member at Dutch Games Association (DGA) representing the serious game industry
- Ronald Leenes, professor at Tilburg Institute for Law, Technology, and Society
- Martijn Peltenburg, Project Manager of digital economies from Rotterdam municipality
- Bruno Setola, Game Thinking teacher at Rotterdam University of Applied Sciences
- Jan-Pieter (JP) van Seventer, managing director of Dutch Game Garden (DGG)
- Jasper van Vught, assistant professor teaching in the department of Media and Culture Studies at the Utrecht University

The decision to cover a wide selection of stakeholders for these interviews was based on the outcomes from the body of literature to date, which point to the need to involve more executives and policymakers for structural developments of GBL in the world of education (Hamari J. et al., 2016, p.177).

2 What is Game-based learning?

As defined by Knapp K., author of *The Gamification of Learning* book series, "a game is a self-contained unit. There is a defined 'game-space' in which the players agree to engage in game activities" (Kapp K. 2014, p.56). Similarly, Tracy Fullerton, author of *Game Design Workshop*, defines a game as "a closed, formal system that engages players in structured conflict and resolves its uncertainty in an unequal outcome" (Fullerton T., 2014). Under both definitions is a *game* and its *game-space* an environment with its rule system, agreed upon between players in a specific context.

As stated by Bernard Suits, a renowned writer and philosopher, "playing a game is the voluntary attempt to overcome unnecessary obstacles" (Suits B. 1978). Fullerton elaborates on that same note stating that "games challenge players to accomplish their objectives while following rules and procedures that make it difficult to do so" (Fullerton T., 2014, p.46). These two definitions highlight the need for voluntary involvement in a *game world* for an experience to be considered a game. Moreover, through voluntary interactions in game space, players get "the opportunity to learn and master new challenges, learn skills and enjoy the experience with others (Macgonigal J., 2011, p88)". This experience of learning through playing within a game space is referred to as GBL.

2.1 Game and play

"To engage with a game is to play it but play itself is not a game" (Fullerton T., 2014, p.37), which further marks the distinction between the concepts of *play* and *game*.

A *game* is "the rule-structured, challenging pursuit of goals" (Deterding S., 2015, p.296) which makes it a closed-ended experience happening in an upon-agreed *game-space* with a set of rules. *Play* is "the unstructured, curiosity-driven exploration and recombination of behaviours, objects, and meanings" (Deterding S., 2015, p.296) or "free movement within a more rigid structure" (Fullerton T., 2014, p.37). These definitions set a dynamic for GBL where learning can happen through play within a game but play and learning often exceed the structures of a game. This dynamic will be elaborated further in this paper.

2.2 Serious games and gamification

"Serious games, gamification and game-based learning are distinct from entertainment-oriented games in that, while they are often also enjoyable, they are designed for primary end purposes other than entertainment and leisure" (Hamari J. et al., 2016). The concepts of *game-based learning, serious games* and *gamification* will be further elaborated hereafter, with a focus on their uses and implementations in education.

2.2.1 Serious games

Like the definition of a *game*, serious games are "games designed and/or used for non-entertainment purposes" (Deterding S., 2015, p.301). Serious games may include simulations that seek to represent the complexity of real-life situations. Alternatively, they can offer fictional or even fantasy scenarios to promote immersion and engagement with compelling narratives (Lepper M., Cordova D., 1996); if the same cognitive schema and tasks are required in the game as in the actual work/implementation environment (Kapp K. 2014, p.53). In short, serious games are designed to meet learning objectives and primary end purposes and reflect real-life situations.

It is necessary to point at a dilemma involving the terminologies used to refer to the concept of *serious games*. For some, the word *serious* contradicts the fun, enjoyment and engagement inherent to the concept of a *game*. For others, the word *game* undermines the seriousness of the primary end purpose the product aims to supply for its players. Several experts interviewed mention people usually resort to terms like *applied games*, *impact games,* or *educational games* to cater to their whims or the whims of their audience. Others underline that these terms refer broadly to the same concept of what a serious game is.

2.2.2 Gamification

Gamification uses parts of games namely "game-based mechanics, aesthetics, and game-thinking to engage people, motivate action, promote learning and solve problems" (Kapp K. 2014, p.57). Furthermore, gamification "describes the means of using game design elements in non-game context (…) to afford the motivating, enjoyable experiences characteristic for gameplay" (Deterding S., 2015, p.297). In short, gamification is the process in which game mechanics are implemented to involve users in a non-game experience.

2.3 The Gaming industry

In the Dutch serious game industry, companies like &ranj, Raccoon Games, Game Tailors, IJsfontein and Grendel Games have built an extensive portfolio of GBL products for local and international implementation. As these companies evolve, the serious gaming sector matures, and GBL gains recognition from implementations in the fields of education, healthcare, business management, and many different sectors. JP van Seventer, managing director of Dutch Game Garden, estimates that serious game startups constitute between 15 to 20% of all gaming entrepreneurship in the Netherlands, which is a relatively high percentage for global standards.

As the representative of the serious game industries at DGA, Emily Jacometti, sees that the Netherlands "could be one of the best ecosystems for serious gaming companies in Europe, and in the world, but we don't have the ecosystem yet to thrive as much as we could… which is something we are building towards". Martijn Peltenburg, Project Manager of digital economies from Rotterdam municipality, acknowledges the need for strategic community building to further consolidate the presence of such specific industries in the future, involving support from governments and municipalities to spark structural growth.

Associations like SAGANET (Serious Games Network) and IGDA (International Game Developers Association) encourage and enable GBL knowledge exchange spaces and promote collaborations between institutions, while initiatives like STRATEGIES build frameworks to attract funding for GBL initiatives. However, Lindy Damen, CEO and founder of EVRgreen Studio, points that GBL initiatives still need "more awareness, backing and funding from local policy authorities" to further increase the value delivered by GBL to society.

To all interview participants, the GBL ecosystem is still segmented. It spreads through different fields of knowledge, which limits the visibility and growth of the serious game industry. Besides a fragmented ecosystem, the GBL-related terminologies are used ambiguously. Consequently, this ambiguity plays against efforts to build unity, raise awareness, and consistently define the identity of the gaming industry. Why learning game-based?

2.4 Motivation and engagement

GBL is identified to encourage a sense of reflective practice, meaning "they can help students (as potential professionals) draw a connection between knowing and doing" (Shaffer 2005). Students are partially motivated to learn because "learning is situated and occurs through a process of hypothesizing, probing, and reflecting upon the simulated world within the game" (Hamari et al. 2016).

It has been proven that keeping the challenge-skill dynamic in balance improves the student's engagement and concentration in their studies while extending their capacities (Fullagar, Knight, & Sovern, 2013). In GBL and gamification contexts, studies predict that learning and gamified curricula will become more common as a method to invoke engagement and flow in students (Crisp, 2014)**.** Flow in a game-based learning environment increased learning outcomes and study satisfaction (Hung, C., Sun, J. C., & Yu, P., 2015).

Flow refers to "a state of mind characterized by focused concentration and elevated enjoyment during intrinsically interesting activities" (Shernoff, Csikszentmihalyi, Schneider, Shernoff, 2003). For a flow experience to occur, an individual needs "to use a high level of skill to meet a significant challenge", and to maintain a state of flow, the level of challenge must constantly increase to encourage the development of an individual's degree of skill (Csikszentmihalyi, 1990). Ultimately, the flow theory proposes that "individuals may progress through increasingly difficult challenges at ever-higher levels of skill" (Hamari et al. 2016). However, if the challenge is beyond an individual's skill level, it might feel uncomfortable or insecure due to perceived incompetence, resulting in a reluctance to take risks or take on new challenges that might increase competencies (Thomas 1980). On the other hand, challenges below an individual's skill level will generally lead to disengagement (Shernoff, 2010; 2013; Yazzie-Mintz, 2007).

2.5 Safe learning environment

GBL is also a way for students to safely fail, revise, improve and succeed in an experimental environment (Katsantonis et al. 2017). Such environments in which students gain exposure to core concepts and mindsets, eliminate the fear of failure while improving the chances for success as students keep on playing, and shift the focus on learning rather than grades (Rowland et al. 2018) (Macgonigal J., 2011, p.68) (Tüzün, Yilmaz-Soylu, Karakus, Inal, & Kizilkaya, 2009). Furthermore, games allow students to connect with learning experiences without bringing in the concerns of the 'real' world and fears (Kapp K. 2014, p.54). Students playing together can build stronger social connectivity by repeatedly experiencing prosocial emotions such as happy embarrassment, vicarious pride and ambient sociability (Macgonigal J., 2011, p.82-94).

Aspects such as motivation, engagement, immersion, knowledge retention, perceived learning and skill mastery, are among the factors GBL has been proven to enhance in learning environments. GBL is an "effective means of creating conditions for flow, heightened engagement (...), and immersion, which can further facilitate the learning of complex strategies" (Hamari J. et al., 2016). Developing skills like complex problem-solving, memorisation, collaboration, critical thinking, strategic thinking and communication are among the most frequently mentioned in such studies.

2.6 Applications of Game-Based Learning

A case study analysis is included in addition to the literature review to understand the practical role of GBL in learning and education[2].

2.6.1 Deal Hero Game at the Erasmus University Rotterdam

The Deal Hero Game is a Playable Case Study (PCS)[3] platform implemented in two faculties of Erasmus University Rotterdam (EUR) since the summer of 2023 as a solution to the repetitive use of static case study analysis in the curricula. EUR brought those static case studies to life and allowed students to learn together by navigating engaging storylines.

According to research conducted, Deal Hero game proved "significantly more engaging across cognitive, emotional, and social aspects than typical university learning experiences, with effect sizes ranging from medium to large" (Ilishkina D., Vidakovic M., 2024). The game's ability to train collaboration skills and problem-solving competencies was highlighted by students during interviews and reflected in the study's quantitative research outcomes. Additionally, the representation of the decision-making process reflecting reality was an important element in perceiving the case as authentic. (Ilishkina D., Vidakovic M., 2024)

2.6.2 REAL game at Tilburg University

To teach the students of the Law and Technology master program of Tilburg Institute for Law, Technology and Society (TILT) about technology regulation, the REAL game is developed in October 2023 to support students to adopt a broad view from multiple scientific domains (like legal, tech philosophy, economy and sociology). Regulation, Ethics, Acceptability, Legitimacy (REAL), is a solution that originated from the students' frustrations when trying to learn through reading materials, according to Professor Ronald Leenes.

By playing the game, students explore each other's perspectives, compare their views with literature and examples, and see the problems from the lens of the given modifying card. According to Leenes, the added value of the game is that it engages the students much more with the theories and tools. Instead of having them read about it, they need to interact with each other and learn together […] The game is available on a Miro board or as a physical board for them to (re)play, review their knowledge, approach new technology plus sociotechnical context combinations, explore the influence of different modifying cards, and prepare for exams".

According to Leenes, the REAL game now invites students to collaborate and reflect together on the regulatory challenges within a sociotechnical setting. Nevertheless, Leenes looks forward to implementing the game as part of the assessment, as he and the innovation team are working on an improved version.

[2] For details on implementing GBL, see this document's appendix.

[3] a PCS provides an authentic professional experience (albeit simulated), along with a safe place for students to fail as they learn (Giborney et al, 2021). In other words, a serious game that allows students to 'play' through an authentic scenario (case study)

3 Futures of learning

3.1 More immersed learning environments and experiences

Parallel to these developments, virtual and augmented reality markets are growing, and education is presented with new technologies and platforms to explore Game-Based Learning (GBL) implementations. This situation calls for education institutions, educators and innovators to experiment with combining technology and learning methods. A recent scientific publication highlights that GBL, enhanced by AI and VR, offers the potential for more dynamic, engaging, and personalised learning experiences (Setiawati R., et al., 2024, p.131).

Peltenburg, van Seventer and Bas mention the recent introduction of government programs, like the Creative Industries Immersive Impact Coalition (CIIIC), which supports the exploration and implementation of immersive technologies across different creative sectors. Alongside this, the Organised Advancement of Specialists in Immersive Solutions (OASIS) is launched this year, connecting six Dutch (vocational) education institutions with over 22 creative media businesses to boost immersive technologies and GBL in education across the Netherlands.

3.2 Game-based vs play-based

Setola, van Vught and Damen mentioned adding more play-centric solutions in education. The discussions align on the thought instead of students learning the rules and structures of a game before play, their learning experience comes to life when they start playing right away, advancing to what could be referred to as “Play-Based Learning”. Setola states that true learning comes from students being able to challenge, redefine and readjust complex systems through playful explorations. Therefore, advocating that students should be incentivised to understand and question many consolidated systems in our society, to adopt an active role in redefining these systems for the development of new worlds. Van Vught stated his wish for “education to start capitalising more on the power of play and playfulness in learning” as open-ended playfulness in learning environments can lead students to have more agency and motivation in the definition of their personal learning journeys.

However, as students play and attain a certain freedom over the game structures, they tend to structure new rules and challenges, or reconfigure available structures into new games, returning to the formality and rule structures of Game-Based Learning. This cycle where Game-Based Learning and Play-Based Learning interconnect is beyond the constraints of this whitepaper and might bring new perspectives and definitions about games and playfulness in education.

Sources

- Crisp G. (2014). “Assessment in next generation learning spaces” in The future of learning and teaching in next generation learning spaces.
- Csikszentmihalyi M. (1975). “Beyond Boredom and Anxiety, Experiencing flow in work and play", Jossey-Bass Publishers.
- Deterding S. (2015). “The Lens of Intrinsic Skill Atoms: a method for Gameful Design”, published by Taylor & Francis Group.
- Fullerton T. (2014). “Game Design Workshop” by CRC Press, Taylor & Francis Group.
- Giborney J. S., McDonald J. K., Balzotti J., Hansen D., Winters D. M., Bonsignore E. (2021) “Increasing Cybersecurity Career Interest through Playable Case Studies” published by Association for Educational Communications & Technology.
- Hamari J., Shernoff D., Rowe E. (2016). “Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning”, in Computers in Human Behavior.
- Huizinga J. (1938). “Homo Ludens” published by Routledge & Kegan Paul.
- Hung C., Sun J. C., Yu P. (2015). “The benefits of a challenge: student motivation and flow experience in tablet-PC-game-based learning” in Interactive Learning Environments.
- Ilishkina D., Vidakovich M. (2024). “Student experiences of a game-based learning case study ‘Deal Hero Game’”. Published by ErasmusX, Erasmus University of Rotterdam.
- Katsantonis M., Fouliras P., Mavridis I. (2017). “Conceptual analysis of cyber security education based on live competitions” in IEEE Global Engineering Education Conference.
- Kapp K. (2014). "The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education", Wiley editorial.
- Lepper M., Cordova D. (1996). “Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice”, published in Journal of Educational Psychology.
- McGonigal J. (2011). “Reality is Broken” published by Vatnge Books, London.
- Rowland, L., Curry, O. S. (2019). “A range of kindness activities boost happiness” in The Journal of social psychology.
- Setiawati R., Danial H., Naldi A., 2024. Development of Game-Based Learning Applications to Increase Students’ Learning Motivation. Al-Fikrah: Jurnal Manajemen Pendidikan, 12(1), 123-135. https://doi.org/10.31958/jaf.v10i1.6007, p.131
- Shaffer, D. W. (2005). “Epistemic games”, in Innovate: Journal of Online Education.
- Shernoff D. J., Csikszentmihalyi M., Schneider B., Shernoff E. S. (2003). “Student engagement in high school classrooms from the perspective of flow theory” in School Psychology Quarterly.
- Suits, B (1978). “The Grasshopper: Games, Life and Utopia”, University of Toronto Press.
- Tilburg University News (June 2024). "Challenging game helps students master complex subject matter”, in [https://www.tilburguniversity.edu/]
- Tüzün H., Yilmaz-Soylu M., Karakus¸ T., Inal Y., Kizilkaya G. (2009). “The effects of computer games on primary school students' achievement and motivation in geography learning”, in Computers and Education.
- V. Visch, N.J.H. Vegt (2013). “Persuasive Game Design: A model and its definitions”

Appendix: Game-Based Learning theoretical models

The Persuasive Game Design Model (PGDM) (Visch V. et al., 2013) presents the process in which a user (player or student) in a specific real-world context, obtains value by interacting with the game-world of a serious game or gamification during a Game-Based Learning experience. In education, the PGDM is a great basis to define how, from interacting with a game world, students learn from exploring content, training new skills, collaborating, competing, experiencing narratives, reflecting and practising their lessons. Although clear, simple and concise, the overview provided by the model remains too broad, and a more specific approach would work best to present the workings of Game-Based Learning in education.

The Lens of Intrinsic Skills Atoms (TLISA) (Deterding S., 2015) elaborates on the way users within a GBL experience learn and train their skills. This model builds upon the structure of PGDM, but it also involves characteristics from the theory of flow to illustrate a user's skill mastery journey.

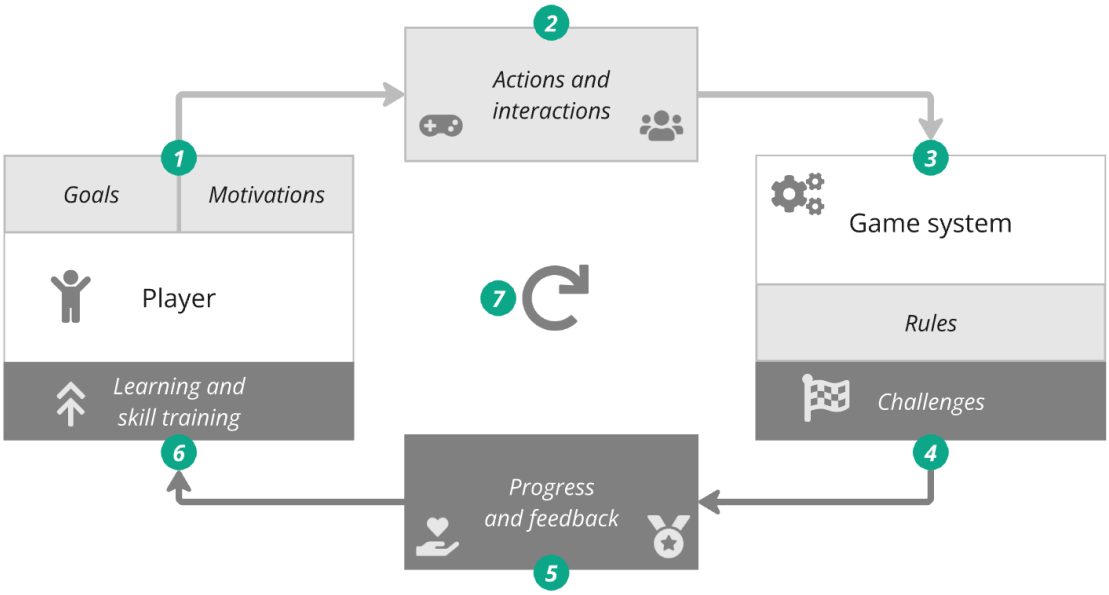

Diagram depicting the process in which user-system interactions contribute to the development of skill atoms. Based on Deterding S., 2015.

In the TLISA model, the value development begins with contemplating the user's real-world **goals and motivations (1)**. In a learning experience, these include the learning goals of a learning activity. A set of **actions and interactions (2)** must be available for the player to interact with the **game system** and the **rules (3)** that structure it. The game system proposes a set of **challenges (4)** that, when completed, provide **progress and feedback (5)** for the player's **learning and skill training (6)**. This **loop (7)** becomes the primary end value offered by the GBL experience to address the player's needs, goals and motivations.

The amount of scientifically backed arguments presented in this literature review support the potential Game Based Learning has to improve learning in education. The definitions of Game-Based Learning, serious games and gamification bring clarity about what Game-Based Learning is and what it can do; while also defining the boundaries of this science. Additionally, the flow

theory and the GBL theoretical models illustrate the processes in which GBL mediates learning and skill training in educational settings.