Designing a Course for Stimulating Entrepreneurship in Higher Education through Serious Games

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Abstract

Enhancing the offer for entrepreneurship education is an important challenge for the nowadays knowledge societies. The eSG project is addressing this issue by analysing the added value that could be contributed by employing serious games (SGs) as a tool for allowing students - in particular technology students - to become familiar, mainly through practice, with basic concepts of entrepreneurship and company management. This paper presents the main requirements for the course and SGs obtained by surveying literature, entrepreneurs, students and teachers. We represented the requirements in a table template keeping into account usability, pedagogy, the entrepreneurship skills expressed by state of the art models and three major axes for entrepreneurship education at universities. These table descriptors were then used to assess validity of SGs and choose an appropriate mix for the courses. We have also defined a set of metrics to evaluate the advancement of students during the course. Based on these tools and knowledge, the next steps of the project will involve extensive user testing in the actual courses that are being performed in Genoa, Delft and Barcelona.

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Keywords: serious games; entrepreneurship; business games simulations; higher education; collection of requirements.

1. Introduction

Entrepreneurship is a personal skill and motivation which draws a person to engage his abilities and efforts in the creation of new products and services, with a business value given by the ability to match the market demand. Apart from the personal value, entrepreneurship has a clear social potential, because it stimulates to consider the needs and requirements from the potential customers (thus improving their conditions, at least in
principle), and because running a business requires setting up and managing a team of people and creating places of work. For these reasons, entrepreneurship is considered as a key factor for contemporary societies.

Key factors are putting new pressure on the western economies, especially in EU: an ageing population, shrinking labour force, increasing competition by emerging countries offering cheaper labour. Entrepreneurship can contribute also to social cohesion, by increasing employment, economic reward and work satisfaction.

However, entrepreneurial education is still relatively immature and rarely adequately addressed at strategic level by universities or national policies. This is true in particular in the technical universities, which is critical, in particular considering the innovation potential coming from the technological studies and researches. The issue involves both the contents and the teaching methodologies and tools, since problem-solving and multi-disciplinarity are important for the development of entrepreneurial attributes of students in scientific and technical fields [1].

In light of this situation, we believe that fostering entrepreneurship could strongly benefit from an effective use of Serious Games (SGs), an emerging paradigm in Technology Enhanced Learning (TEL). Educational SGs use pedagogy to infuse instruction into the game play [2, 3, 4]. Games are effective because “the learning is practiced within that context (Situated cognition)” [5]. According to the Dale’s cone of experience, students can only remember 10% of what they read, but almost 90%, if they engage in the job, even if a simulation [6].

Good SGs challenge and involve players in compelling contexts. This can motivate learners and show the concrete relevance and application of topics and skills that may be difficult to explain in words (this is particularly true for entrepreneurship and soft skills). Moreover, SGs can be used as a lifelong learning tool, without time/space barriers, and as gyms where new knowledge and practices can be freely developed [7, 8].

Surveying e-learning experts, [9] stresses that SGs are perceived as “de facto effective learning environments because games challenge and support players to approach, explore and overcome problems”. Moreover, they offer players the capacity to try alternatives and experience the consequences. They also provide immediate feedback (which is efficient for procedural learning [10]) and assessment and allow for personalised learning. Furthermore, they place the learner in an active role, stimulating him to think critically and lend themselves to collective and social use. They challenge and support learners and implicitly motivate them”. The motivation potential is widely acknowledged (e.g., [11-13]), in particular for awareness raising.

Considering Higher Education (HE), [14] reports his experience in 3 management courses, where 3 Component-Off-The-Shelf (COTS) management simulation videogames were tested. The study reports significantly better curricular performance for test students.

These are the main motivations that have led the University of Genoa, the Italian National Research Council, the Technical University of Delft and the Esade business school of Barcelona to join their forces in the Stimulating entrepreneurship through SGs (eSG), a project in the Lifelong Learning Erasmus Fostering Excellence and Innovation in HE (FEXI) programme.

The eSG objective is to develop, deploy and assess experimental pedagogical plans based on appealing and instructive SGs for stimulating entrepreneurship in HE students, in particular, but not exclusively, technical schools. eSG addresses all the 3 educational levels: Bachelor, Master, PhD. The outcomes from the eSG’s extensive deployment – the first one of this type in EU, to the best of our knowledge – should provide precious experimental information to researchers, that lack real data on using SGs in real HE settings.

This paper intends to describe the experience we are gaining in eSG, in particular considering the phases of requirement collection and of course planning.

Despite being considered as a key competence in a knowledge society, entrepreneurship suffers from an image problem, in education, as it is often narrowed down to “running a business, being an employer/self-employed” [15]. However, this is reductive, and we prefer a broader definition of entrepreneurship education [16], that includes both the training on how to set up a business and a broader concept of education for entrepreneurial attitudes and skills, which involves developing certain personal qualities.
The remainder of the paper is organized as it follows: section 2 provides a background on entrepreneurship education in Europe and the state of the art of educational SGs for entrepreneurship and business; section 3 presents requirements from students, teachers, and entrepreneurs for an innovative course on entrepreneurship; section 4 describes methodologies and outcomes of the selection process for choosing the SGs to be used in the pilot test entrepreneurship courses in Genoa, Delft, and Barcelona; section 5 draws the final conclusions.

2. Background

2.1. Entrepreneurship in Higher Education in Europe

In Europe, low levels of entrepreneurship are a source of concern for growth and employment, according to the University Business Forum [17]. Entrepreneurship is one of the Forum’s 6 themes for cooperation, as universities should increasingly become “actors in the landscape of global economic relationships and transactions” [17]. However, entrepreneurship is still insufficiently reflected in educational policies [18]. “Europe needs to prioritise entrepreneurship” and “universities need to be at the heart of its efforts” [17], by promoting entrepreneurial skills to facilitate the creation of new opportunities from study and research [19].

Entrepreneurship education in EU is behind US and Canada. [20] shows that, of the 21 million students in EU, only around 5 million are involved in entrepreneurship. The fact that almost only business schools offer entrepreneurial education is problematic, since innovative and viable business ideas are more likely to originate from technical, scientific and creative studies [1].

The concept of entrepreneurial education is still relatively immature and rarely addressed at strategic level by universities or national policy. Training for teaching staff is also important (and not yet addressed [20]), because skills for entrepreneurial pedagogy are different than for academic subjects [17].

[1] concludes that traditional education methods do not correlate well with the development of entrepreneurial attributes, and that problem-solving and multi-disciplinarity are essential. In particular for students in scientific and technical fields, a strong practical component should always accompany the theory.

2.2. Serious Games for business and entrepreneurship

[21] report that in US in 1994 over 200 business games were being used by nearly 9,000 teachers at over 1,700 colleges offering business programmes. The current state of the art [22] shows an increasing use of such tools in US Universities and the progressive adoption of cutting edge technologies (e.g. virtual reality, artificial intelligence). The European situation is less investigated and appears more fragmented, although interesting initiatives are to be considered (e.g., the project carried out at Exeter [23], those carried out at ESADE and INSEAD, and the interesting experiment carried out in [24]).

[25] reports his experience at the US Department of Defense, where 3 different Components-Off-The-Shelf (COTS) management simulation videogames were added to 3 courses. The study reports that "Students in classes using the game scored significantly higher means than classes that did not". [26] reports that user performance in simulations is largely the result of players' skills rather than luck; that learning through "trial-and-error" led to better simulation performance; and that skills employed in simulation are not the same as those being assessed in conventional academic evaluation. [27] reports of a project about evaluation of business simulation software for mechanical engineering students, analyzing various open source and COTS tools.

There is a certain number of high-level business games and simulations that are being used with different features and targets, in business schools, also in Europe (e.g., [27-31]). Here is a list of games that we have considered in our analysis (described in section IV): Marketplace Venture Strategy, SimVenture, Virtual Trader, Intopia, Beer Game, Zappalism, Virtual U, Industry Giant II, Virtual U, Innov8, EagleRacing, The Enterprise Game, The Finance Game, MetaVals.
Effectiveness of business games is questioned by [32], that stress the current unavailability of specific evaluation tools and methods, due to the high variability (dimension, content, structure…) of the educational actions. The lack of a common framework for describing/classifying the educational interventions in a SG is a limitation that is being addressed by the state of the art research on SGs and is one of the research questions that eSG is investigating in the specific field of entrepreneurship education.

3. Requirements

The study of the entrepreneurship profile and the entrepreneurship needs has been a major objective of management education in the last years. The interest of these studies is to identify the knowledge and skills of (future) entrepreneurs [33, 34]. For analyzing the entrepreneurship profile and the current needs of teachers in charge of training entrepreneurship we have made interviews and surveys to the three groups. This process aims to provide a detailed analysis of the various dimensions (skills and competencies) related to entrepreneurship and their importance ranking according to experts and users.

The questionnaires presented in the next sub-sections emerge from the work complemented by the review of literature and policies, national and EU, to understand the requirements for teaching entrepreneurship using an advanced educational tool, such as SGs. From this basis, questions were designed around the entrepreneur skills and competencies shown in the literature review; furthermore, questions on previous knowledge and experience on entrepreneurship are also included in the questionnaires to have a picture of the background and initial level of participants. Concerning the questions on SGs, these were developed from the study of existent game classifications, also reviewed in the literature.

The goal of the interviews and surveys are:

- Identification of the Higher Education students’ entrepreneurship learning needs (attitudes and competencies) in order to identify what the entrepreneurship attitudes, knowledge and skills are that should be developed through the use of SGs.
- Identification of the teachers’ needs for teaching entrepreneurship principles and their attitudes towards the use of SGs at this end.
- Identification of the entrepreneurs’ needs for developing entrepreneurship through the use of SG.

We complemented this information also with the definition of the organizational requirements of each of the partners, in terms of target students and learning objectives.

3.1. Student needs

For assessing the entrepreneurship learning needs of the students, we developed a survey adapting the model by Smith, Schallenkamp and Eichholz [35]. Our survey – whose topics are reported in the following - includes additional questions related to the students’ ICT skills and interest in using games for educational purposes.

ICT Skills and games:
- Ability to use ICT to search, share and publish information
- Interest in learning with computer based technologies
- Interest in learning using educational games (Serious Games)

Technical Skills:
- Operational – the skills necessary to produce the product or service
- Supplies/Raw Materials – the skills to obtain them, as necessary
- Office or Production Space – the skills to match needs and availability
- Equipment/Plant/Technology – the skills to identify and obtain
Managerial Skills:
- Management – planning, organizing, supervising, directing, networking
- Marketing/Sales – identifying customers, distribution channels, supply chain
- Financial – managing financial resources, accounting, budgeting
- Legal – organization form, risk management, privacy and security
- Administrative – people relations, advisory board relations
- Higher-order thinking skills (problem-solving, strategic thinking…)

Entrepreneurial Skills:
- Business Concept – business plan, presentation skills
- Environmental Scanning – recognize market gap, identify user needs, exploit market opportunity
- Advisory Board and Networking – balance independence with seeking assistance

Personal Maturity Skills:
- Self-Awareness – ability to reflect and be introspective
- Accountability – ability to take responsibility for resolving a problem
- Emotional Coping – emotional ability to cope with a problem
- Creativity – ability to produce a creative solution to a problem
- Risk taking, tolerance for frustration

Students’ survey results

The questionnaire was proposed to Bachelor and Master students of Esade, TU Delft and University of Genoa. The questionnaire had 41 respondents, of whom 63% were male; 68% under 25 years old, and only a 30% among 25-44 years old (including PhD and worker Master students). The sample retrieved by the partners has students from different countries, the 90% of them are from Europe, a 10% from South America. A 80% of the sample lives in cities with a population higher than 15.000.

17% of the sample students have already created their own business; from those who run their business, more than a 70% have it less than 4 years. Those students preparing themselves to run their own business are mostly interested in ICT (30%) and other services such as tourism, engineering and education.

Concerning ICT and games’ skills, the respondent students are highly interested in learning and using these technologies (60% found them interesting to very interesting both using ICT and games) but they confess themselves only average skilled (30-50%).

When asked on technical and marketing skills, students rate themselves as average-skilled (more than 40% of the students rate themselves as null or low). Concerning management skills, students rate themselves as average (50%). For financial and legal skills, results point to a low skills level among entrepreneurship students, more than 60% affirm they have null or low abilities for legal and financial activities.

Concerning entrepreneurship skills, students admit a low level of ability, especially when asked for business plan and marketing opportunities. The majority of the students rate themselves high in Personal Maturity Skills; more than 60% of the students show higher scorings in responsibility and reflection.

When asked on the learning modality, the students show a clear tendency for blended programs, only a 15% prefer totally onsite programs, and 10% of the students would attend totally online learning modules. Students also prefer active learning methodologies (80%) rather than lecture-based lessons (60%).

Concerning SGs, students prefer both ICT-based and onsite games; nevertheless, there is a tendency to prefer ICT-based games (40% onsite, 60% prefer ICT-based). This comes together with the ease of accessibility to the internet either from home or from their workplace.

Favourite game typologies are strategy games (40%), action and adventure games, and simulation games (20%). When asked for entrepreneurship training, students rate higher the use of strategy games (40%), but also point to simulations and adventure games (less than 20%).
3.2. Teacher survey

The goal of the second questionnaire was to understand the teacher position with regard to new methodologies for teaching entrepreneurship, with particular attention to games.

The questionnaire was filled by 10 teachers, a 40% of them were women, 60% men. Teachers’ ages range from 25 to 64 years, they are all European and live in cities with more than 15,000 inhabitants (80%).

The majority (80%) of the teachers has run their own business for more than 2 years and less than 8; there is one teacher running a company for more than 20 years. Interests for business are 80% ICT (including ICT learning and programming) and 10% manufacturing. 50% of the sample has taught entrepreneurship courses for more than 1 year and less than 10 years; there is a 10% of the teachers that has been teaching entrepreneurship for more than 10 years, and a high 40% without experience on the subject.

Concerning learning modalities, teachers prefer teaching in face-to-face (60% totally agree) and blended environments (40%) rather than in online scenarios (only 10% totally agree). They show an interest for both active learning strategies and ICT-based materials, in concrete, computer-based games (70% agree and totally agree). Focusing on games, teachers prefer strategy and simulation (70%) and especially, role-play games.

3.3. Entrepreneurs survey

For the entrepreneurs requirement elicitation phase, we prepared a questionnaire and defined a structure for a small set of focused interviews. The aim of the entrepreneurs questionnaire was to study how these professionals could bring their experience and know-how to the courses on entrepreneurship with SGs. Questions were designed to stress what would be useful to learn or practice with, in the context of the courses.

The survey was distributed to three Spanish young entrepreneurs, one Italian and one Dutch, with ages among 25 and 44 years old. They have been running their business for more than 1 and less than 5 years, and they are interested in different business sectors; nevertheless there is a tendency for ICT business (50%).

With respect to developing entrepreneurship competencies, participants think that blended learning environments would be the best option (100% agree); but they are only partially in accord (40%) to teach these contents collaboratively and use experience as a tool for teaching entrepreneurship abilities.

Concerning SGs for training about these competencies, all the answers converge to the need of using these as learning tools and, especially, the strategy, simulation and fantasy games (75%), in particular, they agree on the use of business simulators.

There is also a convergence on the need of teaching entrepreneurship to students, and to do it actively, using active methodologies and experiential learning. Though one’s own experience and using simulations and games that help training and practicing all the needed competencies and skills.

In the requirement collection phase we also conducted interviews with two Italian entrepreneurs (Lucia Pannese of iMaginary and Ivan Orvieto of Testaluna) and an entrepreneur education support association (Michael Severance of the Acton institute). The goal of the interviews, that applied a fixed-question schema, was to understand if and how it is possible to teach high-school students about entrepreneurship or aspects of it. The full text of the interviews are published online on the eSG blog [36].

The major outcomes of the analysis were the following:
- Entrepreneurship is a gift (risk taking, efficient decision making). It is possible (and urgent) to create awareness about entrepreneurship, but we must be cautious about the actual possibility of teaching entrepreneurship itself.
- Frontal lectures about entrepreneurship to be quite useless, entrepreneurs talks seem more appropriate
- Serious games can be a means of education, in particular concerning:
  - Enhancing motivation
  - Learning some procedural aspects (e.g. for administration, management, marketing)
- Allowing students the opportunity for hands-on experience
- Stressing decision making, risk taking, need for a long-term vision and for meeting needs and opportunities

- To achieve this goal serious games should be very appealing and realistic

### 3.4. Target students profiles and expected benefits

Students are the major target of the project. eSG involves students of different countries (Italy, Spain and Netherlands), background (ICT in Genoa, Business in Barcelona, Tech/Mgmt in Delft) and levels (Bachelor, Master and PhD), with different contents and objectives. We left attendance as voluntary, as we expected that the appeal and effectiveness of the games and the importance of entrepreneurship would attract students. Tab. 1 provides a prospect of the involved students’ profiles.

**Table 1. Target students’ profile**

<table>
<thead>
<tr>
<th>University</th>
<th>Target students’ profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESADE</td>
<td>Management education students with previous background and professional experience (between 4 and 15 years of professional experience)</td>
</tr>
<tr>
<td>TU Delft</td>
<td>Master students in engineering, of all faculties in TU Delft, from civil engineering to architecture. International students (Dutch, and other nationalities, worldwide), hi-tech startups. The target group is also at the initial stages of their entrepreneurship plans, this means that, after the course, they have the access to other specialized courses, also in the entrepreneurship area. Some of the students have already started up their company</td>
</tr>
<tr>
<td>UNIGE</td>
<td>Students in Electronic Engineering of all the 3 levels (BSc, MSc, PhD). The faculty does not offer any course for entrepreneurship. There is one course on Business Management (Microeconomics), at the 1st year of the MSc. At the second year, financial engineering is optional. The “Orientation workshop” course (2nd year MSc) hosts also some entrepreneurs talks, who report about their experience and show the main features of their companies, in particular the prospects for students who may be interested to work there. During the entrepreneurship short course, students should be able to work/play on their computers. Thus the game programs must be runnable on entry-level PCs and their licence should be free, or paid by the University. It is key that a game should show examples on starting from scratch (an idea) and build and grow a business based on it.</td>
</tr>
</tbody>
</table>

Tab 2 summarizes the expected benefits for the different schools. It summarizes the requirements coming from teachers, students and entrepreneurs, and considers the differences (in terms of course type, student level, local enterprises, etc.) in the eSG’s three pilot sites.

**Table 2. Expected new competencies**

<table>
<thead>
<tr>
<th>University</th>
<th>Current competencies</th>
<th>Expected new competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESADE</td>
<td>General Management (Marketing…)</td>
<td>• eCompetence</td>
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<tr>
<td></td>
<td></td>
<td>• Computer Supported Cooperative Work and Computer Supported Learning (CSCW/CSCL)</td>
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<tr>
<td></td>
<td></td>
<td>• Intercultural management competencies</td>
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<tr>
<td></td>
<td></td>
<td>• Motivation/awareness of the value and potential (both personal and social) of entrepreneurship</td>
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<tr>
<td></td>
<td></td>
<td>• Business identification (market analysis)</td>
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<tr>
<td></td>
<td></td>
<td>• How to translate an idea into a viable market product/service</td>
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<tr>
<td></td>
<td></td>
<td>• Business growth and company management:</td>
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<tr>
<td></td>
<td></td>
<td>o Sales and market</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Organization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Operation (design and production)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Finance</td>
</tr>
<tr>
<td>UNIGE</td>
<td>Our students get off the university with basic knowledge about company management – nothing specific about entrepreneurship and business creation. They lack awareness of the opportunity of developing a new business exploiting their skills and the knowledge they have gained at the university. They are not aware of alternatives to becoming employees.</td>
<td></td>
</tr>
<tr>
<td>TU Delft</td>
<td>Bachelor and Master students in engineering have basic knowledge on company management</td>
<td>Provide tools for students to extend their entrepreneurial skills, particularly in the fields of team and project management, creativity,</td>
</tr>
</tbody>
</table>
problem solving and presentation.
Let students experience the culture and work environment of start-ups and learn from their challenges;
Promote knowledge sharing and dissemination among fellow students
Raise self-awareness by creating a sounding board for students to reflect about their motivations, ambitions and objectives as potential entrepreneurs;
Stimulate students to further develop their entrepreneurial plans.
Recognize the key elements of entrepreneurship within the context of a University, a start-up company and a corporate environment;
Understand what it takes to be an entrepreneur;
Apply different methods and tools for effective team/project management, creativity, problem solving and presentations;
Develop insights into what their motivations, ambitions and objectives are as entrepreneurs.

3.5. Metrics for evaluation

In order to assess validity of the new entrepreneurship courses, we developed metrics on learner assessment that are focused in particular on learner’s acquisition of knowledge and skills. The metrics concerned development of abilities, competencies and awareness. Based on the European Standards and Guidelines for Quality Assurance in the European Higher Education Area [37], which establishes the present foundation for web-based learning provisions and regulations, we defined a set of high-level evaluation criteria/targets aimed at monitoring the progress and development of students during the course in entrepreneurship using SGs.

In particular, students participating in an eSG course, at the end of the action, are expected to be able to:
- present more innovative ideas; be highly motivated for entrepreneurship; demonstrate pro-active attitudes; be self-aware and self-confident.
- be better communicators; decision-makers; leaders; negotiators; networkers; problem solvers; team players; systematic thinkers
- be less dependent; less risk averse; be able to live with uncertainty; be capable of recognizing opportunities

Skills and competencies refer to the three strategic axes identified on the basis of the European document on “Entrepreneurship in higher education, especially within non-business studies” [1]:
  - Raising awareness and motivation
    - Showing that there is the possibility of running a business, starting from a technological idea. Social implications of running a business
  - Developing the entrepreneurial abilities needed to identify and exploit business opportunities
    - Business planning
    - Supply chain
    - Training to set-up a business and manage its growth (including commercialization aspects)
    - Innovation Management (including intellectual property, patent management)
    - Marketing and commercialization
    - Management (organizational behavior, leadership, project and product mgmt, human resources)

4. Selection of the games

The eSG courses involve different aspects, the most innovative of which resides in the use of SGs for supporting entrepreneurship. Thus their selection has been a key step of the project.
First, we prepared a list of SGs based on a web search and authors’ experience. The list included the business games that reported at the end of sub-section II.A. Then, we analyzed them in the light of the requirements stated in the previous section. In particular, we decided to focus on the identified target skills and competencies, on the basis of two major models selected by their relevance in management education contexts such ESADE Business School and in business contexts within corporate universities.

The first model is the entrepreneurship competency model defined by the Consortium for Entrepreneurship Education (CEE) formed in 1980 at the Ohio State University in answer to the US Secretary of Education policy to include entrepreneurship competencies for their students and the USA Employment and Training Administration (ETA) [38]. The CEE ETA model is represented as a pyramid of blocks. At the basis there are the Personal Effectiveness Competencies (soft /transversal) and at the top Management competencies and Occupation Specific Requirements. The model is wide, as each level of the pyramid represents a cluster of competencies: industrial-sector, workplace, academic. Since each competence is further described and operationalized, the model allows reaching a high level of detail in the description of the competencies.

The second model concerns the entrepreneurial competencies identified in [35] and was described in detail in IV.A since we used it – integrated with questions related to the ICT skills, given our specific application target – for the student and teacher surveys.

The two models have some overlapping but they are also complementary to each other, as they point out also different aspects that can be seen as crucial to become an entrepreneur. So, we chose to take into account both of them and map the highlighted skills and competencies to the three strategic axes identified in [1]:

- Raising awareness and motivation
- Developing the entrepreneurial competencies needed to identify and exploit business opportunities
- Training to set-up a business and manage its growth (including commercialization aspects)

So, we first identified the entrepreneurship competencies highlighted in the two models and then mapped them to the three strategic axes. Based on this we have prepared a table, whose structure is reported in Fig. 1, that we have used for the evaluation of each SG. The table includes also an entry for pedagogical and usability features, that are fundamental features to be assessed for a SG.

<table>
<thead>
<tr>
<th>SG NAME</th>
<th>Strategic AXES</th>
<th>Axis 1</th>
<th>Axis2</th>
<th>Axis3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raising awareness and motivation</td>
<td>Business opportunities</td>
<td>Business setup and growth</td>
<td></td>
</tr>
<tr>
<td>Relation to strategic axes</td>
<td>according to [35]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills addressed</td>
<td>according to the CEE/ETA model</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pedagogical/usability features</td>
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</tbody>
</table>

Figure 1. SG description table
In the following, we present as an example the information we have used for describing the Disney’s Hot Shot Business (HSB) game along axis nr. 2: Developing the entrepreneurial competencies needed to identify and exploit business opportunities.

Relation with the strategic axis:
The game aimed at developing an entrepreneurial mindset introducing players to the main issues of a small enterprise:
The game deals with:
- Identifying a business opportunity starting from a problem or an event
- Identifying user needs
- Planning
- Solving a problem following an innovative or a conservative strategy
- Making decisions for your business (e.g., which is the market opportunity in the city?)

Skills addressed according to [35]:
- Management – planning, organizing, supervising, directing, networking
- Marketing/Sales – identifying customers, distribution channels, supply chain
- Financial – managing financial resources, accounting, budgeting
- High order thinking skills
- Environmental Scanning - recognize market gap, identify user needs
- Accountability – ability to take responsibility for resolving a problem
- Risk taking, tolerance for frustration

Skills addressed according to the CEE/ETA model [38]:
- Principles of entrepreneurship
- Planning & organizing
- Problem solving & decision making
- Business fundamentals

Pedagogical/usability features
The game is a standard simulation, for one player. It was designed specifically for “tweens”, children from 9 to 12, but is suitable also for young adult, for introducing business concepts at a basic level. The game allows the player to open three different type of business in the first released version and five in second and third versions (which is the current). Each game session run for 20 minutes, after which the player achieve or not the final goal (earn 2,000 £ in six virtual weeks).

From the pedagogical standpoint, the game presents these main aspects:
- The main concepts addressed (how to finance a business, marketing issues, etc.) are well integrated in the game play
- It provides step by step feedback on different aspects of the business (pricing, customer satisfaction, etc) by clicking on windows for the management of the activities and weekly report on earnings, savings and matching the target budget.
- It presents weekly challenges related to a topic (pricing, marketing, competition)
- It presents problem to solve and suggest different strategies by means of the two assistants (Kate and Jack), supporting active learning.

As to usability, basic information are presented in the introductory sequence by the two assistants, so that the game mechanics is easy to understand and players are able to accomplish basic tasks very early. Players are
able to achieve the final goal in two or three sessions in the most part of the business, so the game is pleasant
and never frustrating.

The game speed is very high, that is appealing for teens but could be not appreciated by young adults. The
speed can make difficult reflecting on decisions, but can be controlled: clicking on windows for management,
the time stops and players are free to take the time needed to think on strategies and decisions

After the analysis process, a set of games has been selected for each of the three courses, to be held in the
partners’ institutions, taking into account their specific needs, objectives and profiles. The general criteria for
the choice have been the following:

- Ability to cover one or more of the strategic axes
- Ability to cover significant skills according to the Smith et al. [35] and the CEE/ETA [38] models
- Satisfaction of basic pedagogical principles (i.e., the game can be used for learning some
topics/principles about entrepreneurship/company management)
- Satisfaction of basic usability criteria
- A licensing cost per student not greater than €50
- Availability on the market
- Possibility for students to play at home or, anyway, on their laptops
- Ability to consider different levels of students (from newbies to experts of gaming and
entrepreneurship-related topics)

Since there is not a single game that is able to meet all the above cited criteria, each partner university chose
to define a mix of games, to be used in different phases of their course, and with different targets. The list of
adopted games is reported in Tab. 3.

Table 3. Selected SGs

<table>
<thead>
<tr>
<th>University</th>
<th>SG</th>
<th>Main features</th>
<th>Axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIGE</td>
<td>Hot Shot Business</td>
<td>A Flash game very useful for introducing students with the basic principles of the entrepreneurship environment</td>
<td>1 and partly 2 and 3 (elementary level)</td>
</tr>
<tr>
<td></td>
<td>The Enterprise Game</td>
<td>A business SG allowing a good-level simulation of running business in different markets. The SG covers the main functionalities concerned with selling, product marketing and managing a small-size enterprise</td>
<td>3 and partly 2</td>
</tr>
<tr>
<td></td>
<td>SimVenture</td>
<td>A detailed business simulation that allows dealing with the management of a computer assembly and selling enterprise of small size. The game covers in detail several aspects, clustered in 4 main functional groups: sales and market; administrative organization; operation (design and production); finance</td>
<td>3 and partly 2</td>
</tr>
<tr>
<td>Esade</td>
<td>MetaVals</td>
<td>A configurable, web based, quiz manager that can be used for testing acquired knowledge in several distinct fields through dyad collaboration and competition among students in the same course. In this case study, it has been focused on assets and liabilities (basic financial concepts).</td>
<td>1 and partly 3</td>
</tr>
<tr>
<td></td>
<td>The Balance Sheet</td>
<td>A SCORM-based, classification game with a time-out and two difficulty levels where students can individually practice the major groups of accounts of the Balance sheet.</td>
<td>1 and partly 3</td>
</tr>
<tr>
<td>TU Delft</td>
<td>Team Up</td>
<td>A four player, digital first person puzzle type game for training and assessment of team roles, interpersonal team communication, emerging and shared leadership.</td>
<td>1 and partly 3</td>
</tr>
<tr>
<td></td>
<td>Slogan</td>
<td>A non-digital chain game for training and assessment of self-organization, change and management.</td>
<td>1 and partly 3</td>
</tr>
<tr>
<td></td>
<td>SimVenture</td>
<td>As above</td>
<td>3 and partly 2</td>
</tr>
</tbody>
</table>
It is important to stress that while several SGs are available on the market that provide a high level of detail in simulating the management of a small-size company, there is a clear lack concerning both (1) the values and motivations that may lie behind an entrepreneurial life choice (this is partially addressed by HSB) and (2) the product/service innovation aspects. Even more important, the simulation algorithms are completely opaque, thus the outcomes of the simulation are not easy to understand and interpret by the players, who have difficulty in learning from their own experience and also errors. This is a clear didactic limitation that should be better addressed by new SG versions.

5. Conclusions and future works

Enhancing the offer for entrepreneurship education is an important challenge for the nowadays knowledge societies. The eSG project is addressing this issue by analysing the added value that could be contributed by employing serious games as a tool for allowing students – in particular technology students - to become familiar, mainly complementing theory and practice, with basic concepts of entrepreneurship and company management.

The main requirements for the course and the SGs, that we obtained by surveying literature and the main actors (entrepreneurs, teachers and students), were represented in a table template keeping into account usability, pedagogy, the entrepreneurship skills expressed by state of the art models and three major axes for entrepreneurship education at universities. These table descriptors were then used to assess validity of SGs and choose an appropriate mix for the courses. From our analysis we saw that while several SGs are available on the market that provide good company management simulation, there is a clear lack in dealing with product/service innovation and the motivational/vocational aspects. Even more important, the simulation algorithms are completely opaque, failing to provide clear indications/feedback on what the player has learnt and in what he should improve. We have also defined a set of metrics to evaluate the advancement of students during the courses that that are being performed in Genoa, Delft and Barcelona with the aim to evaluate the SG-based experimental teaching plan. Based on these tools and knowledge, in fact, the next steps of the project involves extensive user tests in the actual courses. In a longer term, eSG aims at providing a conceptual basis for extending entrepreneurship education also to lower school levels, allowing earlier actions for supporting the development of entrepreneurial mindset.

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References


