7. Gameplay and Game Design to Enhance Design Thinking in Entrepreneurship Education

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Abstract: In this conceptual paper, we present a contribution to game-based learning and design thinking, which translates to teaching and learning practices. We have designed a pedagogical intervention based on a board game to engage learners and mediate the design thinking learning process in entrepreneurship education. We draw upon the idea that entrepreneurial activity is intrinsically related to designers' work. The idea of entrepreneurs as designers requires a change in the way business schools handle design thinking, and in particular, its cognitive aspect. Our intervention will allow us to examine learners' rationality in design thinking by taking 3 distinctive roles. In the first role, students as gamers will employ their cognition to design and execute their strategy to overcome their opponents, considering a general approach and emergent strategies that will arise from changes in the economic scenario and his/her competitors' decisions. Then, after students have played the game, they will role-play as designers, working in groups to redesign the played game. In the last role, students as potential entrepreneurs, we will see how learners design a business model that encompasses the product (the game), the technology applied to it, and the customers' desire. By combining the 3 roles, it is possible to analyze the design thinking development and cognition involved and the impact of the intervention on students' comprehension of entrepreneurship. Our pedagogical intervention can be positioned as a mediational artifact that supports reflection and analysis with expected positive outcomes for both deep learning and engagement.

Introduction

Entrepreneurs think and act as designers; both are motivated to create something for a purpose. Designers and entrepreneurs lead innovation trends in products, services, processes, and business models (Garbuio, Lovallo, Dong, Lin, & Tschang, 2018), designing artifacts and solving problems that challenge established technological regimes. A technological regime embodies the cognitive routines that drive a community of practitioners in their research and development (R&D) projects, leading engineers and designers to look in particular directions rather than in others (Geels, 2005).

However, the idea that entrepreneurs perform as designers requires a change in the way business schools handle design thinking, and in particular, its cognitive aspect. In this sense, before a student can deal with a "design tool" (e.g., business model canvas), she/he first needs to know how to use that tool, not necessarily the steps to reach the final result, but the rationality needed to exploit the tool. To use a metaphor, it seems that in the current entrepreneurial learning setting, students with no or little math literacy are users of electronic spreadsheets. Though this context can be improved. We need to go beyond the surface learning in which students are just following the steps to understand how to perform a task. We should reach the deep learning approach in which the student comprehends the meaning of the task and its intentional content, which allows him/her to achieve better results (Marton & Säljö, 1976).

With this goal in mind, we report in this paper a teaching and learning design to entrepreneurship education (EE) grounded in game-based learning (GBL) and design thinking. We have designed an experiential learning activity that embodied gameplay and game design to engage learners and mediate the design thinking learning process. Applying a board game as our mediational tool (Wertsch, 1998), we propose three interrelated learning experiences called

play, *design*, and *make stages*. In the first stage, the students play a board game designed to provide an introductory experience in entrepreneurship. At this stage, they build their knowledge of game mechanics and market rules to work with at the design stage. Designed for this learning activity specifically, by playing the game, students are allowed to create and execute a strategic plan to attempt to win the game. In the second step, the students are invited to redesign the game they just played and to apply various other perspectives to the original game. They are also encouraged to use analogical reasoning to identify real market mechanisms and elements and use and adapt them to their design. Finally, in the make stage, the students are asked to produce and market their redesigned games and present them in the form of a project. For the last step, the students are expected to use abductive reasoning to analyze the board game market to develop a new business model and validate their design and business solutions. At this point, we would be able to identify and compare the cognitive aspects related to design employed in the rational strategy used to win and redesign the game and also formulate the business model. The combination of all three activities makes the incorporation of design thinking in EE through design cognition possible.

Our proposal does not intend to substitute any established form of teaching and learning in EE, such as studying business cases and developing business plans, since we support the idea that effective entrepreneurs learn from multiple sources (Smilor, 1997).

Background

Business games and simulations have been used to provide learning opportunities in business since the 1930s in Europe (Faria, Hutchinson, Wellington, & Gold, 2009) and the 1950s in North America (Avedon & Sutton-Smith, 1971; Faria et al., 2009). Games are considered an important tool in education to foster student engagement (Jabbar & Felicia, 2015).

Games can be defined as "a system in which players engage in an artificial conflict, defined by rules that results in a quantifiable outcome" (Salen & Zimmerman, 2004, p. 80). Games embody the vision of "reflectively exploring phenomena, testing hypotheses and constructing objects" (Kiili, 2005, p. 14).

Although there is no consensus in the literature on the effectiveness of games and simulations as learning tools (Hays, 2005; Steinkuehler & Squire, 2014), previous research has shown their benefits in supporting student engagement (Boyle, Connolly, Hainey, & Boyle, 2012; Jabbar & Felicia, 2015) and productive student learning with good results (Clark, Tanner-Smith, & Killingsworth, 2016; Vandercruysse, Vandewaetere, & Clarebout, 2012). Gameplay is associated with learning and retention through changes in cognitive processes (Wouters, Van Nimwegen, Van Oostendorp, & Van der Spek, 2013) promoting creativity, concentration, problem solving, and enhancing the ability to process information (Sardone & Devlin-Scherer, 2016).

Even though most of the current literature on GBL emphasizes digital games, board games have persisted at homes and in schools for recreation and learning (Kwok, 2017; Sardone & Devlin-Scherer, 2016). They have been used to address many different topics, such as climate policy (Castronova & Knowles, 2015), history (Hoy, 2018), English, math, and biology (Crocco, Offenholley, & Hernandez, 2016), numerical knowledge (Ramani, Siegler, & Hitti, 2012), e-commerce (Robert & Richard, 2002), knowledge management (Taspinar, Schmidt, & Schuhbauer, 2016), accounting, finance, and marketing (Hergeth & Jones, 2003), and entrepreneurship (Fox, Pittaway, & Uzuegbunam, 2018). Furthermore, board games provide an immersive learning experience and contribute to socialization opportunities in class (Gonzalo-Iglesia, Lozano-Monterrubio, & Prades-Tena, 2018).

Games are models of systems (Kim & Bastani, 2017) and systems themselves (Fullerton, 2008). Understanding games as systems makes game design a promising learning tool for complex contexts such as entrepreneurship through a new way to construct knowledge (Kafai, 2006). Game design as a pedagogical strategy is related to design and/or

programming games that support learning objectives such as coding concepts, design literacy or design thinking, critical thinking, systems thinking, and problem solving (Kim & Bastani, 2017; Martins & Oliveira, 2018).

The use of game design as a pedagogical approach has increased, mainly with the use of computers in classrooms and the popularization of block programming tools such as Scratch, launched in 2007 (Resnick et al., 2009). However, board games encompass cheaper opportunities for design and are a real social practice, not just during the design activity but also during gameplay sessions. Nevertheless, just a small number of studies report the use of board game design in the classroom. Most of them are related to teachers' adaptation/modification of commercial games or custom-built games applied in their courses (Castronova & Knowles, 2015; Hoy, 2018; Sánchez, Parra, Marcela, & Vásquez, 2017). As an educational intervention, board game design was discussed by Kim and Bastani (2017), who showed that eighth grade students designed their own board and card games, mixing different disciplines to integrate multiple sources of knowledge (transdisciplinary approach) in science, technology, engineering, art, and math (STEAM) education.

Our Game Design

Our game, *Entrepreneurial Thinking*, is played taking turns where each turn represents one month. In each turn, a player makes up to four decisions to respond to market demands, ensure profitability, and outperform competitors. After 24 turns, the player who has the highest assets (after paying all his/her debts) wins the game. Player decisions are related to investment, marketing strategy, knowledge management, management, production system, selling, distribution system, and negotiations. As in real life, markets change according to economic events and entrepreneurs have to adapt their strategies according to the new context.

The market is represented on a main board (Figure 1), where players perform marketing research to gather information related to customers' expectations concerning product quality and price. This main board represents two provinces in Canada with cities connected by roads. Besides the customers' expectations, each city has a price for construction. Players have the possibility to build their offices, factories, and warehouses or contract a third-party logistics. These installations are essential to support company management, production, and distribution.

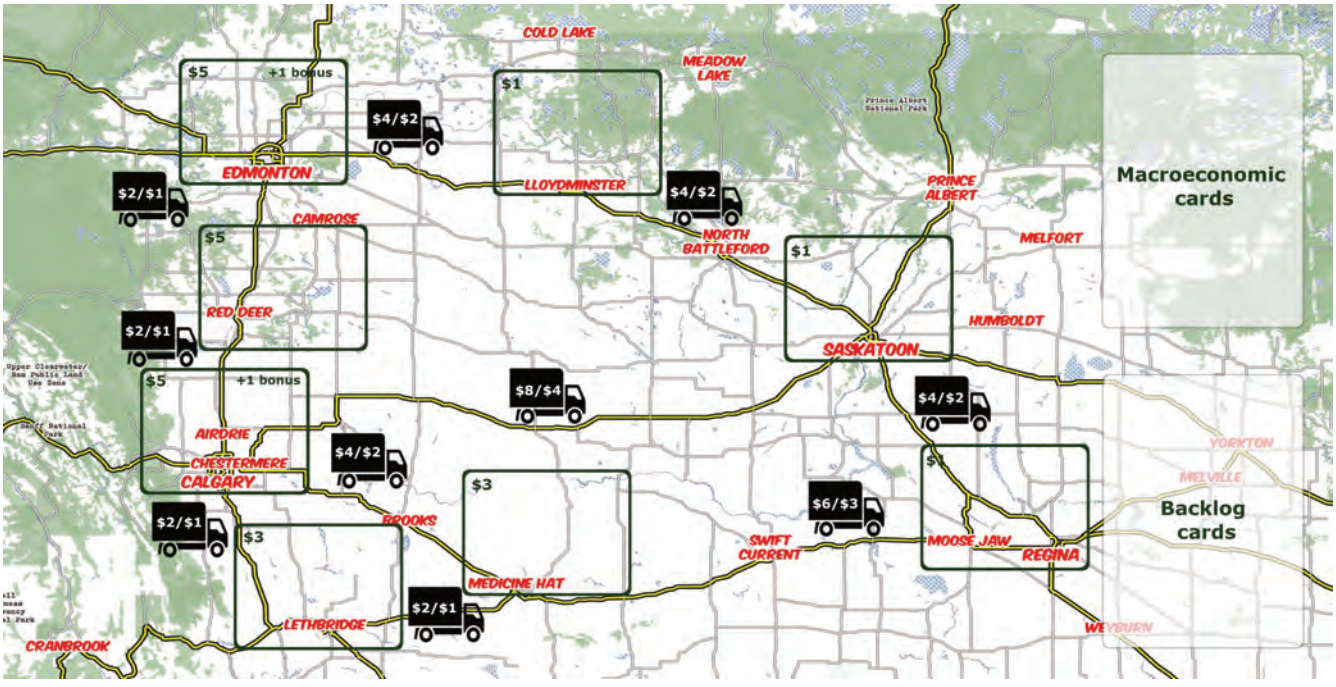

Figure 1. Main board.

A personal board represents the player's company (Figure 2). The company evolves based on the player's strategy, investment capacity, and managers hired. Hiring managers is a critical aspect of the game. To reach better performance, players need to hire executives to help them. Managers such as supply chain managers allow companies to perform better in distribution and finance executives help in the pricing process. Performing all these different roles through this game mechanic, the players act as active problem solvers experiencing the consequences of their choices (Barab et al., 2010) at the same time that they reflect on the importance of teamwork.

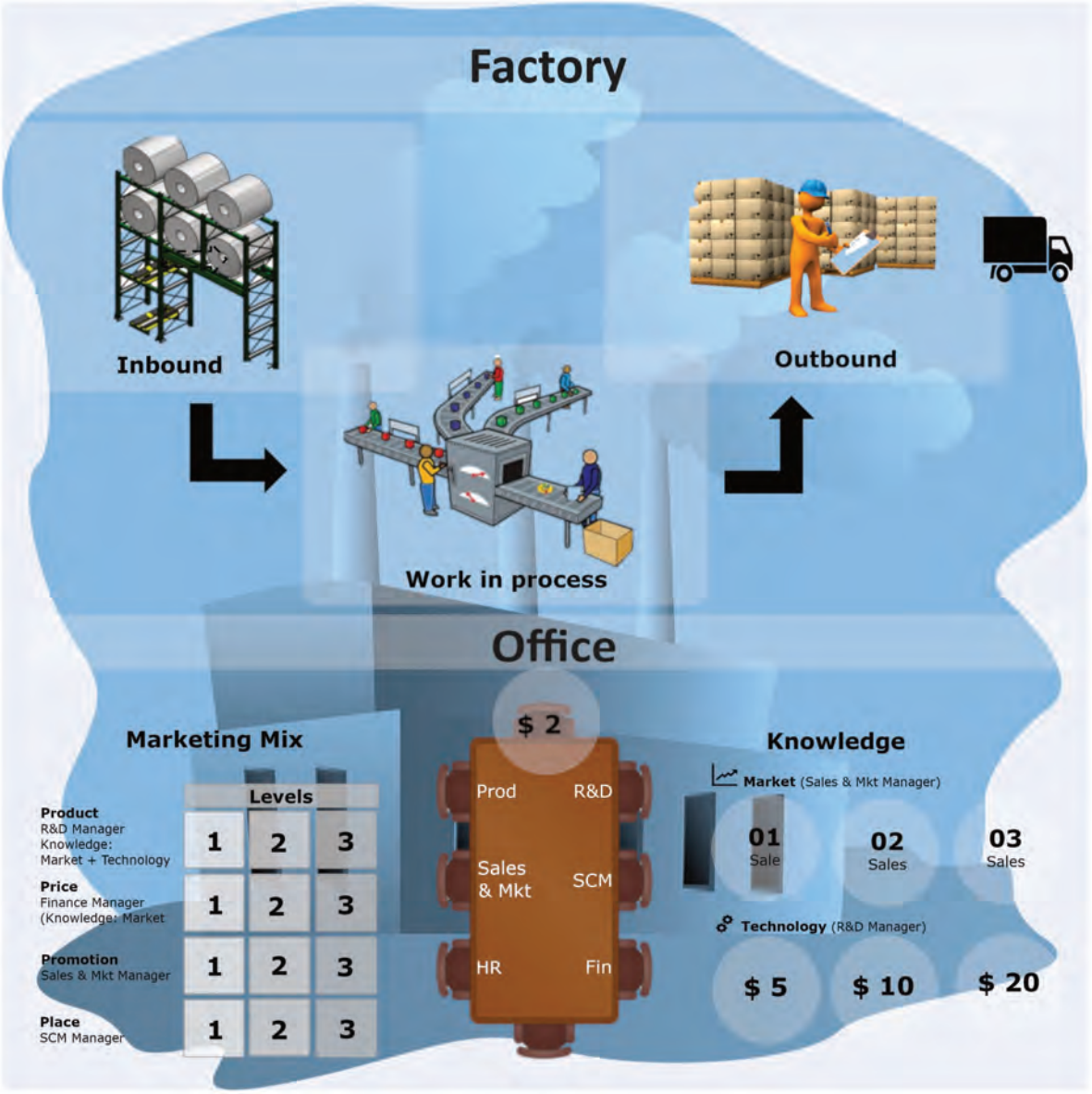

Figure 2. Player's board.

On his or her own board, the player also runs the production system by buying raw material, performing the production itself, and sending the final products to the warehouse, respecting the time needed to perform all these processes. The design of the game pursued a model that strikes a balance concerning playability and learning objectives. In this sense, our game was designed to integrate game structure, learning objectives, and gameplay enjoyment (Plass, Homer, Kinzer, Frye, & Perlin, 2011).

Intervention

In our pedagogical intervention, the students will perform different roles. In each role, the students are immersed in a system with more than one layer. Therefore, the cognitive aspects of design thinking are employed by the students to deal with the elements embedded in each layer and to integrate the different layers to form a meaningful system.

In the first stage, play, students will employ their cognition to design and execute their strategy to overcome their opponents, considering a general approach and emergent strategies that will arise from changes in the economic scenario and his/her competitors' decisions. They must integrate multiple layers, such as the elements of the game (components, mechanics, rules), their assumptions about how to run a business, and the opponents' strategy. Then, after students have played the game, the learners will role-play as designers, working in groups to redesign the played game and to integrate in one layer––the game itself, in the second layer––the relationship between the game and the players, in the third layer––the design team relationship, and in the fourth layer––their beliefs about the game, the game design, and the real business environment. In the last stage of the intervention, the make stage, we will see how the students design a business model that encompasses the product (the game), the technology applied, and the customers' desire. Three complex layers were integrated into one comprehensive system. By combining the three stages, it is possible to analyze the design thinking development and the impact of the intervention in students' comprehension of entrepreneurship.

The intervention described here is offered as opportunities for mediational action in EE but also offers challenges for educators. Garbuio et al. (2018) argued that students who are accustomed to more traditional approaches tend to resist new pedagogies because of uncertainty, messiness, and highly qualitative, real-world aspects that they embody. In turn, Günzel-Jensen and Robinson (2017) examined the barriers to adopting other methodologies considered innovative in EE. New pedagogical approaches go against the right versus wrong–answer dichotomy that permeates students' academic vision, at which the most significant accomplishment is to pass exams. This narrow vision focused on exams also leads to a lack of commitment to entrepreneurship projects that do not contribute/translate to success on exams. In addition, students are not able to reflect on their skills regarding what is essential to becoming an entrepreneur as well as gain little experience on how to create or evaluate business opportunities. Most of the new pedagogies are performed in groups; however, working in groups, students tend to hold back their opinions in order to arrive at collective decision making, which reveals a lack of self-knowledge about their role in a team. Finally, instructors have to legitimize themselves in the learning process as experts in venture creation and also as practitioners with experience in entrepreneurship. Günzel-Jensen and Robinson (2017) also clarified that instructors' legitimacy is essential to keeping students engaged.

It seems that novice teachers will face difficulties experiencing the process proposed here. Experience in dealing with students' frustrations and expectations is one of the essential requirements for instructors to perform well on the implantation of this approach in EE based on design cognition.

Conclusion

In this paper, we draw upon the idea that entrepreneurial activity is intrinsically related to designers' work. Based on that, we support the argument that a reinterpretation of design thinking in teaching and learning practices in EE is needed, mainly when we consider learning contexts with young and undergraduate students who have either no, or very limited, business experience. We build on Garbuio et al.'s (2018) argument that we should teach cognition as explicit content instead of as tools and processes that arise as a pedagogical perspective. Oxman (2001) has also made the same

claim, describing the necessity to reorient design education to a cognition-based approach rather than the production of design artifacts.

We acknowledge the importance of design cognition in the pedagogical practice of EE. However, design cognition will not replace the current EE pedagogy. As such, this paper attempts to present a complementary approach that would bring the essential cognitive tools necessary for instructors and students to creatively work the teaching-learning process aimed to create business opportunities.

In this conceptual paper, we present a contribution to GBL and design thinking, which translates to teaching and learning practices. Through different roles, students will perform design activities with the same subject and artifact but embedded in different systems interacting with distinctive elements. The result will promote a new understanding––based on cognition instead of a process––of design thinking in teaching and learning EE context.

Previous studies (Clark et al., 2016; Denner, Werner, Campe, & Ortiz, 2014; Jabbar & Felicia, 2015) have shown that specific characteristics of games (e.g., mechanics and aesthetics) support better learning and engagement. Our proposal hopes to contribute to the existing literature looking at how game mechanics and other game features contribute to enhancing particular aspects of design cognition, most of which will inform relevant game design attributes to EE. This is relevant as it will not only improve our own design but support future game design in the same field. Moreover, our findings will contribute to the literature in the field, since most of the current research is focused on digital games despite the revival of board games in the game market.

Our proposal also hopes to contribute to deep learning in EE, which is related to reflection (Neck & Greene, 2011). Our pedagogical intervention can overcome the logic of immediacy and urgency, supporting opportunities for reflection and analysis with expected positive outcomes for both deep learning and engagement. Furthermore, our intervention is design oriented, which requires an active learning posture and the synthesis of multiples sources of knowledge. Identifying and understanding which design aspects from our intervention support deep learning will be a contribution to future designs in EE.

References

Avedon, E. M., & Sutton-Smith, B. (1971). *The study of games*. New York, NY: John Wiley & Sons.

Barab, S. a., Dodge, T., Ingram-Goble, A., Pettyjohn, P., Peppler, K., Volk, C., & Solomou, M. (2010). Pedagogical dramas and transformational play: Narratively rich games for learning. *Mind, Culture, and Activity*, 17(3), 235–264. https://doi.org/10.1080/10749030903437228

Boyle, E., Connolly, T. M., Hainey, T., & Boyle, J. M. (2012). Engagement in digital entertainment games: A systematic review. *Computers in Human Behavior*, 28(3), 771–780. https://doi.org/10.1016/j.chb.2011.11.020

Castronova, E., & Knowles, I. (2015). Modding board games into serious games: The case of Climate Policy. *International Journal of Serious Games*, 2(3), 41–62. https://doi.org/dx.doi.org/10.17083/ijsg.v2i3.77

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. *Review of Educational Research*, 86(1), 79–122. https://doi.org/10.3102/0034654315582065

Crocco, F., Offenholley, K., & Hernandez, C. (2016). A proof-of-concept study of game-based learning in higher education. *Simulation and Gaming*, 47(4), 403–422. https://doi.org/10.1177/1046878116632484

Denner, J., Werner, L., Campe, S., & Ortiz, E. (2014). Using game mechanics to measure what students learn from programming games. *International Journal of Game-Based Learning*, 4(3), 13–22. https://doi.org/10.4018/ijgbl.2014070102

Faria, A. J., Hutchinson, D., Wellington, W. J., & Gold, S. (2009). Developments in business gaming: A review of the past 40 years. *Simulation & Gaming*, 40(4), 464–487. https://doi.org/10.1177/1046878108327585

Fox, J., Pittaway, L., & Uzuegbunam, I. (2018). Simulations in entrepreneurship education: Serious games and learning through play. *Entrepreneurship Education and Pedagogy*, 1(1), 61–89. https://doi.org/10.1177/2515127417737285

Fullerton, T. (2008). *Game design workshop: A playcentric approach to creating innovative games* (2nd ed.). Burlington, MA: Morgan Kaufmann.

Garbuio, M., Lovallo, D., Dong, A., Lin, N., & Tschang, T. (2018). Demystifying the genius of entrepreneurship: How design cognition can help create the next generation of entrepreneurs. *Academy of Management Learning & Education*, 17(1), 41–61. https://doi.org/10.5465/amle.2016.0040

Geels, F. W. (2005). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management*, 17(4), 445–476. https://doi.org/10.1080/09537320500357319

Gonzalo-Iglesia, J. L., Lozano-Monterrubio, N., & Prades-Tena, J. (2018). The usage of game-based learning in university education. How to motivate and foster creativity among adult students through board games. In *Proceedings of Play2Learn* (pp. 67–84). Lisbon, Portugal. Retrieved from http://gamilearning.ulusofona.pt/play2learn-2018-proceedings/

Günzel-Jensen, F., & Robinson, S. (2017). Effectuation in the undergraduate classroom: Three barriers to entrepreneurial learning. *Education + Training*, 59(7/8), 780–796. https://doi.org/10.1108/ET-03-2016-0049

Hays, R. T. (2005). *The effectiveness of instructional games: A literature review and discussion*. Orlando, FL: Naval Air Warfare Center Training Systems Division. Retrieved from https://apps.dtic.mil/dtic/tr/fulltext/u2/a441935.pdf

Hergeth, H. H., & Jones, M. R. (2003). Board games and teaching textile marketing and finance. *Developments in Business Simulation and Experiential Learning*, 30, 126–130.

Hoy, B. (2018). Teaching history with custom-built board games. *Simulation & Gaming*, 49(2), 115–133. https://doi.org/10.1177/1046878118763624

Jabbar, A. I. A., & Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. *Review of Educational Research*, 85(4), 1–40. https://doi.org/10.3102/0034654315577210

Kafai, Y. B. (2006). Playing and making games for learning: Instructionist and constructionist perspectives for game studies. *Games and Culture*, 1(1), 36–40. https://doi.org/10.1177/1555412005281767

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *Internet and Higher Education*, 8(1), 13–24. https://doi.org/10.1016/j.iheduc.2004.12.001

Kim, B., & Bastani, R. (2017). Students as game designers: Transdisciplinary approach to STEAM education. *Alberta Science Education Journal* (ASEJ), 45(1), 45–53.

Kwok, R. (2017). Game on. *Nature*, 547, 369–371. https://doi.org/10.1038/nj7663-369a

Martins, A., & Oliveira, L. (2018). Educational video game design by 8th graders: Investigating processes and outcomes. In *Proceedings of 12th European Conference on Game-Based Learning* (pp. 379–387). Sophia-Antipolis, France: ACPI.

Marton, F., & Säljö, R. (1976). On qualitative differences in learning: I—Outcome and process. *British Journal of Educational Psychology*, 46, 4–11. https://doi.org/10.1111/j.2044-8279.1976.tb02980.x

Neck, H. M., & Greene, P. G. (2011). Entrepreneurship education: Known worlds and frontiers. *Journal of Small Business Management*, 49(1), 55–70. https://doi.org/10.1111/j.1540-627X.2010.00314.x

Oxman, R. (2001). The mind in design: A conceptual framework for cognition in design education. In C. M. Eastman, W. M. McCracken, & W. C. Newstetter (Eds.), *Design knowing and learning: Cognition in design education* (pp. 269–295). Kidlington, UK: Elsevier. https://doi.org/10.1016/B978-008043868-9/50012-7

Plass, J. L., Homer, B. D., Kinzer, C., Frye, J., & Perlin, K. (2011). *Learning mechanics and assessment mechanics for games for learning* (White paper # 01/2011). New York, NY: Institute for Games for Learning. https://doi.org/10.13140/2.1.3127.1201

Ramani, G. B., Siegler, R. S., & Hitti, A. (2012). Taking it to the classroom: Number board games as a small group learning activity. *Journal of Educational Psychology*, 104(3), 661–672. https://doi.org/10.1037/a0028995

Resnick, M., Maloney, J., Monroy-Hernández, A., Rusk, N., Eastmond, E., Brennan, K., … Kafai, Y. (2009). Scratch: Programming for all. *Communications of the ACM*, 52, 60–67. https://doi.org/10.1145/1592761.1592779

Robert, G., & Richard, D. (2002). The E-Commerce GameTM: A strategic business board game. *Developments in Business Simulation and Experiential Learning*, 29, 195–207.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge, MA: The MIT Press.

Sánchez, J. S., Parra, J. D., Marcela, L., & Vásquez, L. (2017). Design of a game to make decisions under pressure. *Developments in Business Simulation and Experiential Learning*, 44, 189–195.

Sardone, N. B., & Devlin-Scherer, R. (2016). Let the (board) games begin: Creative ways to enhance teaching and learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 89(6), 215–222. https://doi.org/10.1080/00098655.2016.1214473

Smilor, R. W. (1997). Entrepreneurship reflections on a subversive activity. *Journal of Business Venturing*, 12(5), 341–346. https://doi.org/10.1016/S0883-9026(97)00008-6

Steinkuehler, C., & Squire, K. (2014). Videogames and learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (2nd ed.). New York, NY: Cambridge University Press.

Taspinar, B., Schmidt, W., & Schuhbauer, H. (2016). Gamification in education: A board game approach to knowledge acquisition. *Procedia Computer Science*, 99(October), 101–116. https://doi.org/10.1016/j.procs.2016.09.104

Vandercruysse, S., Vandewaetere, M., & Clarebout, G. (2012). Game-based learning: A review on the effectiveness of educational games. In M. M. Cruz-Cunha (Ed.), *Handbook of research on serious games as educational, business and research tools* (pp. 628–647). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-4666-0149-9.ch032

Wertsch, J. (1998). *Mind as action*. New York, NY: Oxford University Press.

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. https://doi.org/10.1037/a0031311