



## **Deliverable 26 – Analysis of Pilot**

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## Introduction

Europe faces a number of challenges that can only be met if it has innovative, well-educated, and entrepreneurial citizens who, whatever their walk of life, have the spirit and inquisitiveness to think in new ways, and the courage to meet and adapt to the challenges facing them (EACEA, 2012). It is critical for Europe to maintain a knowledge-based economy and be at the forefront of technological, innovative entrepreneurship to maintain its competitiveness. To meet these targets young people should study and seek careers in the scientific and technological fields and understand entrepreneurship. In a discussion entitled: 'Educating the Next Wave of Entrepreneurs' at the World Economic Forum 2011, it was concluded that the earlier an entrepreneurial spirit is encouraged the better the results for society. This project field was chosen to directly address the motivation of entrepreneurship and innovation within European secondary school students.

StartUp\_EU is designed to motivate secondary school students by simulating the excitement and creative innovation of a start-up company. The project has created a series of educational games to foster the development of entrepreneurial skills on a Web2.0 technology platform where secondary school students will learn about entrepreneurship through inspiring and thought-provoking videos, online workbooks covering business and marketing plans, and presentation skills. Students are then supported to develop their own business ideas collaboratively, and across Europe if possible. The process mirrors the idea creation, barriers and problems in developing new technology and building a company. The goal is to enable students to understand the problems and rewards of working in the exciting high tech area and inspire students to seek out careers in this vital European sector. Through reflection activities students will have the opportunity to understand what factors influenced their success or failure.

This report provides an analysis of three pilots performed of the StartUp\_EU competition. The initial pilot ran from January 11th to March 18th 2013 to have a trial run of the competition prior to the main pilot with **5** schools from Spain, Italy and Belgium. The main pilot ran from April 1st to June 14th 2013 with **64** schools. There was a further small third pilot with **5** schools from September 30th to November 30th 2013 to ensure that the changes resulting from feedback from the main pilot addressed the issues raised.

## Method

### Participants

682 participants, between 14 and 18 years of age, were registered on the StartUp\_EU platform to participate in the piloting across 74 schools. The participants were recruited

via their schools.

## Materials

Different types of material were available to the students and teachers through the Web 2.0 platform. The materials were videos, mini-games, how to guides and examples. Videos are videos of 2 to 3 minutes that set the task within the narrative framework and declare the task's goals and expected outcome. Mini-games are self-contained games to be played for stimulating certain skills to be applied in the challenge at hand and save the scores within the game. How to guides are short practical guides that assist in solving the tasks. There are three how to guides, one explaining the StartUp\_EU competition, the second explaining the challenges and the third explaining how to use the platform. Examples are useful to enhance the quality of student work by modelling the expected output. The examples were taken from real IT companies (Apple, Dell, Microsoft, etc.). The game rules were presented in written documents describing the rules, roles, deadlines and assets. All the materials were made available through the StartUp\_EU platform.

## Apparatus

Two types of apparatus were used in this study a Web 2.0 Learning Content Management System (LCMS) and five independent mini-games.

### Web 2.0 LCMS

The StartUp\_EU platform was based on the ILIAS 4.3.0 version. ILIAS is a SCORM compliant LCMS developed at the University of Cologne/Germany and is available as Open Source Software (OSS). The technical characteristics available to the users were the following:

- Integration/upload of text, images, audio, video in various file formats including: (jpg, png, gif, mp3, wav, mp4, avi, pdf, doc).
- File upload, material collection and creation of containers such as folders for topics. Uploads were restricted to a defined maximum size to prevent server overload.
- Group communication enabled by the following facilities: messages that could be forwarded to a personal email account, forum, chat, communication with tutor/mentor/discussion board for individuals or teams to ask questions that could be answered by mentors or peers, a star system allowing students to rate each other's responses and allowing mentors to provide qualitative feedback, group collaboration

tools (wiki), links to Google Docs documents to allow collaboration, surveys to decide on questions within groups and a calendar to set deadlines for the submission of documents.

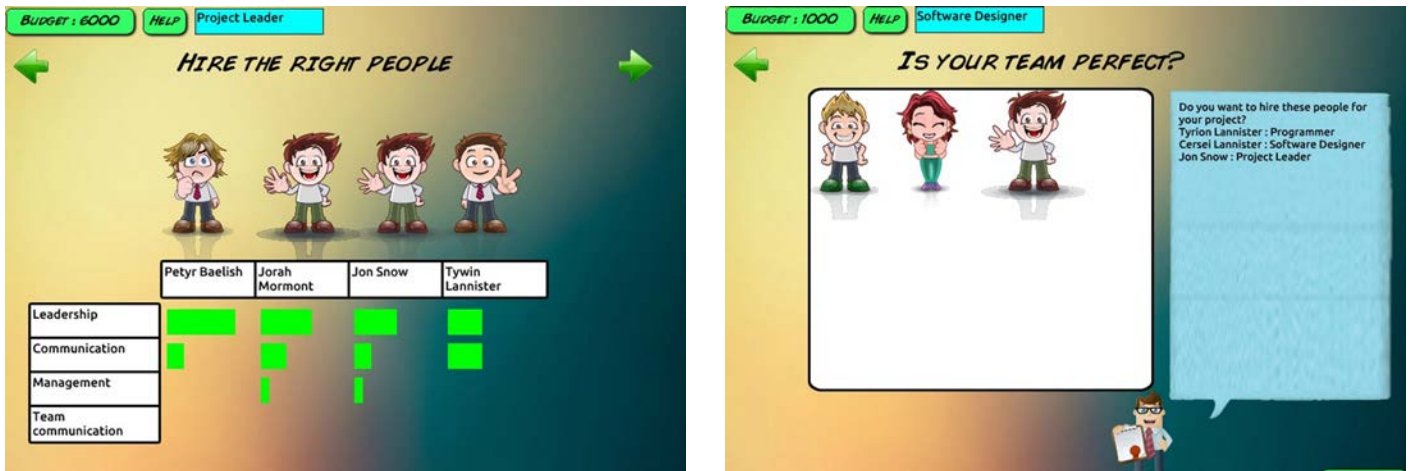
- Group brokerage function - groups can form online or offline, rights and roles are defined to support different users on the platform, groups are able to use a “notice board” to post “job offers” to recruit team members with particular skill sets and mentors/tutors can change the status of an individual’s group membership.

## Mini-games

A set of educational mini-games have been developed that allows students to practice and enhance their entrepreneurial skills as they develop their own business ideas collaboratively and autonomously across Europe. Mini-games have been created to support a number of challenges including:

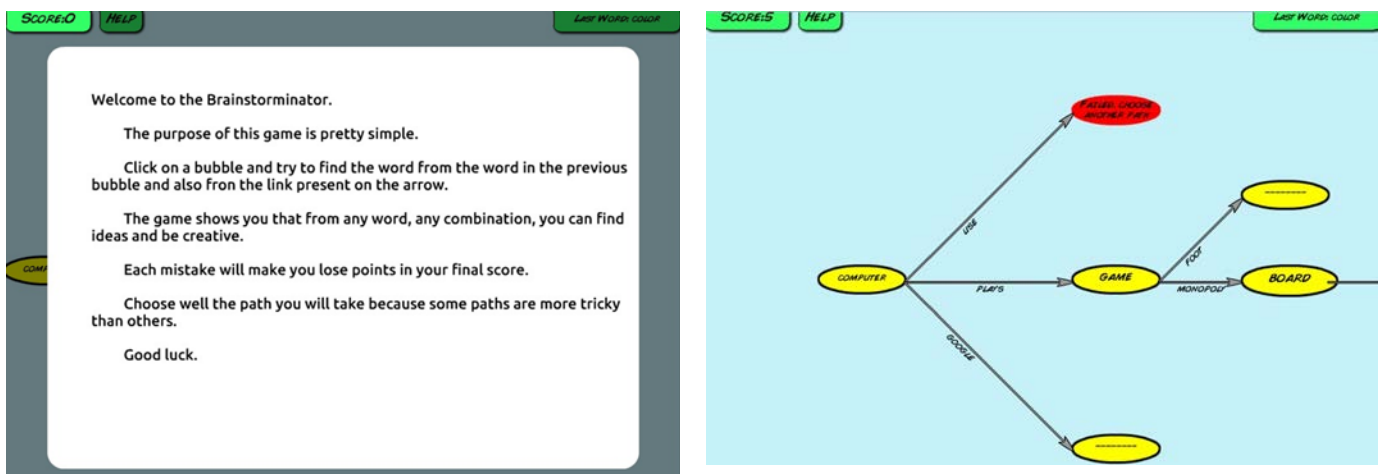
- Building your company team
- Sparking creativity
- Understanding your clients
- How to develop your product
- Marketing your product.

Assessment in each mini-game is through the use of quests and how well an individual or team performs determines their final score. Mini-games can be played more than once to increase a player’s score (that is, increase their learning). For example, in the mini-game “Building your company team”, the player is given a description of a project and a budget and then has to select the roles required for project and, for each of the roles, the skills required for the role. After that, the player is given a selection of possible staff for each role with different combinations of skills and needs to select the most appropriate people to make up his team. Figure 1 provides an illustration of this mini-game.



**Figure 1: StartUp\_EU mini-game “Building your team”**

In the mini-game “Finding the idea”, the player has to use their creativity to connect a series of words together by going through a maze, with each word having to be identified in a hangman-style game. If the player fails to identify a word, he must backtrack and find another path through the maze to get to the end of the game. Figure 2 provides an illustration of this mini-game.



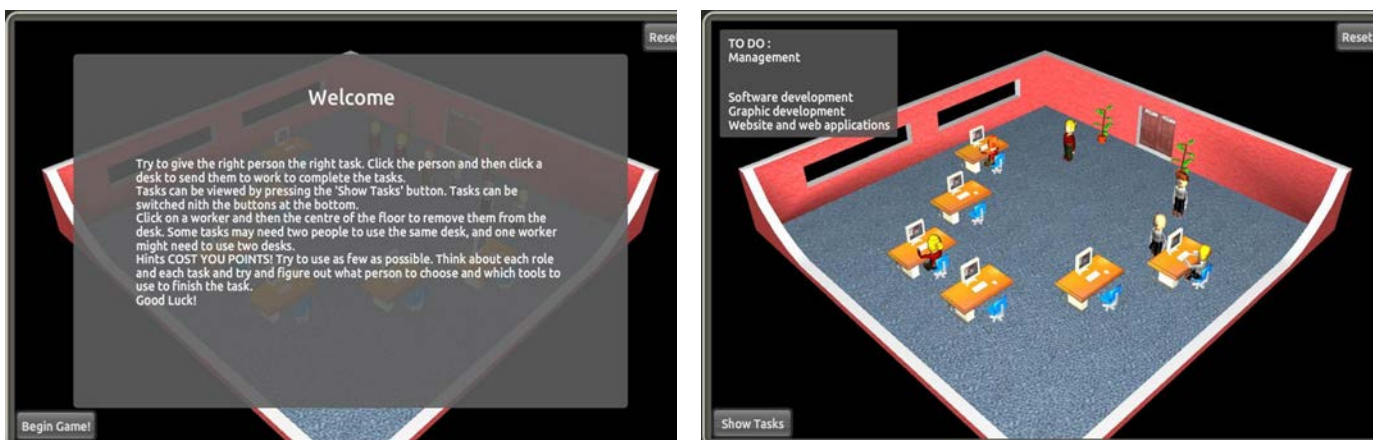
**Figure 2: StartUp\_EU mini-game “Finding the idea”**

In the mini-game ‘Understanding your clients’ the player plays the role of a salesman who sells a number of products. By driving a car through part of a city, the player has to find potential clients and match them to a suitable product. On finding a client, the player is allowed to ask a number of questions to help select the most appropriate product. Figure 3 provides an illustration of this mini-game.



**Figure 3: StartUp\_EU mini-game “Understanding your clients”**

In the mini-game “Develop your product”, the player has to identify the the type of staff required in a team to carry out specific tasks to develop a product. Figure 4 provides an illustration of this mini-game.

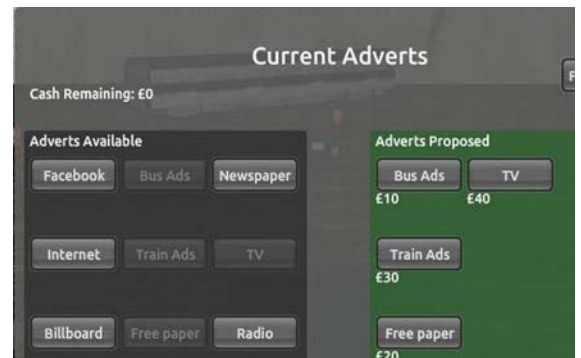


**Figure 4: StartUp\_EU mini-game “Develop your product”**

In the mini-game ‘Marketing your product’, the player is given a marketing budget and has to identify characteristics of his clients that may indicate how the budget should be spent. For example, one client may travel by train and watch TV, while another might travel by train and use the Internet frequently. Given that two clients travel by train, this might suggest that some of the marketing budget should be allocated to train advertising with a lower spend on TV adverts and Internet adverts. Figure 5 provides an illustration of two screens for this game, one where the player is identifying characteristics of a client and the second screen showing an example of how the marketing budget is being allocated.



(a)



(b)

**Figure 5: StartUp\_EU mini-game 'Marketing your product': (a) finding out about the clients; (b) allocating the marketing budget**

## Procedure

The students were set a series of 8 challenges, a preparation stage and a final stage which replicated the process of arriving at an idea for a business. The process involved building a business plan for taking an idea or pitch to the reality of a real product. Each challenge was related to a real problem or information needed to build the business plan and was introduced by a thought-provoking video accompanied by a mini-game and supportive material which explained in detailed how each challenge should be completed. All the material was uploaded onto the StartUp\_EU platform and was accessible online.

Students had to fill in a pre-competition questionnaire at the beginning and a post-competition questionnaire at the end of the competition. The pre-competition questionnaire assessed their own experiences, attitudes, knowledge and skills, and their expectations of the StartUp\_EU tools, while the post-competition questionnaire focussed on assessing the usability of the tools, students' motivation, pedagogy and the skills developed by the students. Additionally, both questionnaires assessed their perceptions towards the broad dimensions of entrepreneurship (EACEA, 2012). The questionnaires were completed online during three pilots in 2013:

- A mini-pilot from 11 January to 18 March 2013 with 63 students across 5 schools from Spain, Italy and Belgium.
- The main pilot with 64 schools from 1 April to 14 June 2013.
- A small third pilot with 5 schools from 30 September to 30 November 2013 to ensure.



## Results

### Pre-competition Questionnaire

#### Experience with entrepreneurship education

Out of the 682 students 364 completed the pre-test student questionnaire. 177 participants (48.6%) were female and 187 participants (51.4%) were male. Students were asked to specify what experience they had with entrepreneurship education. 189 participants (60%) indicated that they had no experience, 76 participants (24%) indicated that they had experienced it once or twice a year, 22 participants (7%) indicated twice in a school term, 9 participants (3%) indicated that they had experienced it once a month and 21 participants (6.6%) specified more than once a month. The results indicated overall that the students' experience of entrepreneurship in education was very limited. A Mann-Whitney  $U$  test indicated that there was no difference in the levels of experience associated with entrepreneurship between males and females ( $Z = -0.835$ ,  $p < 0.404$ ). Students were asked to list and describe their experience with entrepreneurship programmes. Some of the answers were as follows:

- *"I have experience in Junior Achievement Programme".*
- *"I have been involved twice in a local competition consisting in managing an enterprise through a software program called Praxis".*
- *"Idea of the year, Zagreb 2013. We had to come up with an idea and it had to involve IT. We thought of an application that would help students in testing their knowledge before exams".*

Participants were asked if they had ever participated in an entrepreneurship competition before, 73 participants (23%) stated indicated that they had and 249 (77%) participants indicated that they had not.

#### Experience of games-based learning

The results indicated that student experience of games-based learning was more extensive. 131 participants (41%) specified that they had no experience of games-based learning, 83 participants (26%) had experienced it once or twice a year, 50 participants (16%) indicated that they had experienced games-based learning twice in a school term, 23 participants (7%) experienced it once a month and 41 participants (10%) specified more than once a month. A Mann-Whitney  $U$  test indicated that there was no difference in the levels of experience associated with games-based learning between males and females ( $Z = -1.640$ ,  $p < 0.101$ ).

## Ratings of knowledge, attitudes and skills relating to entrepreneurship

Participants were asked to assess their attitudes, knowledge and skills in relation to entrepreneurship education on the following Likert scale: very low, low, medium, high and very high. The student ratings are presented in Table 1.

**Table 1:** Student ratings of knowledge, attitudes and skills

<i>Knowledge, attitudes, skills</i>	<b>Very low</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>Very High</b>
<b>Self-awareness</b>	6 (1.9%)	17 (5.5%)	<b>140 (45.9%)</b>	106 (34.7%)	36 (11.8%)
<b>Self-confidence</b>	5 (1.6%)	19 (6.2%)	<b>116 (37.9%)</b>	112 (36.6%)	54 (17.6%)
<b>Sense of initiative</b>	4 (1.3%)	21 (6.8%)	113 (36.5%)	<b>119 (38.8%)</b>	52 (17%)
<b>Risk-taking</b>	4 (1.3%)	33 (10.7%)	<b>124 (40.1%)</b>	97 (31.4%)	51 (16.5%)
<b>Creativity</b>	7 (2.2%)	25 (8.1%)	104 (33.8%)	<b>106 (34.4%)</b>	66 (21.4%)
<b>Problem-solving</b>	5 (1.6%)	12 (3.9%)	101 (33%)	<b>141 (46.1%)</b>	47 (15.4%)
<b>Knowledge on career opportunities and the world of work</b>	11 (3.6%)	55 (17.9%)	<b>137 (44.5%)</b>	73 (23.7%)	32 (10.4%)
<b>Knowledge of economic and financial literacy</b>	34 (11.1%)	90 (29.5%)	<b>111 (36.4%)</b>	55 (18%)	15 (5%)
<b>Knowledge on business organisation and processes</b>	31 (10%)	87 (28.3%)	<b>112 (36.5%)</b>	58 (18.9%)	19 (6.2%)
<b>Communication</b>	6 (2%)	13 (4.2%)	88 (28.7%)	<b>136 (44.3%)</b>	64 (20.8%)
<b>Presentation</b>	7 (2.2%)	17 (5.5%)	105 (34.1%)	<b>129 (41.9%)</b>	50 (16.2%)
<b>Planning</b>	4 (1.3%)	21 (7.8%)	100 (32.5%)	<b>117 (37.9%)</b>	66 (21.4%)
<b>Team work</b>	5 (1.6%)	8 (2.6%)	73 (23.7%)	102 (33.1%)	<b>119 (38.6%)</b>
<b>Exploring entrepreneurial opportunities</b>	29 (9.8%)	44 (14.8%)	<b>114 (38.4%)</b>	81 (27.3%)	29 (9.8%)
<b>Design business projects</b>	20 (6.6%)	48 (15.8%)	<b>114 (37.5%)</b>	87 (28.6%)	35 (11.5%)

**Table 2 shows the rankings of knowledge attitudes and skills.**

<i>Knowledge, attitudes, skills</i>	<b>Ranking</b>	<b>Mean</b>	<b>SD</b>
<b>Self-awareness</b>	1 <sup>st</sup>	4.05	0.85
<b>Self-confidence</b>	2 <sup>nd</sup>	3.78	0.90
<b>Sense of initiative</b>	3 <sup>rd</sup>	3.71	0.89
<b>Risk taking</b>	4 <sup>th</sup>	3.70	0.93
<b>Creativity</b>	5 <sup>th</sup>	3.65	0.98
<b>Problem solving</b>	6 <sup>th</sup>	3.64	0.84
<b>Knowledge of career opportunities and world of work</b>	7 <sup>th</sup>	3.63	0.97
<b>Knowledge of economic and financial literacy</b>	8 <sup>th</sup>	3.62	1.03
<b>Knowledge of business and organisational processes</b>	9 <sup>th</sup>	3.51	1.05
<b>Communication</b>	10 <sup>th</sup>	3.49	0.89
<b>Presentation</b>	11 <sup>th</sup>	3.23	0.90
<b>Planning</b>	12 <sup>th</sup>	3.19	0.92
<b>Team work</b>	13 <sup>th</sup>	3.12	0.94
<b>Exploring entrepreneurial opportunity</b>	14 <sup>th</sup>	2.83	1.09
<b>Design business processes</b>	15 <sup>th</sup>	2.76	1.06

Students rated self-awareness, self-confidence and sense of initiative as the three top

ranking attributes in relation to entrepreneurial education. Design business processes, exploring entrepreneurial opportunity and team work as the three lowest ranking motivations. Table 3 shows student self-assessment of their attitudes, knowledge and skills split by gender.

**Table 3:** Ratings of knowledge, attitudes and skills in relation to gender

Knowledge, attitudes, skills	Males			Females		
	Rank	Mean	SD	Rank	Mean	SD
<b>Team work</b>	1 <sup>st</sup>	4.01	0.92	1 <sup>st</sup>	4.09	0.95
<b>Communication</b>	2 <sup>nd</sup>	3.77	0.88	3 <sup>rd</sup>	3.79	0.91
<b>Problem Solving</b>	3 <sup>rd</sup>	3.73	0.88	6 <sup>th</sup>	3.66	0.78
<b>Self Confidence</b>	4 <sup>th</sup>	3.66	0.82	8 <sup>th</sup>	3.58	0.99
<b>Creativity</b>	5 <sup>th</sup>	3.64	1.02	7 <sup>th</sup>	3.65	0.93
<b>Planning</b>	6 <sup>th</sup>	3.63	0.95	2 <sup>nd</sup>	3.80	0.89
<b>Sense of Initiative</b>	7 <sup>th</sup>	3.59	0.84	5 <sup>th</sup>	3.67	0.94
<b>Risk Taking</b>	8 <sup>th</sup>	3.57	0.92	10 <sup>th</sup>	3.45	0.94
<b>Presentation</b>	9 <sup>th</sup>	3.56	0.85	4 <sup>th</sup>	3.73	0.94
<b>Self-awareness</b>	10 <sup>th</sup>	3.51	0.86	9 <sup>th</sup>	3.47	0.83
<b>Design Business Processes</b>	11 <sup>th</sup>	3.28	1.05	11 <sup>th</sup>	3.16	1.06
<b>Knowledge of career opportunities and world of work</b>	12 <sup>th</sup>	3.25	0.96	12 <sup>th</sup>	3.13	0.97
<b>Exploring Entrepreneurial Opportunities</b>	13 <sup>th</sup>	3.23	1.01	13 <sup>th</sup>	3.01	1.17
<b>Knowledge of business and organisational processes</b>	14 <sup>th</sup>	2.92	1.01	14 <sup>th</sup>	2.73	1.08
<b>Knowledge of economic and financial literacy</b>	15 <sup>th</sup>	2.86	1.04	15 <sup>th</sup>	2.66	1.01

Mann Whitney *U* tests indicated that there were no significant differences in terms of knowledge, attitude and skill attributes in relation to gender.

## Skills participants believed they would develop through using StartUp\_EU

Participants were also asked to rate the skills that they believed that they would develop through participation in the StartUp\_EU service. 311 participants answered the question. The results are shown in Table 4.

The four most popular skills that participants believed that they would develop through participation in the StartUp\_EU competition were creativity, team-working, knowledge of business organisation and processes and knowledge of economic and financial literacy. The least popular skills that participants believed they would develop were self-awareness, risk taking, self-confidence and exploration of entrepreneurial opportunities.

**Table 4:** Skills participants believed they would develop through participation in StartUp\_EU

<i>Skills</i>	<b>Ranking</b>	<b>Number</b>	<b>Percentage</b>
<b>Creativity</b>	1 <sup>st</sup>	199	63.9%
<b>Team-working</b>	2 <sup>nd</sup>	198	63.6%
<b>Knowledge of business organisation and processes</b>	3 <sup>rd</sup>	195	63%
<b>Knowledge of economic and financial literacy</b>	4 <sup>th</sup>	178	57%
<b>Design business projects</b>	4 <sup>th</sup>	178	57%
<b>Knowledge on career opportunities and world of work</b>	5 <sup>th</sup>	174	56%
<b>Initiative</b>	6 <sup>th</sup>	165	53%
<b>Problem-solving</b>	7 <sup>th</sup>	164	52.7%
<b>Planning skills</b>	8 <sup>th</sup>	161	52%
<b>Presentation skills</b>	9 <sup>th</sup>	149	48%
<b>Communication skills</b>	10 <sup>th</sup>	148	47.5%
<b>Exploration of entrepreneurial opportunities</b>	11 <sup>th</sup>	141	45%
<b>Self-confidence</b>	12 <sup>th</sup>	133	43%
<b>Risk-taking</b>	13 <sup>th</sup>	117	38%
<b>Self-awareness</b>	14 <sup>th</sup>	115	37%

## Post-test questionnaire

122 participants completed the student post-test questionnaire. 61 participants (50%) were female and 61 participants (50%) were male. Assuming that they had access for to StartUp\_EU for the next 12 months, participants were asked if they would be willing to use the service. 19 participants (16%) strongly agreed, 31 participants (25%) agreed, 43 participants (35%) were neutral, 16 participants (13%) disagreed and 9 participants (7%) strongly disagreed. The results indicate that the majority of the participants would be willing to use the platform hypothetically for the next 12 months indicating that there is strong sustainability.

## Usability assessment of the StartUp\_EU service

The students were asked to assess the usability of the StartUp\_EU service. The results were generally positive and are displayed in Table 5.

**Table 5:** Usability assessment of the StartUp\_EU service

<i>Usability statements</i>	<b>Strongly Disagree</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Strongly Agree</b>
<b>I think that I would like to use the StartUp_EU service frequently</b>	5 (4%)	30 (26%)	<b>36 (31%)</b>	<b>31 (27%)</b>	14 (12%)
<b>I found the StartUp_EU service unnecessarily complex</b>	21 (18%)	<b>35 (30%)</b>	<b>35 (30%)</b>	20 (17%)	5 (4%)
<b>I think the StartUp_EU service is easy to use</b>	1 (1%)	20 (17%)	25 (22%)	<b>40 (34%)</b>	30 (26%)
<b>I think that I would need the support of a technical person to be able to use the StartUp_EU service</b>	<b>34 (29%)</b>	25 (22%)	24 (21%)	24 (21%)	9 (8%)
<b>I found the various functions in the StartUp_EU service to be well integrated</b>	2 (2%)	14 (12%)	<b>40 (34%)</b>	<b>43 (37%)</b>	17 (15%)
<b>I think there is too much inconsistency in the StartUp_EU</b>	31 (27%)	<b>34 (29%)</b>	<b>34 (29%)</b>	12 (10%)	5 (4%)
<b>I imagine that most people would learn to use StartUp_EU very quickly</b>	3 (3%)	19 (16%)	21 (18%)	36 (31%)	<b>37 (32%)</b>
<b>I found the StartUp_EU very difficult to use</b>	<b>44 (38%)</b>	34 (29%)	17 (15%)	13 (11%)	8 (7%)
<b>I felt very confident using the StartUp_EU service</b>	3 (3%)	14 (12%)	<b>40 (34%)</b>	<b>35 (30%)</b>	24 (21%)
<b>I needed to learn a lot of things before I could get going with the StartUp_EU service</b>	24 (21%)	<b>38 (33%)</b>	18 (16%)	24 (21%)	12 (10%)

The results of the usability assessment was generally positive with the majority of participants wanting to use the system frequently, not finding it unnecessarily complex, and finding it easy to use without requiring technical support. Participants also believed that the various functions integrated well, that the system was not inconsistent, that people could learn to use the system quickly, were confident using the system and did not require a lot of learning before using the system.

Mann-Whitney *U* tests indicated that there were no significant differences between male and female in relation to any of the usability assessment attributes indicating that male and female generally agreed in terms of the usability of the StartUp\_EU system. Participants were asked if they believed that the StartUp\_EU service was useful for learning entrepreneurship. 52 participants (45%) strongly agreed and 35 participants (30%) agreed that the service was useful for learning entrepreneurship.

## Motivational usability

Participants were asked to rate the motivational usability of the StartUp\_EU service. The results are show in Table 6.

**Table 6:** Motivational usability of the StartUp\_EU service

<i>Motivational statements</i>	<b>Strongly Disagree</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Strongly Agree</b>
<b>The StartUp_EU service incorporates novel characteristics</b>	6 (5%)	16 (14%)	<b>49 (42%)</b>	<b>27 (23%)</b>	18 (16%)
<b>The StartUp_EU service stimulates further inquiry</b>	3 (3%)	8 (7%)	<b>43 (37%)</b>	<b>40 (34%)</b>	22 (19%)
<b>The StartUp_EU service is enjoyable and interesting</b>	1 (1%)	10 (9%)	<b>22 (19%)</b>	<b>47 (41%)</b>	36 (31%)

The results of the motivational usability assessment were also generally positive with the majority of participants finding the StartUp\_EU service enjoyable and interesting, stimulating further enquiry and incorporating novel characteristics. Mann-Whitney *U* tests indicated that there were no significant differences in terms of the following motivational statements: incorporation of novel characteristics ( $Z = -0.896$ ,  $p < 0.370$ ), stimulation of further inquiry ( $Z = -0.302$ ,  $p < 0.762$ ) and the service being enjoyable and interesting ( $Z = -0.744$ ,  $p < 0.457$ ) in relation to gender.

## Evaluation of the pedagogical model

Participants were asked to rate what extent they agreed with a number of statements associated with the pedagogical model. The results are show in Table 7.

**Table 7:** Evaluation of the pedagogical model

<i>Knowledge, attitudes, skills</i>	<b>Strongly Disagree</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Strongly Agree</b>
<b>Self-awareness</b>	4 (3%)	10 (9%)	<b>38 (33%)</b>	<b>37 (32%)</b>	27 (23%)
<b>Self-confidence</b>	5 (4%)	12 (10%)	<b>42 (36%)</b>	28 (24%)	29 (25%)
<b>Sense of initiative</b>	3 (2.5%)	7 (6%)	29 (25%)	<b>49 (42%)</b>	28 (24%)
<b>Risk-taking</b>	5 (4%)	19 (16%)	<b>36 (31%)</b>	<b>31 (27%)</b>	25 (22%)
<b>Creativity</b>	4 (3%)	9 (8%)	<b>37 (32%)</b>	30 (26%)	<b>36 (31%)</b>
<b>Problem-solving</b>	3 (2.5%)	8 (7%)	35 (30%)	<b>45 (39%)</b>	25 (22%)
<b>Knowledge on career opportunities and the world of work</b>	5 (4%)	10 (9%)	33 (28%)	<b>39 (34%)</b>	29 (25%)
<b>Knowledge of economic and financial literacy</b>	5 (4%)	17 (15%)	29 (25%)	<b>33 (28%)</b>	32(28%)
<b>Knowledge on business organisation and processes</b>	3 (2.5%)	10 (9%)	23 (20%)	<b>44 (38%)</b>	36 (31%)
<b>Communication</b>	4 (3%)	17 (15%)	25 (22%)	<b>36 (31%)</b>	34 (29%)
<b>Presentation</b>	3 (2.5%)	14 (12%)	29 (25%)	<b>44 (38%)</b>	26 (22%)
<b>Planning</b>	5 (4%)	9 (8%)	<b>39 (34%)</b>	34 (29%)	29 (25%)
<b>Team work</b>	5 (4%)	7 (6%)	27 (23%)	<b>43 (37%)</b>	34 (29%)
<b>Exploring entrepreneurial opportunities</b>	2 (2%)	5 (4%)	<b>40 (34%)</b>	<b>36 (31%)</b>	33 (28%)
<b>Design business projects</b>	3 (2.5%)	9 (8%)	29 (25%)	<b>43 (37%)</b>	32 (27.5%)

Participants were asked to rank the knowledge, attitudes and skills that they believed they had developed through using the StartUp\_EU service. The results are presented in Table 8.

**Table 8:** Knowledge, attitudes and skills participants developed

<i>Knowledge, attitudes, skills</i>	<b>Ranking</b>	<b>Mean</b>	<b>SD</b>
<b>Knowledge of business and organisation processes</b>	1 <sup>st</sup>	3.86	1.04
<b>Team work</b>	2 <sup>nd</sup>	3.81	1.06
<b>Exploring entrepreneurial opportunities</b>	3 <sup>rd</sup>	3.80	0.96
<b>Design business projects</b>	4 <sup>th</sup>	3.79	1.02
<b>Sense of initiative</b>	4 <sup>th</sup>	3.79	0.96
<b>Creativity</b>	5 <sup>th</sup>	3.73	1.09
<b>Problem solving</b>	6 <sup>th</sup>	3.70	0.97
<b>Communication</b>	7 <sup>th</sup>	3.68	1.15
<b>Knowledge of career opportunities and the world of work</b>	8 <sup>th</sup>	3.66	1.08
<b>Presentation</b>	8 <sup>th</sup>	3.66	1.04
<b>Planning</b>	9 <sup>th</sup>	3.63	1.08
<b>Self-awareness</b>	9 <sup>th</sup>	3.63	1.04
<b>Knowledge of economic and financial literacy</b>	10 <sup>th</sup>	3.60	1.16
<b>Self-confidence</b>	11 <sup>th</sup>	3.55	1.11
<b>Risk taking</b>	12 <sup>th</sup>	3.45	1.13

The top four knowledge, skills and attitudes that participants believed they had developed through participation in the StartUp\_EU service were: knowledge of business and organisation processes, team work, exploring entrepreneurial opportunities and designing business projects. The lowest ranking knowledge, attitudes and skills were risk taking, self-confidence, knowledge of economic and financial literacy and self-awareness. Table 9 shows the knowledge, attitudes and skills that participants believed they developed from using the StartUp\_EU service split by gender.

Mann-Whitney *U* tests indicated that there was a significant difference in the rating of team work with regards to gender. Females believed that they developed team work significantly more than males from using the StartUp\_EU service ( $Z = -2.181$ ,  $p < 0.029$ ). There were no other significant differences with regards to skills that participants believed that they developed by using the StartUp\_EU service in relation to gender.

**Table 9:** Knowledge, attitudes and skills split by gender

Knowledge, attitudes, skills	Males			Females		
	Rank	Mean	SD	Rank	Mean	SD
Knowledge of business and organisation processes	1 <sup>st</sup>	3.83	0.99	3 <sup>rd</sup>	3.90	1.09
Design business projects	2 <sup>nd</sup>	3.78	0.94	6 <sup>th</sup>	3.81	1.10
Exploring entrepreneurial opportunities	3 <sup>rd</sup>	3.76	0.98	5 <sup>th</sup>	3.84	0.95
Sense of initiative	4 <sup>th</sup>	3.67	0.85	2 <sup>nd</sup>	3.91	1.06
Problem solving	5 <sup>th</sup>	3.64	0.89	9 <sup>th</sup>	3.76	1.05
Team work	6 <sup>th</sup>	3.62	1.02	1 <sup>st</sup>	4.00	1.08
Creativity	7 <sup>th</sup>	3.60	1.12	4 <sup>th</sup>	3.86	1.05
Knowledge of career opportunities and the world of work	8 <sup>th</sup>	3.57	1.04	9 <sup>th</sup>	3.76	1.11
Communication	8 <sup>th</sup>	3.57	1.16	7 <sup>th</sup>	3.79	1.14
Planning	8 <sup>th</sup>	3.57	0.99	10 <sup>th</sup>	3.69	1.16
Presentation	9 <sup>th</sup>	3.55	1.01	9 <sup>th</sup>	3.76	1.06
Knowledge of economic and financial literacy	10 <sup>th</sup>	3.52	1.17	10 <sup>th</sup>	3.69	1.16
Self-awareness	11 <sup>th</sup>	3.48	0.96	8 <sup>th</sup>	3.78	1.11
Self confidence	12 <sup>th</sup>	3.41	1.09	10 <sup>th</sup>	3.69	1.11
Risk taking	13 <sup>th</sup>	3.28	1.14	11 <sup>th</sup>	3.62	1.11

## Ratings of mini-games and motivational videos

Participants were asked to rate the motivational videos and mini-games against a number of statements on a Likert scale ranging from strongly disagree to strongly agree. The results are presented in Table 10.

**Table 10:** Ratings of mini-games and motivational videos

Statement	Strongly Disagree	2	3	4	Strongly Agree
I think the videos introducing each challenge are highly motivational	9 (8%)	19 (16%)	30 (26%)	<b>37 (32%)</b>	21 (18%)
I think the mini-games embedded in StartUp_EU improve my learning of entrepreneurship	10 (9%)	16 (14%)	<b>35 (30%)</b>	<b>28 (24%)</b>	27 (23%)
I think that the StartUp_EU mini-games are complicated	23 (20%)	<b>30 (26%)</b>	<b>32 (28%)</b>	22 (19%)	9 (8%)
I think that the StartUp_EU mini-games are useful in learning entrepreneurship	13 (14%)	13 (14%)	<b>38 (33%)</b>	<b>31 (27%)</b>	21 (18%)

The results were generally positive with the majority of the participants indicating that the videos introducing each challenge were highly motivational, that the mini-games embedded improved their learning of entrepreneurship, that the mini-games were not complicated and that they were useful for learning entrepreneurship. Mann-Whitney *U*



tests indicated that there were no significant differences in these ratings in relation to gender with regards to the videos being highly motivational ( $Z = -1.057$ ,  $p < 0.291$ ), the mini-games improving learning ( $Z = -0.350$ ,  $p < 0.727$ ), the mini-games being complicated ( $Z = -1.867$ ,  $p < 0.062$ ) and the mini-games being useful ( $Z = -0.040$ ,  $p < 0.968$ ).

## StartUp\_EU scenario

Participants were asked if the scenario introduced by the StartUp\_EU service was too demanding. 13 participants (11%) strongly disagreed, 36 participants (31%) disagreed, and 44 participants (38%) were neutral. This generally indicated that 80% of the participants did not find the scenario introduced by StartUp\_EU to be too demanding. Participants were also asked if they thought that the StartUp\_EU scenario introduced through the challenges helped them to develop their entrepreneurial skills. 29 participants (25%) strongly agreed, 41 participants (35%) agreed and 31 participants (27%) were neutral. Generally this indicates that participants believed that the scenario introduced through the challenges helped them to develop their entrepreneurial skills.

## Evaluation of the community of users and supportive mechanisms

Participants were asked to evaluate the community of users and supportive mechanisms against a number of statements on a Likert scale ranging from strongly disagree to strongly agree. The results are presented in Table 11.

**Table 11:** Evaluation of the community of users and supportive mechanisms

<i>Statement</i>	<b>Strongly Disagree</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Strongly Agree</b>
<b>I am satisfied with the adequacy of online guides, manuals and supportive materials in general provided with the StartUp_EU service</b>	4 (3%)	18 (15%)	<b>34 (29%)</b>	28 (24%)	<b>32 (28%)</b>
<b>I am satisfied with the support provided through the online community forums</b>	5 (4%)	22 (19%)	<b>37 (32%)</b>	<b>29 (25%)</b>	23 (20%)
<b>I collaborated a lot with my team members during our StartUp_EU competition</b>	3 (2.5%)	9 (8%)	25 (22%)	37 (32%)	<b>42 (36%)</b>
<b>I collaborated a lot with my teacher during the StartUp_EU competition</b>	6 (5%)	11 (9%)	37 (32%)	24 (21%)	<b>38 (33%)</b>

The results again are generally positive with participants indicating that they were satisfied with the supportive materials and support provided through the online community forums. Participants also indicated that they collaborated a lot with their team members and their teachers during the competition. In terms of collaboration, the results are slightly

higher in relation to teamwork collaboration than teacher collaboration indicating that participants collaborated with their team members to a higher degree. Mann-Whitney  $U$  tests indicated that there were no significant differences in relation to gender with regards to the statements associated with: supportive materials ( $Z = -0.919$ ,  $p < 0.358$ ), online community forums ( $Z = -0.853$ ,  $p < 0.394$ ), collaboration with team members ( $Z = -1.838$ ,  $p < 0.066$ ) and collaboration with the teacher ( $Z = -0.342$ ,  $p < 0.732$ ).

## Improvements to StartUp\_EU

Participants were asked how StartUp\_EU could be improved so as to be used more appropriately for entrepreneurial learning purposes. Some of the answers provided by participants are as follows:

- *“I think it is a very good concept but the competition between all the other teams has to be higher. You don't have the feeling that it is a game where you have to be the best team”.*
- *“Some of the challenges weren't well enough explained, since this is the first time I've done something like this, at times I wasn't really sure if I was doing what I was asked for. If the Student's Guide and How to Guide were a bit more precise it would be a great”.*
- *“I think the project could be longer or more difficult. It should have more challenges”.*

Participants were asked what they liked and what they disliked about the StartUp\_EU platform. Some of the answers provided were as follows:

- *“I liked making the movies and working with my team! I learned a lot about planning and working with a 'real' product!”*
- *“I like the mini games the most”.*
- *“What I liked the most was that I can interact with many people. What I disliked was that my team had many things to do in such a short time”.*
- *“The mini games were amusing. The website was a little bit difficult to use”.*
- *“What I liked the most was the marketing plan and the advertisement materials, which I found interesting and fun at the same time. What I didn't like was the financial part, I found it complicated and there was no real help in the guides”.*

## Comparison of pre-test and post-test

101 participants completed both the pre and the post-tests. In the pre-test participants were asked to rate a number of their knowledge, attitudinal and skill attributes. This

process was then repeated in the post-test to ascertain if any of the knowledge, attitude and skill attributes increased as a result of using the StartUp\_EU service. Wilcoxon-matched paired signed ranks tests indicated that there were significant increases with regards to the following knowledge, attitudes and skills: self-confidence ( $Z = -2.610$ ,  $p < 0.009$ ), knowledge of economic and financial literacy ( $Z = -4.066$ ,  $p < 0.000$ ), knowledge of business organisation and processes ( $Z = -4.991$ ,  $p < 0.000$ ), communication skills ( $Z = -2.524$ ,  $p < 0.012$ ), presentation skills ( $Z = -2.279$ ,  $p < 0.023$ ), planning ( $Z = -2.943$ ,  $p < 0.003$ ), team work ( $Z = -3.194$ ,  $p < 0.001$ ), exploration of entrepreneurial opportunity ( $Z = -2.971$ ,  $p < 0.003$ ) and design of business projects ( $Z = -2.962$ ,  $p < 0.003$ ). There were no significant difference in relation to the following knowledge, attitudes, and skills: self-awareness, sense of initiative, risk-taking, creativity, problem solving and knowledge of career opportunities and the world of work.

## Discussion and Conclusions

This study focused on the assessment of the piloting use of the StartUp\_EU service in school education. The objective was to acquire the views of students on the mini-games, materials and competition. The majority of students were generally positive about the StartUp\_EU competition.

- In terms of usability, 82% of students found the system to be easy to use with functions that were well integrated and 81% of students believed that other students would learn to use the StartUp\_EU platform very quickly.
- Students generally (90%) found the platform to be interesting and enjoyable with regards to motivational usability with 81% feeling that it stimulates further enquiry and incorporating novel characteristics. 87% of the participants believed that the competition was useful for entrepreneurship education.
- The top four knowledge, skills and attitudes that students believed they had developed through participation in StartUp\_EU were: knowledge of business and organisation processes, team work, exploring entrepreneurial opportunities and designing business projects. The lowest ranking knowledge, attitudes and skills were risk taking, self-confidence, knowledge of economic and financial literacy and self-awareness.
- Overall, there was a positive attitude towards the contribution and usefulness of mini-games towards learning entrepreneurship and a clear opinion that the mini-games are not complicated and the majority of participants believed that the mini-

games improved learning of entrepreneurship and that they were useful for learning about entrepreneurship.

- The results were indicated that students were satisfied with the supporting materials and help provided through the online community forums. Participants also indicated that they collaborated significantly with their team members and their teachers during the competition.

Comparing the pre and post-tests, Wilcoxon-matched paired signed ranks tests indicated that there were significant increases with regards to the following knowledge, attitudes and skills: self-confidence, knowledge of economic and financial literacy, knowledge of business organisation and processes, communication skills, presentation skills, planning, team work, exploration of entrepreneurial opportunity and design of business projects. There were no significant difference in relation to the following knowledge, attitudes, and skills: self-awareness, sense of initiative, risk-taking, creativity, problem solving and knowledge of career opportunities and the world of work.