Education and Information Technologies (2019) 24:3841–3854
https://doi.org/10.1007/s10639-019-09958-4

The use of a serious game in entrepreneurship teaching

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Received: 17 September 2018 / Accepted: 21 June 2019 / Published online: 8 July 2019

Abstract

In this article, this research examines the use of a Serious Game at the end of an entrepreneurship course, following the experiential learning theory which states that learning couldn't take place if student are unable to experiment what they are learning in class. That is especially true in an entrepreneurship course where understanding how a company works can't be complete without trying to simulate what is like to be an entrepreneur in real life. The Serious Game makes it possible to; apply concepts acquired in class, in a virtual environment, while eliminating the risk factor. A field survey was conducted to determine the profile of students, their predispositions to use the Serious Game and the influence of the game on the engagement of students in their entrepreneurship learning. This study discusses the results obtained as well as the possibility of adopting Serious Games as a learning tool.

Keywords Education · Serious games · Entrepreneurship · Experiential learning · Student learning · Student engagement · Activity theory

1 Introduction

Student born in this era, also known as generation Y are very familiar with electronic devices, which affected their concentration and developed an impatient behavior. In

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s10639-019-09958-4) contains supplementary material, which is available to authorized users.

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addition, motivation became a problematic issue in nowadays schools. Khenissi et al. (2015) wrote: "*students of this generation are disengaged, bored, suffering from a bad attitude and they aren't challenged in traditional classroom"*. Since students are eager to use anything that involves technology, we considered the use of Serious Games as a learning tool. Serious Games can be defined as: "*a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives*" (Zyda 2005). Using such a tool to teach certain parts of a concept could offer a suitable solution to resolve the lack of interest felt in classrooms, as well as enhancing the overall understanding of the teaching (content). Although, "*game playing and learning sometimes seem to be based on principles that are apparently contradictory […]Video games are associated with interaction, practice, and immersion in the game environment; on the other hand, learning can require a break in the activity so as to take the time to think about what is going on and what one is learning*" (Huynh-Kim-Bang et al. 2010, p.2). The use of Serious Games goes beyond the scope of education and can be transposed in other fields. Combining two concepts (learning and fun) is not as contradictory as it seems.

Literature is full of article and research that stresses the relevance of such tools for education. Simulation and games as teaching aids are also part of an experiential learning, since they propose the construction of learning through the direct application of acquired knowledge. For example, Borrajo et al. (2010), found that the use of the SIMulator Business Administration (SIMBA) enabled the application of the concepts and techniques learned during the training, through analysis, decision-making, and assessment of various proposed situations without having to take any risks. In Medicine, Sabri et al. (2010), have used "*Total knee arthroplasty Serious Game*" to help students understand the steps of the surgical procedure as well as the decision-making and cognitive process that are used during the operation. The authors explained that the realization of these tasks in advance allows the future doctors to concentrate exclusively on the technical aspects. Meanwhile, Khenissi et al. (2015), studied the differences between a game created to play and the same game hijacked for educational purposes. They listed nearly 6 of the most popular games such as Tetris, Snake etc. to other lesser known, which have been diverted from their primary goal successfully.

This article represents the second part of a study on the use of Serious Games in entrepreneurship teaching. The aim is to analyze how a Serious Game can affect student's learning experience in the field of entrepreneurship. Our research has been divided into two parts; a first survey on the accuracy of the project itself, since it is a new tools that has never been used in our school. The results were discussed in a previous article (Charrouf and Janan 2016). The second part, presented in this article, focuses on the application of a Serious Game to study whether there is an increase in students' commitment to their learning of entrepreneurship.

In the first study, a questionnaire gave us an overview of the student's profile. The data obtained shows individuals interested in entrepreneurship, curious to learn but especially with an entrepreneurial intention (69%). As explained by Walter and Block (2016): "*the better an individual feels equipped with entrepreneurial knowledge and motivation from entrepreneurship education, the more likely she has the confidence to overcome regulation-related barriers* ". According to our survey, we found that students are prone to use a serious game as part of an exercise at the end of their entrepreneurship course. The awareness of video games functioning combined with the

interest in entrepreneurship helped us continue the experiment. We think that Serious Games as learning tools can bring value to the entrepreneurship course, since it allows students to discover the world of business in a secure environment that reflects reality.

2 Theoretical framework

2.1 Methodological approach and items definition

Based on items description of the interaction triangle in (Abouelala et al. 2015) work, and (Engeström 2006) Fig. 1, we can define the components as follow:

- Subject: student or group of students;
- Object: application of concepts acquired during entrepreneurship course;
- Mediating Artifact: Serious Game;
- Rules: legislative texts regarding the organization of studies (teaching hours, number of subjects, tutorials, etc.);
- Community: schools and universities, Serious Game designers, developers, Serious Game users (students, players, professors, researchers ...), companies etc.;
- Division of labor: presidents, directors, deans, departments, branches, task etc.

Either explicitly or implicitly, it is the community that sets the rules and elaborate the appropriate division of labor (Engeström 2006). In the following diagram we gathered the components above in order to clearly show the interactions between them (Fig. 2).

2.1.1 The subject

To develop our questionnaire we analyzed the different components of the interactions triangle. Each one has its own characteristics forming a complex system (an entity) that interacts with other entities, creating a causal relationship that goes in both directions.

The first component is the "subject" which in our case, refers to students from the same class. However, students are different human being with different personalities,

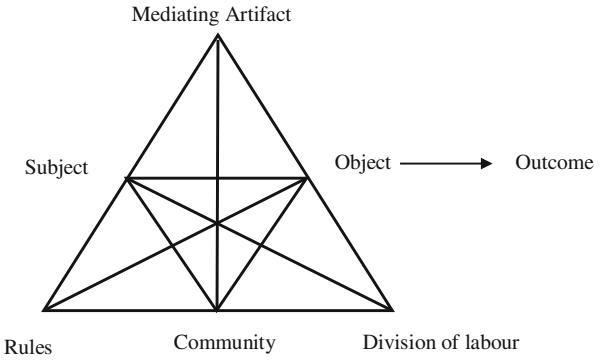

Fig. 1 The structure of a human activity system (Engeström 2006)

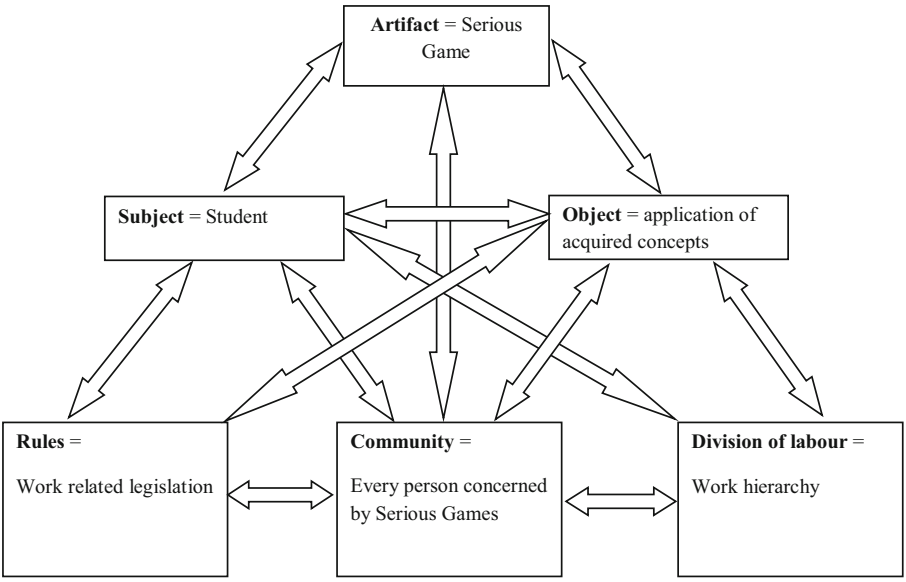

Fig. 2 Interactions between the components

social behaviors etc. These diversities generate different responses depending on the situations. Even though students are using the same tool in the same context, they will have different reactions to it. It is then necessary to study students' characteristics to determine the achievement of the goal.

The figure below presents the main characteristics to study (non-exhaustive list):

The student is characterized, on the one hand, by a social and historical background: the family he grew up in, the different schools he got in to, the people he met, etc. All these influences helped shape an individual who will influence his environment as well, starting the first loop of a dynamic change.

So as to see whether or not the purpose of the activity has been achieved (learning application) it is necessary to collect data on: students' age, gender, field and education level, English level (since the artifact is in English), extracurricular activities (especially those tending towards voluntary work). The latter could reveal if there is a relationship between associative work and entrepreneurial intention or behavior. Furthermore, the purpose of the item 'desired job' is to determine whether the student prefers to work as an employee or is more likely to work on his / her own. The item "entrepreneurial possibilities" refer to the existence or non existence of opportunities for the student to consider entrepreneurialism. Finally, the 'Family Background' item will give us an insight about the influence of the student's environment regarding his life's decisions (studies, future profession, etc.).

On the other hand, we need to evaluate the student's requirements in two sectors: entrepreneurship and Serious Games. The prerequisites for entrepreneurship help us determine knowledge and interest in the subject. In fact, a student who appreciates entrepreneurship course and finds it useful will not consider the Serious Game as a student who doesn't. In addition, having already attended entrepreneurship classes may help the student understand even better the course and its application. As to video

gaming prerequisites, they aim to acknowledge student familiarity with video games; which type is preferred (arcade, role play, reflection ...) as well as the usual media game (console, PC, phone).

Gathering this information will help us understand the attitude with which the Serious Game will be tackled, but also, will give us a first idea on the possible results of the experimentation.

2.1.2 The artifact

The artifact is the tool by which subject realizes the activity and tries to achieve its objective. In our case the artifact is a Serious Game named "GO VENTURE Small Business" which is an educational game to simulate a business. Students, either alone or in a group, must make decisions related to the management of their business. Those decisions could be about the production of goods, the sale process, team management, etc. Two aspects seemed important to study: the ergonomic aspect and the pedagogical aspect. In that, to explain how and why it can help achieve the purpose of our learning activity.

The following diagram illustrates the items of the component "Artifact":

The Serious Game ergonomic refers to the adequacy between the game and user abilities. Several criteria can be evaluated: the interface, which is the visual structure used to choose the steps to follow. Interactivity makes it possible to determine the mechanics of the game through the interaction Human-Interface. Usability, in turn, refers to ease of handling. The more easily manipulated, intuitive and effective the game is, the more usable it is. Utility refers to the use made of the functions and how well the game serves the purpose.

Other items should be considered in evaluating the ergonomic factor such as realism and gameplay. The first one is important since the purpose of using this tool is to bring the student closer to the reality lived by a business owner on a daily basis. Secondly, gameplay refers to interactions between the user and the game (Perron et al. 2012). It should be easy to handle in order to have a pleasant and fun experience, and not be a "serious" learning activity. Finally, the system performance and speed items are there to support the previous variables and to make sure that the game works well (no bugs).

The second factor presented in Fig. 4 is the pedagogical aspect. Indeed, the difference between a normal video game and a Serious Game is its educational aim. The game becomes a learning tool in addition to its recreational aspect. Our tool must therefore combine these two aspects in order to best serve its primary purpose. In order to do this, we need to know the students' perceptions of the pedagogical scenario and the game's playfulness. The purpose of studying these items is to collect data about student's satisfaction as well as experience using a new learning tool. It also might be interesting to know if he would be willing to play it again or even share it other students.

2.1.3 The object

Previously, we set as a goal of the learning activity, the application of acquired knowledge. In that, to evaluate the object we need to ask ourselves some questions: What are these achievements? How does "application of prior learning" action take place? Can it be evaluated or measured? What are the items that reflect it?

By ‘acquired knowledge’ and ‘prior learning’ we refer to concepts taught in the entrepreneurship course such as: market place, competition, customer, marketing, business plan, intellectual property etc. The actions taken while playing may give us answers regarding the question “how?”. These actions reflect decisions made by the student in response to different situations. In fact, the decision making process results from understanding a concept in the classroom. In other words, during the game, if the student is confronted with selling a certain amount of product, he must refer to what he has learned as marketing concepts in order to determine the price, the type of promotion to choose etc. The same goes for hiring employees, purchasing raw materials and so on.

In our study, we used a combination of two scores: “customers’ satisfaction score” and “revenues” as a way to tell if the knowledge learned in the classrooms is put to usage. It should be noted that the score (revenues) also depends on a good comprehension of the game as a whole by passing the language (the game is in English). Moreover, familiarity with gaming can also have an influence. These elements must be taken into account when analyzing and discussing the results.

The last three components of the triangle (Rules, community and division of labor) will be the subject of a separate article as they require a full study. For this reason we will not discuss them in this document.

2.2 Questionnaire

We collected data through using a questionnaire build only with questions about the first three components of the interactions’ triangle: Student - Serious Game - Objective.

Since this article is not meant to assess the environment of our activity we intentionally left the other component (rules, community, and division of labor). If we gather the component cited above we shall find six factors, each one divided into multiple items:

- F1: Students’ social and historical profile;
- F2: Prerequisites for entrepreneurship;
- F3: Prerequisites for video games;
- F4: Serious Game Ergonomic;
- F5: Pedagogy of the Serious Game;
- F6: Success of the game (score achieved, objective).

The table below details each factor with related items:

(Concerning the first factor two items from the Fig. 3 are not in the table education field and education level since all the student were in the same class and studying the same thing) (Table 1)

The next step is to translate items into question, to provide answers that will enable us to assess the achievement of our proposed learning activity.

3 Results and discussion

The purpose of this study is to collect data through the questionnaire to provide answers that might help us verify our two hypotheses:

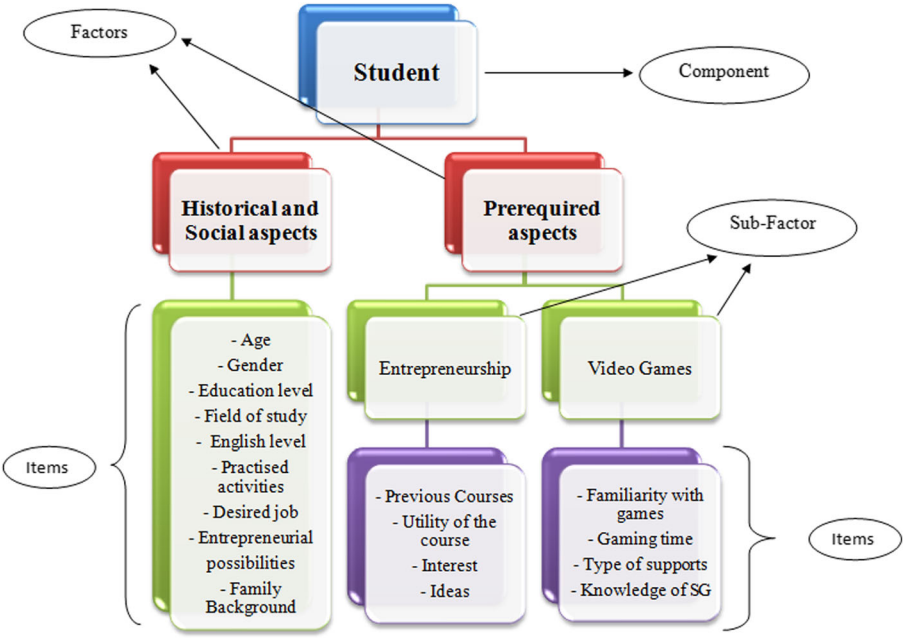

Fig. 3 Items from the component 'Student' (or subject)

- Does the use of a Serious Game influence students' entrepreneurial behavior and / or the way they perceive entrepreneurship?
- Can we consider the use of Serious Game as a tool to partly apply knowledge acquired during entrepreneurship course?

3.1 Population

The students selected for the experimentation attend a Master degree program in Water, Energy and Environment Sciences. As in the previous research (Charrouf and Janan 2016), they have an entrepreneurial course divided into four chapters: the first one explains the concepts of business, market, suppliers, competition, etc. The second chapter focuses on the technical model: the conception of the idea, its usefulness, costumers, the determination of the market, competition, and the terms of development and realization. Finally, the third chapter deals with the financial model, in other words, the business plan. In this part the student learns the basics of short-term and long-term strategic planning, budget estimation, and the company functioning (expenses, immobilization etc.). At the end of the entrepreneurship program, 2 h were dedicated to the application. Student played the Serious Game for an hour and half and after that they had 30 min to answer the questionnaire.

The sample is composed of 31 learners; 16 girls and 15 boys with an average age of 21 years. Data processing has been made using SPSS statistical software. We used cross-tabular dependency analysis to determine possible links between variables and their degree of intensity.

Table 1 Factors and items

F1: Students' profile	F2: Entrepreneurship prerequisites	F3: Prerequisites for video games	F4: Serious game ergonomic	F5: Pedagogy of the serious game	F6: Success of the serious game
Age	Previous courses	Gamer	Interactivity	Pedagogical scenario	Revenues
Gender	Intrest	Gaming time	Usability	Improved knowledge	Human ressources
English level	Utility of the course	Type of support	Game language	Hook	Custumors satisfaction
Practiced avtivities	Ideas	Knowledge of SG	Realism	Skill developpement	Playing again Go Venture
Desired Job		Knowledge of GO venture	Gameplay		Game influence
Possibilité d'entreprendre			Utility		
Family backgroung			System performance		

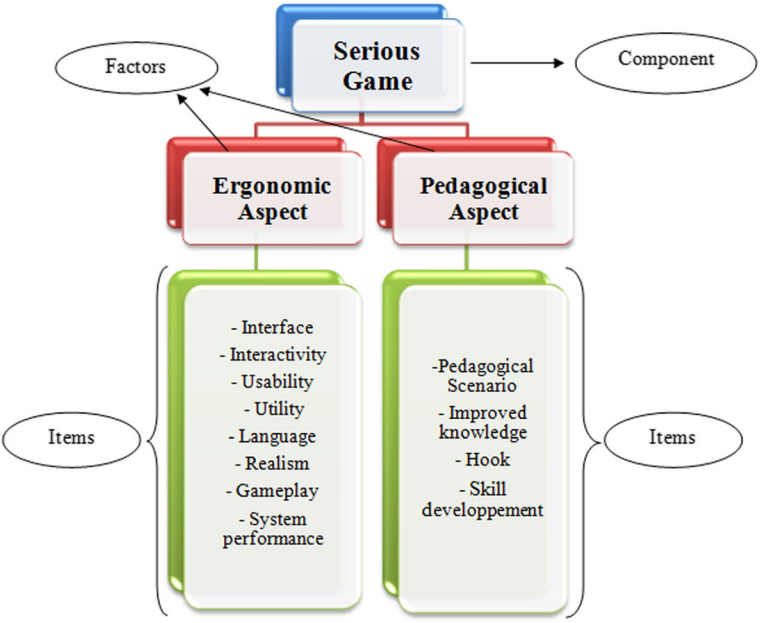

Fig. 4 Items of the component 'Serious Game'

3.2 Results and discussions

The study of the data collected allowed us to obtain several results. First, the following correlation table determines the most significant ones among all the variables in our

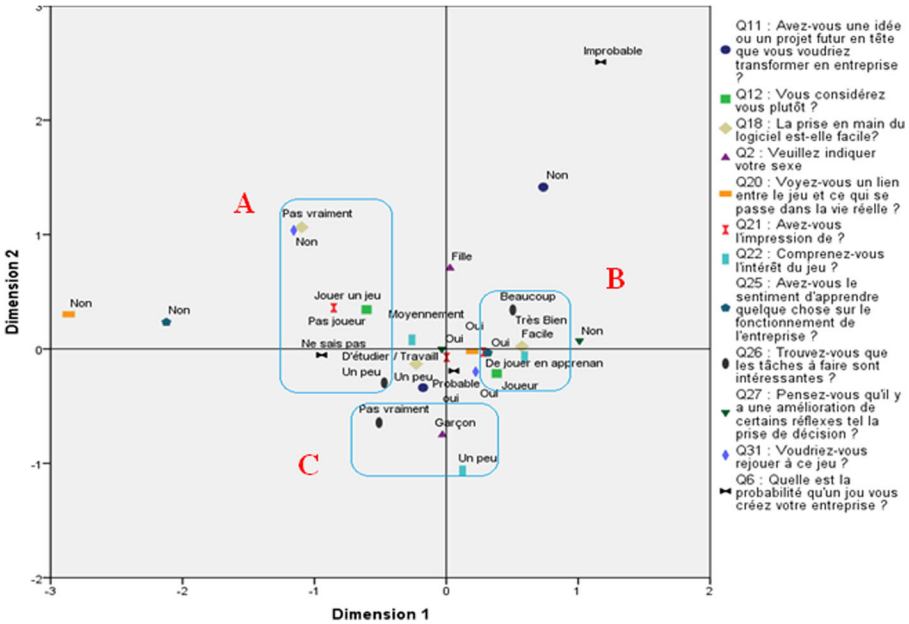

Fig. 5 Attached diagram (Le 1st factorial plane)

survey. A correlation refers to a relationship or connection between two or more elements. Three major intervals can be pointed; weak correlation are those between $0 \leq |\text{correlation}| \leq 0.175$, moderate correlation are between $0.175 \leq |\text{correlation}| \leq 0.35$, and strong correlation are $0.35 \leq |\text{correlation}| \leq 1$. To obtain this table, two criteria were followed:

- The correlation significance at 1%, or 5%: meaning that the correlation is accepted with an error level not exceeding 1% or 5%,
- The importance of the correlation: two variables are considered highly correlated if the value of the correlation is close to 1. However, in general it is difficult to find that, so we admitted that two variables are correlated if $(0.35 \leq |\text{correlation}| \leq 1)$.

Our analysis points out three important and significant correlations between the variables of the study:

– The variable represented by question Q12 (Gamer or not) and the one represented by question Q18 (ease of use) have a correlation of 0.399. This is a positive correlation that shows the existence of a link between; the fact that a student is used to playing video games and the handling of the software. The more students are familiar with playing video games the easier it will be to use Serious Game.
– The variables represented by question Q18 (ease of use) and Q25 (learning new things) have a positive correlation of 0.359. This correlation indicates that getting started with the software seems easier for students who feel they are learning something about how the business works, and vice versa. In fact, putting themselves in the manager/owner position in real time and seeing the impact of their decisions in the game, pushes students to make more effort to understand and play the game more seriously.
– The variable represented by question Q25 (learning new things) and the variable represented by the question Q20 (realism) have a correlation of 0.682. This is a positive and rather important correlation. It shows that the link between the game and what is happening in real life, is perceived more clearly by students who feel they are learning something about how a business works, and vice versa. When a student gets into the game, he realizes what it is like to be a business manager, leading him to rethink the business functioning in reality. In the opposite, if students have troubles endorsing the manager's role, it will be difficult for them to really understand the educational purpose of the game and create a connection with businesses in the real world (Table 2).

After the correlation table, we did a Multiple Correspondence Analysis (MCA) in order to study the links between more than two qualitative variables. This analysis can help us define underlying links between variable's modalities. The proximity of modalities in the factorial space points a resemblance or an association between them. Thus, two categories of different variables are associated if they concern students of the same typology. We can study the representation of each modality by an axis or by a plane. A modality well represented has a contribution close to 1.

Table 2 Bivariate correlations between the survey's variables

	Q2	Q6	Q11	Q12	Q18	Q20	Q21	Q22	Q25	Q26	Q27	Q31
Q2	1	.078	0.311	0.107	0.072	−0.008	0.109	−0.111	−0.012	−0.205	0.177	0.249
Q6	0.078	1	0.008	0.204	−0.169	0.258	−0.029	−0.039	0.099	0.043	−0.085	0.176
Q11	0.311	0.008	1	0.114	−0.177	−0.129	−0.055	−0.073	−0.189	−0.335	−0.089	0.007
Q12	0.107	0.204	0.114	1	**0,399***	0.330	0.108	0.144	0.287	−0.187	−0.145	0.192
Q18	0.072	−0.169	−0.177	**0,399***	1	0.132	0.223	0.185	**0,359***	−0.006	−0.224	0.220
Q20	0–.008	0.258	−0.129	0.330	0.132	1	0.297	0.134	**0,682****	0.212	−0.048	0.242
Q21	0.109	−0.029	−0.055	0.108	0.223	0.297	1	0.089	0.148	−0.053	0.070	0.169
Q22	−0.111	−0.039	−0.073	0.144	0.185	0.134	0.089	1	0.196	0.044	0.093	0.224
Q25	−0.012	0.099	−0.189	0.287	**0,359***	**0,682****	0.148	0.196	1	0.311	−0.070	0.354
Q26	−0.205	0.043	−0.335	−0.187	−0.006	0.212	−0.053	0.044	0.311	1	−0.179	0.354
Q27	0.177	−0.085	−0.089	−0.145	−0.224	−0.048	0.070	0.093	−0.070	−0.179	1	−0.080
Q31	0.249	0.176	0.007	0.192	0.220	0.242	0.169	0.224	0.354	0.354	−0.080	1

*. The correlation is significant at 5% level

**. The correlation is significant at 1%

Table 3 Summary of models

Dimension	Cronbach's Alpha	Explained variance		
		Total (eigenvalues)	Inertia	Percentage variance explained
1	,705	2828	**0,236**	**23,564**
2	,545	1999	**0,167**	**16,657**
3	,513	1888	**0,157**	**15,735**
Total		6715	**0.560**	
Moyenne	,604[a]	2238	,187	18,652

Table 3 gives a summary of the first three factorial axes which explain 23.6% + 16.7% + 15.7 = 56% of the information. The model is considered satisfying in terms of information explained without needing to resort to a fourth axis.

Generally, factorial designs can explain analysis of the proximities between variables and modalities.

In this article, we choose the first factorial plane, composed by the first two factors (1st and 2nd dimension in the table above). The following figure allows us to visualize the different modalities, and consequently to define proximities and homogeneous groups graphically.

The Fig. 5 illustrates three distinct groups. According to the 1st axis:

> Group A: The proximities between the modalities (Q6:"Not really", Q:12"No", Q:21"Don't know", Q:18"Play a game", Q:26"little" and Q:31"Not player") reveal that students who don't play video games find the use of SG quite difficult, since they are not used to handling this type of software. They think the game's actions are not very interesting. Perhaps the fact that this is an educational game, they don't find it fun enough. This attitude makes them unwilling to play again. Also, their experience with the game does not influence their perception on business, since they didn't really feel they learned anything while playing. Maybe this is one of the reasons they answered negatively to the question of whether they think of starting their business in the future
>
> Group B: The proximities between the modalities (Q12: "Many", Q18: "Very good", Q22: "Easy", Q21: "to play by learning", Q25: "yes", and Q26: "player") highlight an interesting profile. The students considered as players, understand the purpose of the game and have no problem with handling the software. Also, they are interested by the game's tasks, and feel they are learning something about business while playing. Being used to play video games has probably made it easier for them to focus more on the content of the game, than on the manipulations to be done.

According to the 2nd axis:

> Group C: Finally, the proximities between the modalities (Q2: "Boy",Q22: "A little" and Q26: "Not really") indicate that boys in general, don't really find

the game's tasks interesting. Moreover, they do not understand the interest of the game. We can maybe explain that by the competing tendency of the boys; as an educational game, is not really the winning part that's important but rather the process. So, the fact that there is no competition maybe they lost interest, or didn't strive for the game as they would have to if a win was on stake.

4 Conclusion and limitation

In this article we worked on the use of a Serious Game as an application tool for an entrepreneurship course. The use of the activity theory allowed us to define the main components of our learning activity, thus facilitating the determination of the items to be studied in order to provide elements of answer to our hypotheses. In fact, each component of our activity was translated into factors which themselves were divided into variables then into modalities. The latter formed the questionnaire that was distributed at the end of the game session (Go Venture Small business). We were looking for answers to the question: does the use of a Serious Game have an influence on students, there entrepreneurial behavior and / or perception of entrepreneurship?

An initial study of the data obtained leads us to two types of profiles:

- Students, who are used to playing video games, can more easily use the Serious Game and realize its pedagogical scope. They understand how the company operates and therefore perceive entrepreneurship differently. Students realize that skills needed to run a business are multiple and from different courses they had before.
- Students, who are not used to playing video games have more difficulty in taking control of the software and therefore find themselves looking at the game as a fun tool nothing more. They do not understand the purpose of the game. For these students we cannot talk about a change in entrepreneurship perception. It is possible that if they play again and have more time to be familiar with it, they can see more than just the fun part but also the educational part.

Those results are just a first analyze of the data we have. We need to dive more into the Serious Game and its different component to identify educational element and see how it affects students and influences their answers.

We also have to take into account, the fact that it was the first time that our student played this game, as well as had to think differently about mobilizing the knowledge acquired in the classroom in a practical perspective: making decisions, what information to use, when to use it etc., things that students may not be used to doing in their regular courses. Further research should focus on elaborating a combined approached of teaching based on simultaneously using the Serious Game while moving forward in the course. This will give the student a better understanding of the game purpose as well as more opportunities to use the full potential of the game.

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