SUPPORTING DESIGN THINKING THROUGH A GAME-BASED PEDAGOGY
IN ENTREPRENEURSHIP EDUCATION

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Design thinking is an important concept presented in entrepreneurship education. However, the cognitive aspect of design thinking has been neglected by business teaching and learning practices. The aim of this paper is to present a game-based pedagogy to support the cognitive aspect of design thinking and to promote this approach as an alternative to predictive and adaptive pedagogies that are still dominant in entrepreneurial learning. To disseminate our pedagogical approach, we designed and presented experiential learning activities in a workshop format. In this workshop, the participants took part in ludic tasks such as gameplay and board game design to enhance their comprehension about entrepreneurship through design thinking.

Drawing on Simon's (1996) definition for design, we can define design thinking the cognitive effort and design methods to transform a given situation into a desirable one. Design thinking is an essential tool for the future generation who will be tasked with designing new experiences in real and virtual worlds using artificial intelligence and biotechnology. In management practice and literature, design thinking could be improved with the recognition of traditional research in the design field. The synergic integration between design and business thinking is necessary to produce and execute the innovations and changes needed in the business context (Liedtka, 2010; Martin, 2007). As Glen, Suciu and Baughn (2014) pointed out, instead of replacing traditional methods and tools taught and learned in business schools, it is necessary to complement them with design thinking. The use of design thinking is an attempt to combine linear and nonlinear thinking styles, and therefore the integration of design and business thinking to form, for example, better entrepreneurs.

The issues around design thinking in the business education context are in its use as a tool or a procedure for problem-solving. This misuse of design thinking may create linear problem-solving procedures that can lead to rigidity in the solutions (Mayer, 1989). A possible approach may be the development of something neglected by management literature in design thinking so far: the understanding of the cognitive processes involved in design thinking rather than the solution-producing procedures (Badke-Schaub, Roozenburg, & Cardoso, 2010).

Different cognitive processes are presented in business education to enhance the notion of design thinking, such as abductive reasoning, framing, analogical reasoning, and mental simulation (Garbuio, Lovallo, Dong, Lin, & Tschang, 2018). However, there is not a clear pedagogical orientation to promote these cognitive processes in teaching and learning practices.

In this paper we present a pedagogy to support the cognition needed in design thinking and we examine how we adapted it to a workshop format. The pedagogy may be considered as an alternative to the predictive and adaptive pedagogies that still dominate in business, primarily

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within entrepreneurship education (EE) that employs prescribed methods and tools to teach design thinking.

THE PROPOSED PEDAGOGY

In order to propose a new approach to EE grounded in design thinking, we have designed a board game to engage learners and mediate the cognitive aspect of design thinking. Games are models of systems (Kim & Bastani, 2017) and systems themselves (Fullerton, 2008). Understanding games as systems makes gameplay and game design promising learning tools for complex contexts such as entrepreneurship through new ways to construct knowledge (Kafai, 2006). As a tool, a board game embodies design possibilities based on low-cost resources and can easily be used in classrooms without computers, internet access, or other technical devices. Additionally, a board game does not require any previous knowledge for learners to play or design (e.g., coding) while providing an immersive learning experience.

The use of a board game as a pedagogical intervention strategy allows us to incorporate two interrelated learning experiences that we called the play and design 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 the game mechanics and the market rules that will be used during the design stage. By playing the game, students are given an opportunity to create and execute a strategic plan in an attempt to win the game. In the second stage, the design stage, the students are invited to redesign the game they just played and to apply various other perspectives to the original gameplay. They are also encouraged to identify real market mechanisms and elements and to use and adapt them to their design. Furthermore, a pedagogy based on game design produces more inclusive learning environments that can engage students with different skills through the exploration of their interests and creativity in the design process (Kim & Bastani, 2017). At this point, we are able to identify and compare the cognitive aspects related to design employed in the rational strategy used to win and redesign the game.

OUR GAME DESIGN

Entrepreneurial Thinking is a non-commercial board game that offers students the opportunity to role-play as entrepreneurs and develop design thinking skills. Although the game was designed with first-year undergraduate students in mind, a large range of students (from junior high to graduate students) can learn design thinking using this game.

The game is played by 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. Player decisions are related to investment, marketing strategy, knowledge management, management, production and distribution system, sales, and negotiations. Therefore, the game is entirely contextualized to provide an immersive experience in entrepreneurship activity and motivated learning (Ke, 2016).

As in real life, markets change according to economic events, forcing entrepreneurs to adapt their strategies within a new context. These changes are represented by macroeconomic cards that players randomly draw at the beginning of each round (Figure 1). This is an essential feature incorporated into the game design since exogenous factors are not very often included in business simulations. This mechanism was incorporated to address the lack of uncertainty observed in game or simulation design (Fox, Pittaway, & Uzuegbunam, 2018). At the same time,

the players should be able to manage the growth of their business by hiring employees and allocating their talents and workforce.

To design the game, we drew upon the concept that EE goes beyond the venture creation process (Pittaway & Cope, 2007). Entrepreneurial Thinking was designed to provide experience in entrepreneurial activity while incorporating some specific learning objectives. Table 1 summarizes these learning objectives and which game structures would best support them.

Table 1
Entrepreneurial Thinking learning objectives

Learning Objective	Related Game Sctruture
Introducing the principles of the industrial company activity and its main challenges	Production system
	Managers' roles
	Different product's quality and price
	Production lead time
	Selling system
	Customers' expectations
	Money and Investment
	Marketing strategy
Improving the decision making and planning reasoning	Up to four decisions per turn
	Decision related not just production system
	Production lead time
	Selling system
	Customers' expectations
	Money and Investment
	Marketing strategy
Learn from events, crises and failures	Bankrupt
	Macroeconomic events

Entrepreneurial Thinking is a competitive game. After 24 turns, the player who has the highest assets (after paying all debts) wins the game by converting assets into money. The assets encompass both tangible (e.g., money) and intangible assets (market leadership). For example, the market leadership of each city is equivalent to $60.

MACROECONOMIC CARD

NEWS

Oil price increases

Freight increased in $1
(only in this turn)

Figure 1. Example of a macroeconomic card in the game

Market leadership is measured by the number of "Sales Markers" in a city. For example, if Company A has two Sales Markers in a city, and Company B has just one, then Company A has the market leadership. If both have the same number of Sales Markers, then the two companies divide the value of leadership and receive $30 each. In a city with a player's factory, a rival company has the leadership only if it has three Sales Markers in that city. If two or more players have the same amount of money in the end, they will both be considered winners.

The market is represented on the main board (Figure 2), 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' pricing expectations, each city has a designed price for building offices, factories, and warehouses. To experience the make-or-buy decision, players also have a choice to contract a third-party instead of building their own warehouse. These installations are essential to support company management, production, and distribution.
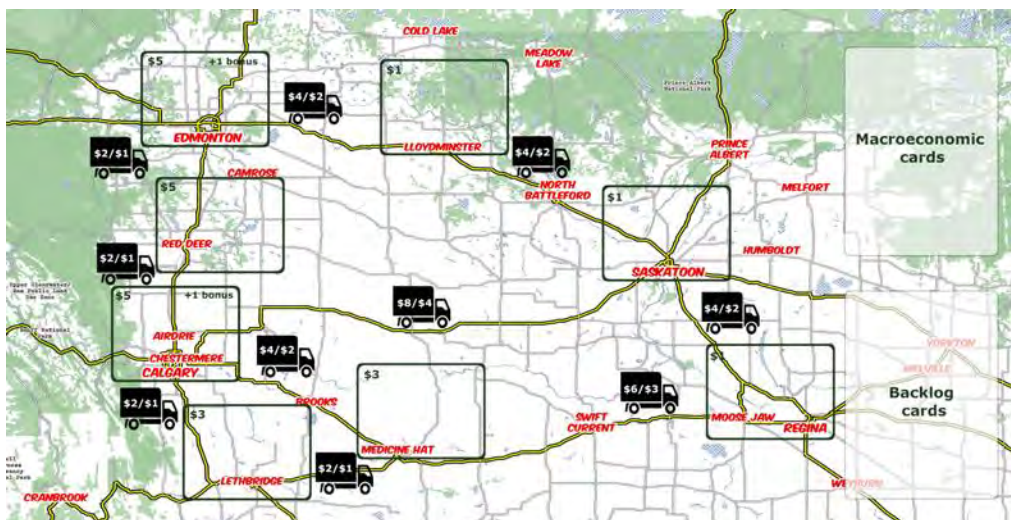

Figure 2. The main game board

A personal board represents the player's company (Figure 3). The company evolves based on the player's strategy, investment capacity and managers hired. This is an important 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. Finance executives help in the pricing process, and Research and Development (R&D) managers work in product development. 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) while simultaneously reflecting on the importance of teamwork.
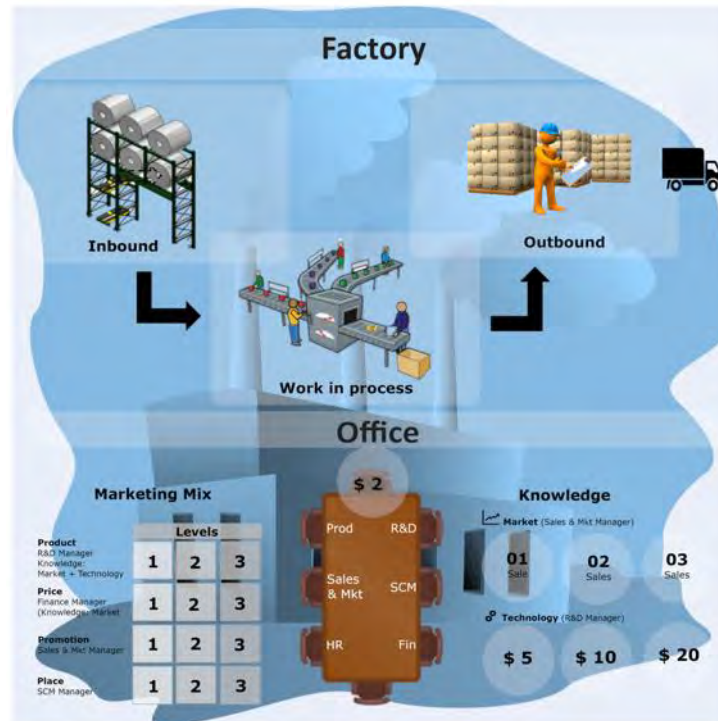
Figure 3. One of the player's board

On their own board, the player also runs the factory by buying raw material, performing the production process itself, and sending the final products to the warehouse. However, one needs to respect the time needed to perform all of these processes. Other elements of the game include the opportunity to pitch the company to gather more investments, as well as an advanced module with an added set of cards. The rules and design cards allow the players to change the rules and expand the design of the game, which can bridge their design activity and deepen their knowledge of entrepreneurial work.

The design of the game follows a model that strikes a balance concerning playability and learning objectives. In this sense, Entrepreneurial Thinking was designed to integrate game structure, learning objectives, and gameplay enjoyment (Plass, Homer, Kinzer, Frye, & Perlin, 2011). This approach required a modular design that uses a core module responsible for learning objectives and peripheral modules that support the learning objectives. Peripheral modules can be removed without impacting the learning objectives. This approach also considered the design of components, rules, and mechanics that make the game more realistic or less complex. Figure 4 presents some examples of the game structures used in the game design approach.
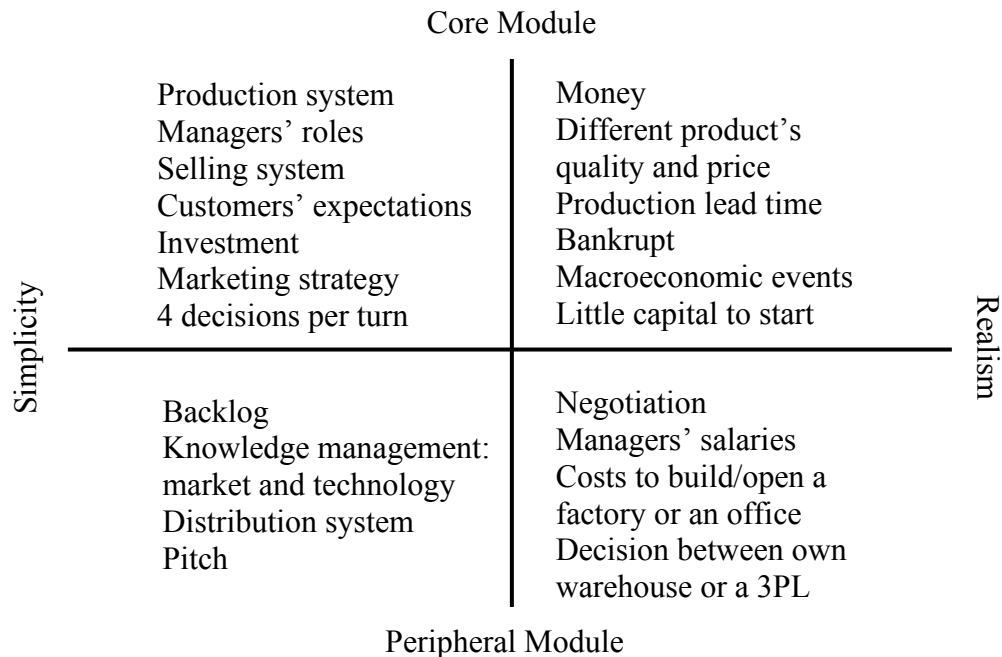
Core Module

Production system Managers' roles Selling system Customers' expectations Investment Marketing strategy 4 decisions per turn	Money Different product's quality and price Production lead time Bankrupt Macroeconomic events Little capital to start
Backlog Knowledge management: market and technology Distribution system Pitch	Negotiation Managers' salaries Costs to build/open a factory or an office Decision between own warehouse or a 3PL

Simplicity — Realism

Peripheral Module

Figure 4. Game design approach

WORKSHOP EXPERIENCE

To disseminate our pedagogical approach for EE based on the Entrepreneurial Thinking game, we organized and implemented a workshop. The participants, who included instructors, lecturers and graduate students interested in new pedagogies, were engaged in experiential and ludic activities involving gameplay and board game design to enhance their comprehension about entrepreneurial learning. We aimed to enhance the notion of design thinking, providing a compelling experience for participants in any field who are interested in promoting an innovative classroom pedagogy as entrepreneurial skills, design thinking and experiential learning do not apply only in business contexts. In the workshop, however, we used a modified and simpler version of the original game to overcome time constraints. We removed some of the peripheral modules such as backlog cards, knowledge management (market and technology) and pitch.

The workshop format allowed us to incorporate elements commonly discussed in traditional entrepreneurship classes with the engaging experience of playing and redesigning a game. In doing so, we highlighted the importance of integrating various pedagogical methods for an insightful entrepreneurship course.

We organized our presentation towards entrepreneurial thinking in four interrelated topics. First, we presented approaches to generate ideas and the essential role of creative thinking in innovation. We also discussed the importance of combining divergent and convergent thinking to the ideation process.

After a brief conceptual explanation about tools and methods used to generate ideas, our second topic was a gamified activity related to the development of a product. Gamification, the way to learn through game-like activities, has been used as a strategy to engage and motivate students and received increased attention in different contexts (Buckely & Doyle, 2016). In this sense, for our gamified activity, the participants were organized in groups, and each group

received a deck of cards that we adapted from an exercise proposed by Dr. Jim Wilson from Innovate Calgary. The cards represented features that could be incorporated into a fictitious product and scores were added for each included feature. The scores encompassed our gamified intent in which the groups would compete against each other to combine many features as they wished to create an innovative (and crazy) product. The group that got the highest score won the activity. Figure 5 presents some of the cards available for workshop attendees.

Autonomous Score: 5	Hand Score: 3	Implant Score: 5

Figure 5. Example of feature cards

In our third topic, we discussed the concept of creating a business model. We presented well-known tools for business model design, such as the business model canvas (Osterwalder & Pigneur, 2010), idea model (Straight Up Business Institute, n.d.), and lean start-up canvas (Lies, 2011). After this concise discussion, we started our final experiential activities.

The gameplay and game design were performed as our fourth topic in which we attempted to underline the assumption that the entrepreneurial activity goes beyond the ideation process and business model development. At this point, we presented that running and growing a business are both essential endeavours for a successful entrepreneur.

To simplify the gameplay and potential time constraints, we shared the main board on a large, central screen. To speed up the process of learning and playing the game, we also defined the business localization and customer expectations using the classification of our earlier gamified product development activity. The group that won the activity received the best starting city (the orange company in Lloydminster) and so on. The most challenging business to manage was designated to the group that scored the least (the grey company in Calgary) (Figure 6).
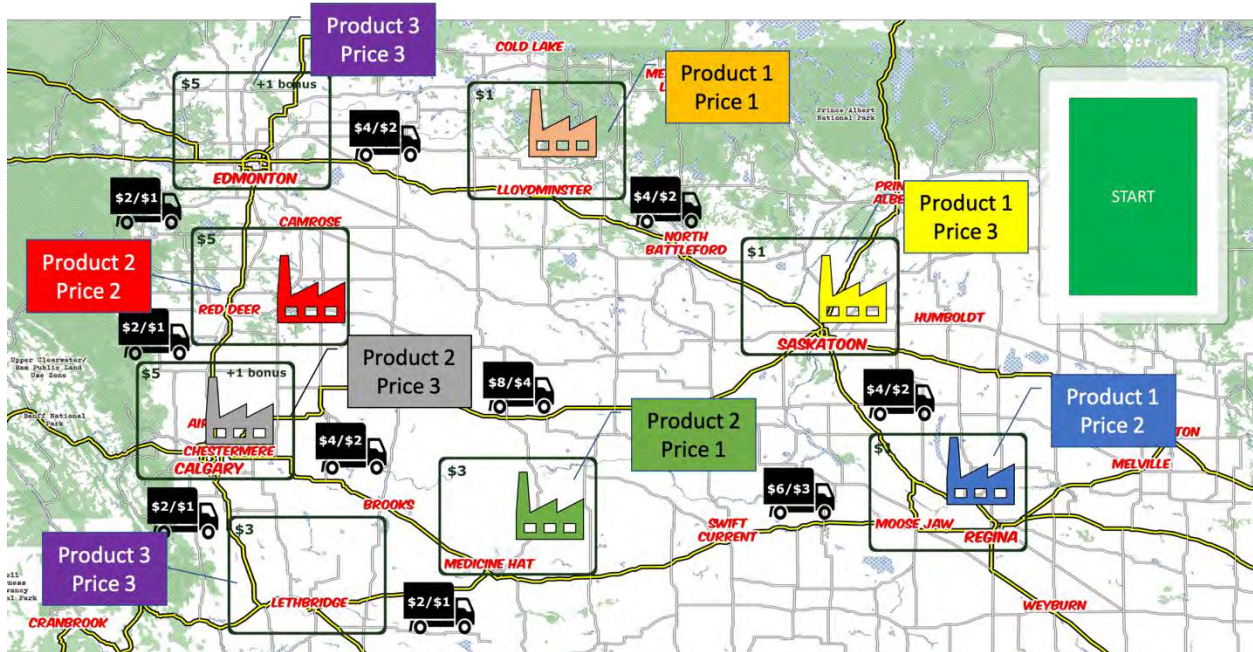
Figure 6. Main board projected to workshop attendees

The players' boards were also modified and simplified to represent the factory and the marketing mix levels (Figure 7). As the game was played in groups, to engage all participants, we created additional executive cards (Figure 8). Each member of the group performed actions representative of their assigned executive position.
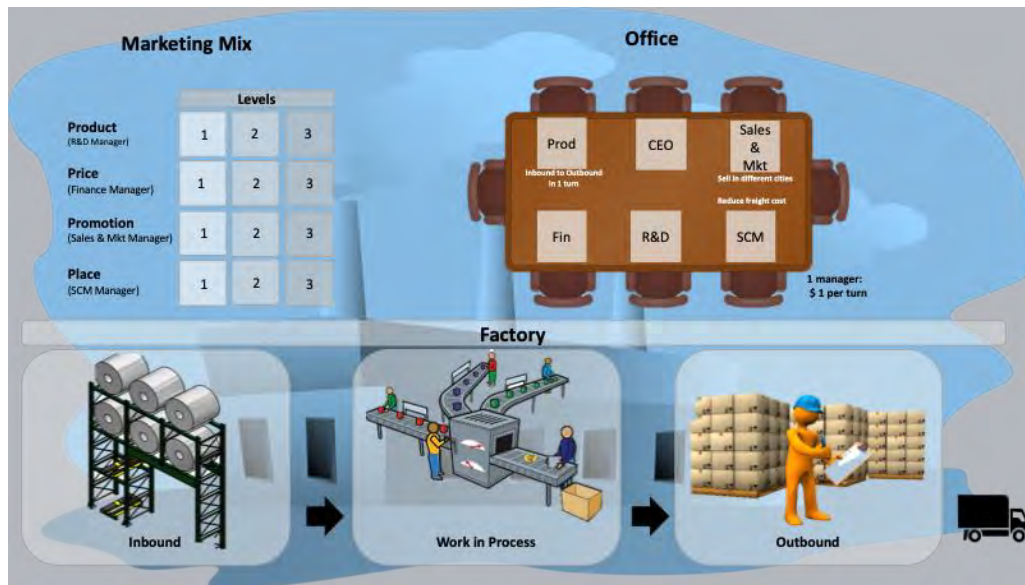

Figure 7. One of the modified player's board

Figure 8. Example of executive cards

Participants played four rounds, and after each round, we promoted quick reflective analyses. These analyses covered themes related to the entrepreneurial activity such as team formation, how to progress with little or no resources, product adoption, the view of business as a system, the importance of resiliency, emergent strategy, the increasing complexity of business environment, and learning from failures.

Finally, we presented some basic concepts of game-based teaching and learning, highlighting the differences between learning by playing games and gamification. Both approaches were integrated into our workshop. We discussed the idea of learning by designing games, and we invited the participants to think about rules or elements that the group might like to redesign and why, depending on their own area of technical expertise. At the end of the workshop, the participants shared their ideas on how to incorporate our approach into their teaching and learning practices.

Reflecting on our observations about the workshop, we noted that participants who work as instructors in the business field, some in entrepreneurship education, saw a straightforward connection between their practices and our pedagogical strategy. One of the business instructors who attended the workshop sent an email to the first author, after some days, in which he said: "I would love to talk about your game. I have thought about it a lot." However, they mentioned that it would be challenging to adapt this game-based activity to large classes and also expressed concerns on how to assess students' work based on game design. Instructors from different areas, such as health care, presented ideas to create games adapted to their context, for example, a hospital setting.

CONCLUSION

To promote a new and complementary approach for teaching and learning practices grounded in design thinking in EE, we designed a board game to teach introductory concepts of entrepreneurship. In our original pedagogical strategy, students, after playing the game, are invited to redesign it. In their strategic plan formulation and execution and through the game redesign process, opportunities are presented to promote the cognition required for the design thinking process.

Our workshop was designed to promote the same experience provided by our game-based activity and to stress the importance of combining various pedagogical approaches in EE. As discussed, our approach was intended to be a complement rather than a substitution for traditional pedagogical methods.

The workshop participants had an opportunity to design their own innovative products, gameplay strategies, and even game design ideas within an engaging, experiential learning context. Moreover, participants had to negotiate their ideas within groups considering diverse backgrounds, values, and management assumptions.

For us, this entire process also offered important lessons. First, we had an opportunity to test our pedagogical design through the observation of design thinking and design cognition in action. Second, we learned through our own workshop preparation process how to utilize design thinking. To adjust our approach for a workshop format, we employed design thinking to prepare our interrelated activities and overcome the time constraints for our presentation. We successfully adjusted our time frame for gameplay and game (re)design to support valuable teaching and learning practices through changes in some game mechanics (e.g., the way players chose the city to start a business) and in how to play the game (e.g., using the screen as the main board).

Our game-based pedagogy does not intend to substitute any established form of teaching and learning in EE, such as studying business cases and developing business plans. It is designed to complement other approaches by enhancing or introducing design cognition in EE. Existing EE approaches are useful sources of knowledge and provide students with the skills needed for the entrepreneurial activity applied in the design game phase. Effective entrepreneurs learn from multiple sources; they learn from customers, suppliers, competitors, their own experiences, from what works and especially from what does not work (Smilor, 1997). We suggest that our pedagogical strategy based on gameplay and game design supports deeper learning alongside the application of existing techniques.

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