PROACTIVE

Fostering Teachers' Creativity through Game-Based Learning

Evaluation Analysis Report

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EXECUTIVE SUMMARY

ProActive - Fostering Teachers' Creativity through Game-Based Learning is a European project which promotes an innovative pedagogical approach where practitioners at various educational levels become game designers and engage in creative teaching practices. WP6 - Evaluation aims to validate the approach of the project as a means of learning, by evaluating its impact on teachers' creativity and students' outcomes.

The present deliverable – D6.3, Evaluation Analysis Report, aims to present in detail the instruments and procedures applied within the evaluation process, as well as the findings elicited. Results are presented by answering different research questions related to three evaluation dimensions: the pedagogical framework adopted within the project, the technical aspects of the two game editors (EUTOPIA and <e-Adventure>) and the impact of the project on the participating educational centres, teachers and students.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**

1. INTRODUCTION **5**

2. OVERVIEW OF THE PROACTIVE EVALUATION **6**

2.1. The evaluation approach 6

2.2. Tools and procedures 7

3. EVALUATION OF THE PEDAGOGICAL FRAMEWORK **11**

P1. To which extent did teachers get involved in a creative process while designing a GBL scenario? 11

P2. Are the metaphors present in the process of designing a GBL scenario? 17

P3. To what extent is the GBL scenario designed adapted to teachers' specific teaching contexts? 18

P4. How are the metaphors present in the GBL scenario created? 23

P5. How do teachers experience the implementation of the GBL scenario? 25

P6. How do students experience the GBL process? 27

4. TECHNICAL EVALUATION **29**

T1. Do the game-editors support the creation of a creative educational game? 29

T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)? 32

4. IMPACT EVALUATION **34**

5.1. The pedagogical framework 37

5.2. Technical evaluation 38

5.3. The project impact 38

APPENDIX 1: THE GBL DESIGN CREATIVE PROCESS QUESTIONNAIRE **40**

APPENDIX 2: METAPHORS' TABLE INSTRUMENT **44**

APPENDIX 3: THE GBL QUESTIONNAIRE **45**

APPENDIX 4: EUTOPIA PARTICIPANTS' SELF-ASSESSMENT TOOL **48**

APPENDIX 5: <E-ADVENTURE> EVALUATION FORM **51**

APPENDIX 6: TEACHER INTERVIEW GUIDE **53**

APPENDIX 7: OBSERVATION GRID **54**

APPENDIX 8: GUIDE TO INTERVIEWS TO STUDENTS **55**

1. INTRODUCTION

ProActive - Fostering Teachers' Creativity through Game-Based Learning (GBL) promotes an innovative pedagogical approach where teachers become game designers and experience creative educational practices. In four different EU countries (Spain, Romania, Italy and UK), 80 teachers and trainers at various educational levels used two game editors for designing their learning games: <e-Adventure>, an open source software for creating adaptable 2D point-and-click adventure games for educational applications, and EUTOPIA, a free of charge tool for designing multiplayer educational scenarios in a 3D environment. Furthermore, the 58 GBL scenarios created were tested in real settings with students involved in hands on sessions. ProActive facilitated this by providing the tools and the methodology for GBL design.

We start from the hypothesis that we don't learn in only one way, but in different ways that depend on personal aptitudes, on the learning situation and on the content to be learnt. In fact, every person is able to use a different combination of learning styles depending on the situation. The five learning metaphors model[1] adopted in ProActive describes different ways of learning and is used as stimulus in the GBL design process. Each metaphor represents a preference for learning that is not exclusive.

The Project adopted a scenario-based approach. Indeed, in order to design meaningful GBL activities, many aspects need to be considered: the game is perceived as embedded in a learning scenario that takes into account the different parameters of the teaching and learning context. While planning their GBL scenarios, educators should consider the particular characteristics of the learning audience, the specific learning objectives, the evaluation approach, the time-space resources and the technical requirements of the games. Moreover, it is be helpful to plan the step by step organization of the learning activities: the structure of the activities before (e.g. introductory session, presentation of the game), during and after the game (e.g. discussion) need be planned.

Within the project, WP6 - Evaluation aims to validate the approach of the project (i.e. educators as designers of their own GBL scenarios) as a means of learning, by evaluating its impact on teachers' creativity and students' outcomes.

The evaluation methodology was defined within Task 6.1 - Development of Evaluation Framework. The framework has set three evaluation dimensions, namely the pedagogical framework, the technical dimension and the impact dimension. Furthermore, it has proposed evaluation tools and procedures specifically designed for the ProActive contexts. Tools and procedures have been applied by all project partners during the implementation phase of the project. Data collected was published in Deliverable 6.2 – Report on evaluation data.

The present deliverable – D6.3, Evaluation Analysis Report, aims to provide a detailed analysis of the data collected by all partners, presenting the procedures and findings. It first provides an overview of the ProActive evaluation approach and tools. Afterwards, results are presented by answering different research questions related to three evaluation dimensions, namely the pedagogical framework, the technical dimension and the impact dimension. Finally, a synthesis section highlights the main findings and outcomes elicited from the project implementation.

[1] The five learning metaphors model is described in D3.3 – Psycho-pedagogical Framework for Fostering Creativity, available on the BSCW platform of the project, or publically at http://www2.ub.edu/euelearning/proactive/documents/proActive-psycho-pedagogical-framework.pdf.

2. OVERVIEW OF THE PROACTIVE EVALUATION

This section aims to present the evaluation approach adopted in ProActive, as defined in D6.1 – the Evaluation Handbook. It details the dimensions that have been evaluated, as well as the tools and the procedures that have been used (questionnaires, interviews, etc.).

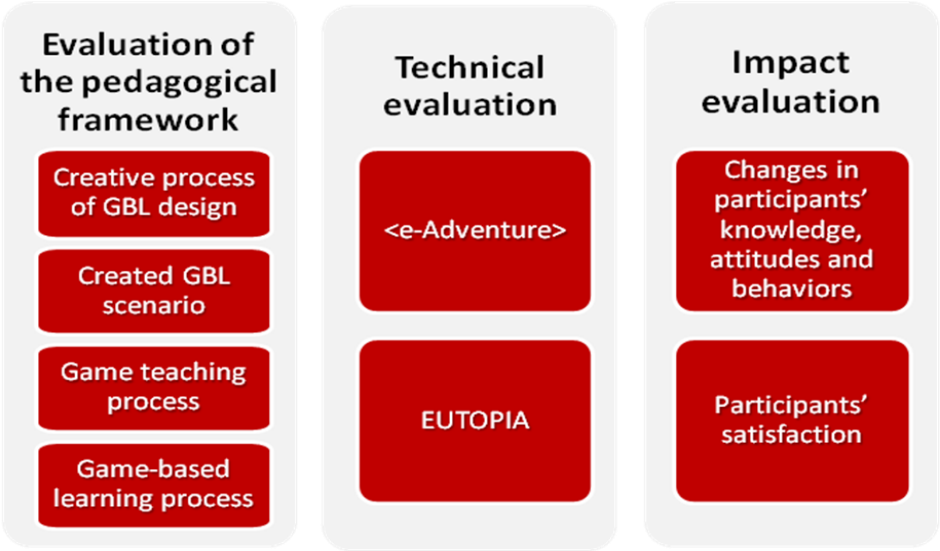
2.1. The evaluation approach

The ProActive evaluation focused on three different dimensions which provide a complete picture of the project implementation:

- *The pedagogical framework adopted within the project*: this dimension focused on the creative process of GBL design, the use of the five learning metaphors, the GBL scenarios created by teachers, the game-based teaching process (from teachers' point of view), and the game-based learning process (from students' point of view).
- *The technical aspects of the project*: this dimension looked at the functionalities and the usability of the two game editors (<e-Adventure> and EUTOPIA);
- *The project impact*: this dimension looked at the effects of the project on the participating teachers / trainers in terms of changes in knowledge, attitudes and behaviours and participants' satisfaction.

Figure 1 summarizes the different dimensions evaluated throughout the project.

Figure 1. The different dimensions explored by evaluation tools in the ProActive project



In order to evaluate each dimension, the evaluation process answered specific questions:

- *The pedagogical framework adopted within the project*

  P1. To what extent did teachers get involved in a creative process while designing a GBL scenario?
  P2. Are the metaphors present in the process of designing a GBL scenario?
  P3. To what extent is the GBL scenario designed adapted to teachers' specific teaching contexts?
  P4. How are the metaphors present in the GBL scenario created?
  P5. How do teachers experience the implementation of the GBL scenario?

P6. How do students experience the GBL process?

- *The technical aspects of the project*

  T1. Do the game-editors support the creation of a creative educational game?
  T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)?

- *The project impact*

  IM1. Did project participants' knowledge, attitudes, beliefs, or behaviours change as a result of the implementation?
  IM2. Did the project meet the expectations of the participants?

2.2. Tools and procedures

In order to answer the questions, several tools and procedures have been employed by partners. Table 1 summarizes the different research questions and the tools which enable answering them.

a) The GBL design creative process questionnaire

To answer P1, an open-ended questionnaire was designed[2], with the aim to explore the characteristics of teachers / trainers' creative process of GBL design. The questionnaire links the different phases of the creative process, as described in the literature on creativity with the GBL design process. Before applying it, the questionnaire was validated by recognized experts in the field.

The questionnaire has been filled by teachers / trainers from the different partners' target groups, after the GBL design process. In total, 47 questionnaires have been collected, either in paper or electronic format.

The data analysis process consisted, for each partner, in looking at participants' choices and comments, and establishing categories on the characteristics of teachers' mindsets during the different phases of the creative process. Analysis by each partner have been synthesized.

b) In-depth interviews with teachers / trainers

Partners have conducted interviews with teachers / trainers involved in the project as game designers, in order to answer different research questions: P2, P5, IM1 and IM2. According to the circumstances, the interviews were conducted face-to-face or through phone calls, individually or in group, at the end of the GBL design process or after the implementation of the GBL scenarios in teaching settings.

For questions P2 and P5, the interviews have been analyzed by reducing, condensing and organizing data into small units in order to find common themes and set up categories. Answer to IM1 come from comparing the results of the preliminary focus groups conducted at the beginning of the project (available in D3.2) with the outcomes of interviews to teachers carried out at the end of the project.

- *Focus groups:* Between April and June 2010, 15 focus groups were organized by the ProActive consortium in four different countries (Italy, Romania, Spain and UK). The main objectives were the following: a) to explore teachers' and trainers' use and interest in ICT and Game-Based Learning in their teaching methodologies; b) to explore teachers' and trainers' attitude and opinion about the link between creativity and Game-Based Learning; c) to explore teachers' and trainers' point of

[2] Note: The questionnaire used by partners is different from the one mentioned in the evaluation framework. Indeed, the Proactive team adapted the project evaluation approach regarding creativity after the publication of D6.1.

view in relation to learning metaphors and their adaptation to their teaching approach. The focus groups enabled obtaining quality data on current practices, as well as on practitioners' interests and needs for developing creative Game-Based Learning scenarios. A total of 90 participants attended the focus groups. Participants were mainly teachers who already use ICT in their daily activities.

- *Interviews:* Interviews were conducted by all partners after the implementation phase. A total of 23 participants were interviewed. More specifically, data to answer this question comes from the following interview questions:
    - Has the project made you reconsider any of your beliefs about teaching and learning?
    - What did you learn in this project that can be useful for your practice?
    - Did ProActive enhance your flexibility in teaching? How?

Questions 11 and 12 from the interviews to teachers and trainers carried out at the end of the project allow us to get information on IM2.

c) The GBL questionnaire

To answer P3, a questionnaire was designed which assesses the appropriateness of the designed GBL scenarios for specific teaching contexts, according to three dimensions[3]: gaming aspects, learning aspects and technical aspects. The tool includes items which act as indicators that show if the GBL scenario presents necessary success factors to be implemented in a specific teaching context.

Independent experts (in the fields of education and / or GBL) chosen by partners evaluated the created games and their related learning scenarios. In total, 20 GBL scenarios have been evaluated by experts through the GBL questionnaire.

Data from the 20 GBL questionnaires collected within the partnership has been integrated and analysed on the basis of common findings and relevant aspects to be considered.

d) The Metaphors' table

This tool was developed in order to answer P4, i.e. to find out how each learning metaphor is present within a GBL scenario, through several dimensions: learning objectives, role of the teacher, role of the learner, game representation, learning strategy, dominant gaming aspect, what promotes learning and nature of the task.
After having analysed the GBL scenarios developed by participants, independent experts chosen by partners identified which metaphors are the best for describing the dimensions mentioned above.
In total, 17 metaphors' tables have been collected.

The data analysis process has been done by observing the presence and the consistence of the metaphors in the GBL scenarios created among the different project countries. The metaphor tables provided for each scenario have been compared by crossing the presence of the metaphors in relation to the dimensions for evaluating a GBL scenario.

e) Participant observations (optional)

[3] Note: These three dimensions were identified by the ProActive consortium in the context of D3.1 – ProActive Success Factors for GBL, available on the BSCW platform of the project.

Some partners closely followed the pilot GBL sessions in which the GBL scenarios were implemented in real teaching settings. An observation grid was filled by an observer in order to collect data regarding teachers' / trainers' behaviours. In total, observations were conducted with 6 teachers / trainers with more than 367 students.

Observations have been analysed by reducing, condensing and organising data into small units in order to find common themes and set up categories.

f) In-depth interviews with students (optional)

With the purpose of obtaining data about students' experience during the implementation of the GBL scenarios (P6), some partners (and in one case the teacher as tutor of the game session) conducted interviews with the students from the pilot sites. Interviews were individual or within discussion groups after the game sessions.

The interviews involved 208 students in total.

Interviews have been analysed by reducing, condensing and organising data into small units in order to find common themes and set up categories.

g) The EUTOPIA participants' self-assessment tool

This tool has been developed in order to evaluate the functionalities of the EUTOPIA game editor (T1 and T2). It aims to understand users' satisfaction in relation to the platform. In particular, questions address the easy exploration of technical issues, the platform's features and facilities, and the interface assessment.

A total of 15 questionnaires have been collected among partners.

Summative scales were calculated by aggregating questions in blocks (already defined in the questionnaire) and by generating standard statistic metrics (average, mode, min value, max value, median).

h) The <e-Adventure> evaluation form

It is a tool for the technical evaluation of the functionalities and the usability of <e-Adventure> game editor, with the same purposes of EUTOPIA participants' self-assessment tools.

The form has been filled out by 64 participants.

For <e-Adventure>, summative scales were calculated by aggregating questions in blocks 1, 2, 3 and 4, respectively. Each summative scale represents one of the following factors: "Game model", "General opinion about <e-Adventure", "Functionality in <e-Adventure>" and "Learning materials provided". Each summative scale will generate standard statistical metrics (average, mode, min value, max. value, median).

Table 1. Overview of research questions and instruments

	Creative process Questio-nnaire	Meta-phors table	GBL questio-nnaire	Observa-tions	In-depth interviews	<e-Adventure> questionnai re	EUTOPIA questionnai re
EVALUATION OF THE PEDAGOGICAL FRAMEWORK							
P1. To what extent did teachers get involved in a creative process while designing a GBL scenario?	**X**						
P2. Are the metaphors present in the					**Question 1**		

process of designing a GBL scenario?							
P3. To what extent is the GBL scenario designed adapted to teachers' specific teaching contexts?			**X**				
P4. How are the metaphors present in the GBL scenario created?		**X**					
P5. How do teachers experience the implementation of the GBL scenario?				**X**	**Questions 2 to 7**		
P6. How do students experience the GBL process?				**X**	**X**		
TECHNICAL EVALUATION							
T1. Do the game-editors support the creation of a creative GBL game						**X**	**X**
T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)?						**X**	**X**
IMPACT EVALUATION							
IM1. Did project participants' knowledge, attitudes, beliefs, or behaviors change as a result of the implementation?					**Questions 8 to 10**		
IM2. Did the project meet the expectations of the participants?					**Questions 11 and 12**		

3. EVALUATION OF THE PEDAGOGICAL FRAMEWORK

The pedagogical framework of the ProActive project, as described in details in the Deliverable 3.3 – Psycho-Pedagogical Framework for Fostering Creativity, has been evaluated considering the following aspects: the role of the metaphors during the GBL design process, the presence of the metaphors in the GBL scenarios created, the creative process of game design, the game teaching process and the success factors of the games developed by participants.

Through the employment of the tools and procedures described in the previous section of this document, partners have gathered and analysed data in order to answer different research questions.

This section aims to present the results of the evaluation of the project pedagogical framework for all partners.

P1. To which extent did teachers get involved in a creative process while designing a GBL scenario?

Different authors[4] describe the creative process as an iterative sequence of steps or stages. Models vary according to the number and characteristics of stages. By examining different models, it is possible to establish four groupings which represent the major phases of a creative process:

- *Analysis:* This phase consists of defining and setting the problem to develop an understanding of what is required in order to generate an acceptable solution. The individual becomes familiar with the content area by building or recalling relevant domain knowledge, and learning from previous works stored in libraries, on the web, etc. Task motivation has to be high for, the individual to have sufficient interest to pursue solving the problem.
- *Generation:* This is the creative phase of the process, during which the individual searches through available pathways, exploring features of the environment that are relevant to the task at hand, in order to generate adapted ideas and responses.
- *Evaluation:* The novel ideas and solutions produced during *generation* are tested, evaluated and verified regarding their appropriateness and value.
- *Communication / implementation:* The solution is implemented and communicated to others.

These stages do not appear in a particular order in time, as they can be revisited by teachers at different moments of the process.

Results obtained enabled describing the GBL design process within the different stages of the creative process models.

a) Analysis

During the analysis stage, teachers engaged in the process of GBL design. Furthermore, they prepared for the task by acquiring different types of knowledge and skills. Results showed that teachers considered different activities as useful.

[4] G. Wallas, *The art of thought*, Jonathan Cape, London, 1926.
T. Amabile, *The social psychology of creativity*, Springer-Verlag, New York, 1983.
B. Shneiderman, "Creating creativity: user interfaces for supporting innovation", *ACM Transactions on Computere Human Interaction*, vol. 7 No. 1, pp. 114-138, 2000.

Definition of the task: Teachers decided to engage in the process of GBL design ,defined their specific teaching objectives (i.e. students' profiles, concepts to be taught, etc.) and became aware of the resources available, i.e. time, material, etc. Some of them decided to work collaboratively and established work groups. During this stage, motivation acted as a critical factor. Two types of motivation appeared which are not mutually exclusive within a participant:

- *Extrinsic motivation:* A majority of the participating teachers / trainers (28 out of 47) saw a pragmatic approach in many terms, but were eventually highly motivated by the outcome of the process: a new teaching resource useful, engaging and attractive for their students which brings novelty and creativity in their classroom. Indeed, teachers mentioned that they needed a change in their methodology ("*my course had too much theory*", a Romanian trainer), as well as resources that "*connect with the curriculum, enrich it, offering another way of learning*" (a Spanish school teacher). Furthermore, respondents focused on the possible positive effects and benefits of the activity on their students: they are *"concerned about student's motivation"* (a teacher working with UCM) and seek for *"innovative strategies"* (an Italian university teacher). One of the UCM teachers affirmed that he had already tried different ways to improve engagement (for instance, by creating videos), but did not succeed in the past. That was his main motivation to go for a GBL-based approach. Other teachers pointed out that games are better aligned to new Spanish University education programmes (responses to what is usually referred to as the "Bologna plan"). Furthermore, some budget issues were mentioned: *" in the Army we use some very realistic serious games which are very effective. But they are also very expensive and we have no budget for this type of development"* (a professional trainer from the UK). Finally, Romanian trainers mentioned a need for risk-free learning environments, in which students' actions could not damage the resources: "*I teach a course in which equipment is vital for understanding the concepts. Unfortunately, sometimes, except pictures, I cannot bring with me in classes real servers, routers, switches, cables."*
- *Intrinsic motivation:* Intrinsic motivation appeared also as an important factor to push teachers in engaging in the process. Indeed, many teachers (20 out of 47) affirmed that they were personally interested in games *per-se*, and were motivated by the design process itself and by mastering the topic. In teachers' words: "*I have always liked to play videogames, I was excited to create my own*" (a Spanish primary school teacher), "*I immediately get involved in the project because I like creating, trying something new and putting myself to the test*" (an Italian primary school teacher). Furthermore, one of UNINA teachers stated: "*The idea of employing the EUTOPIA platform for my teaching motivated not only my students, but also myself!"* Finally, one of UCM teachers stated: *"Although I think that games are motivating for the student's learning, my choice was determined by my interest in games".*

Preparation: Teachers got ready to create their GBL scenarios, by acquiring different types of knowledge and skills. In most cases, the activity started during the initial training provided, and continued later on all along the design process.

- *Consulting examples of similar works:* For most teachers / trainers (33 out of 47), the activity was inspiring and helpful in order to develop an idea of the editors' (<e-Adventure> and EUTOPIA) functionalities and possibilities, and to know what they would be able to create with them. Indeed, teachers mentioned that it was important to understand how other people employed the platforms: *"examples gave me a clear vision of what is possible to do with the editor and how"* (a Spanish school teacher). In some Italian university teachers' words, *"looking at different games gave me the possibility to identify much better my path*". Furthermore, examples inspired teachers / trainers to learn about

game dynamics. For instance, a Spanish school teacher stated that he consulted classical examples of graphical adventure, so to have an idea of narrative dynamics. Furthermore, teachers / trainers found it useful to consult educational games of their discipline. As an example, UCM trainers used COTS from the field of medicine education to gather ideas for game design. An Italian university teacher mentioned that *"it is important to have an idea of what the market produces".* However, few teachers mentioned that the examples presented within the training were not conceptually rich or attractive. Thus, some teachers, such as UNIBUC's and UB's, made their own research using web resources. CAST trainers did not find any example that was useful to develop their game, as they already had a clear idea of what they wanted to do. As mentioned by one of them: *"We looked around at games that dealt with the same issues but they weren't very good. It made us think that our game was pioneering in some way"*.

- *Exploration of the game editors:* This activity started during the training provided, in which teachers were introduced to the affordances offered by each editor through tutorials. Most teachers (35 out of 42) considered the technical training sufficient, while some of them (7) stated that they needed more information. Furthermore, comments highlight that teachers / trainers needed more practice and support from the ProActive team in order to develop their games. In a Spanish school teacher's words: "*we received training to start creating our games, but not enough to design them in an autonomous way. With the support provided all along the development, we could finalize our games*". Thus, the exploration activity continued after the training: "as *it happens with each ICT application, one needs time and practices in order to control and manage the editor*". As mentioned by a UK trainer, "*we relied a lot on CAST for the work after the design stage"*. Besides the support provided, teachers / trainers made their own research using web resources. They started to create games having the basis of the training, and researched when needed. In a Romanian trainer's words, *"I needed to discover other similar approaches or elements that could offer me other perspectives on my game"*, and *"the resources that I had helped me to start; I knew that for the rest I should investigate on my own".*

b) Generation

During this stage, teachers created their GBL scenarios. The results of the questionnaire have enabled outlining several GBL design activities, as described below.

Conceptualization: This activity consisted in generating ideas. Results highlighted different characteristics for this activity that are common for all partners.

- *Coming up with ideas:* Teachers' ideas of GBL scenarios emerged according to different sources of inspiration. First, exploring the affordances of the game editors determined and conditioned teachers' ideas: "*since I heard about the editor and its features, I knew what kind of game I wanted to develop"* (a Romanian trainer). Second, consulting examples of GBL scenarios helped them generating ideas and deciding on which editor to choose. "*Examples helped me understanding how the editors work, and developing an idea more and less in line with the possibilities they can offer*" (a Spanish school teacher). Furthermore, teachers generated their ideas according to their specific teaching objectives, educational contexts and students' profiles. Indeed, for UCM, 7 out of 11 the participants agreed with the statement that their idea for a game was influenced by the specific educational goals. For UNINA, nearly all the teachers (5 of 6) developed their GBL scenarios starting from their didactic idea. Furthermore, as stated by other teachers, "*I already had an idea about the game structuring in connection with the target"* (an Italian school teacher); *"we were very clear about this – the game had to conform quite strictly to our educational aims"* (an English trainer).

Finally, in most cases, ideas were determined by external constraints, such as the time they could dedicate to the design process and the editors' limitations. For instance, 7 out of the 11 UCM participants took into account resources and time available when planning the game development. While 20 teachers chose to develop an idea which was rather easy to develop, according to resources available, 27 of them did not mind choosing challenging ones, as their objectives were to develop innovative resources. Teachers often enjoyed trying unusual or unconventional ideas for their game (26 out of 47), as their objectives were to "*try finding new forms of learning for students*" (a Spanish school teacher), "*to focus on innovative approaches*" (a Spanish university teacher). However, some teachers mentioned that they "*decided to go for a safe option*" (an English professional trainer) as it was their first GBL project.

- *Incubation:* 37 out of 47 respondents mentioned that new ideas for their GBL scenario sometimes came to their mind when they were away from it. In a teacher's words: "*I thought a lot about the game and got ideas and inspiration while I was not working on the game*" (a Spanish university teacher) ; "*some ideas appeared while I was walking back home, specially the days in which I worked a lot on my game*" (a Spanish school teacher). Furthermore, 38 out of 47 teachers / trainers affirmed that they experienced some kind of "enlightenment" or insight during the design process. "*I had ideas to solve the problems in the most unexpected moments*" (a Romanian trainer); "*all my ideas were spontaneous"* (an Italian school teacher).

Prototyping: Most of the teachers / trainers found it very useful to write a storyboard in order to effectively expand their ideas into the plan of a full consistent game, by planning details about the game dynamics, the forms of gameplay, the content of scenes, and the progression of the narrative: *" I think the storyboard is necessary to gather all the ideas and to obtain an initial prototype of the game"* (a Spanish university teacher" ; *"I drew the story, character,s and after that it was much clearer: what, how, how much, when?"* (a Romanian professional trainer). This stage helped teachers draw a map of the path to follow in the game: "*without the storyboard we would have got lost, it acted as a guide for developing the game*" (a Spanish school teacher). It enabled them to modify the dynamics in a consistent way, to know where each element (objects, characters, etc.) of the game had to be, where it should be moved, and to program restrictions. However, some teachers (especially UNIBUC participants) stated that they preferred to work with the game editor from the beginning, as they felt more confident this way than writing the storyboard. Looking back, they were tempted to revise this way of working, concluding that maybe they could be more efficient if they planned more and work less with the editors. "*I would rather spend 10 hours planning and one hour designing, than spending 10 hours working with the editor and one hour planning the game".*

c) Evaluation

Through an iterative process, the GBL scenarios and games were regularly reviewed by most of the participating teachers / trainers (34 out of 47). For instance, one of UCM participants stated that "*the development process was iterative, so I made lot of improvements".*

The opinion of others: 38 out of 47 respondents affirmed that the opinion of others helped them in the GBL design process: "*I consulted widely with colleagues and valued their input*" (one of CAST trainers) ; "*I can say that my colleagues' opinion helped me to improve my game to be the best*" (UNIBUC trainer). UNINA teachers also stated that peers helped them gaining feedback and a guidance. For UB, sometimes, teachers called out students or experts in order to evaluate the quality of their scenarios. For CAST, all groups were keen to evaluate their partly-completed and completed games with end users. In the case of a pilot site, this led to an evaluation of a partly-completed game which initially started with subjects who

fitted the profile of end-user. It was extended to others because they felt the need to evaluate more objectively the impact of aspects such as playability and impact of graphics on engagement. Another CAST pilot site evaluated a number of aspects such as graphics and playability with its students as the game was being developed.

Evolution of ideas: In some cases, the initial game idea was kept by teachers and adjusted along the process ("*The team followed a process according to which the main idea remained although it got modified along the elaboration*", A Spanish school teacher). However, many teachers / trainers (33 out of 47) did not stick with the first idea they got, showing a flexible approach to the design activity. Game ideas and objectives were generally adapted all along the design process, according to different criteria:

- *Feasibility:* teachers adapted their game ideas and objectives according to time constraints: *according to the time available, I adapted the game that I wanted to create"* (a Spanish university teacher). One of UNIBUC trainers mentioned that they chose to develop *"the most feasible idea"*. Second, editors' affordances have been considered: "*I played around with the idea, but this happened because of the editor's features, which did not allow me to follow a specific path"* (a Romanian trainer). Finally, teachers took into account their own skills to manage the editor: "*I changed my idea as it was too difficult to implement*" (a Spanish school teacher).
- *ProActive success factors:* they were taken into account by 31 out of 47 of the participants who answered the questionnaire. Success factors were considered as useful and crucial. However, in an English trainer's words: *"they were quite useful but in theory only. It's difficult enough to design a game without referring to a checklist. It was easier just to know about them".*
- *Appropriateness to teaching objectives:* The GBL scenarios were reviewed considering their appropriateness, usefulness, correctness, and value. "*My classes and my students were the context in which I always thought to review my game*"; "*I reviewed my game checking the ease of interactions, explanations, plot and objectives*" (a Spanish school teacher).

d) Communication / implementation

At this stage, teachers decided whether to keep working on their GBL scenario or to start implementing it and diffusing it as a final product.

Self satisfaction and task completion: Most teachers (39 out of 47) affirmed having enjoyed the experience of designing their games. This number depicts that the experience of co-designing and implementing games was really satisfactory. According to UCM teachers' comments, different aspects were enjoyable for them, according to their preferences: art resource production, the development of the script, etc. For UNIBUC, the responses show that the creation process has been a pleasant experience. Furthermore, 30 of the teachers considered their goal accomplished, and they felt happy with their games. In a Spanish school teacher words: "*Our team is happy with the result*". However, 11 of them did not consider the game completed, but they would still like to finish it at some point in time. One of UCM teachers stated: *"I am happy with the game, but I would also like to keep improving it in the future".* None considered their goals unaccomplished.

Perceived novelty and usefulness: The GBL scenarios developed are mostly (42 out of 47 teachers / trainers) considered as good and useful educational tools. A DPPSS teacher mentioned: "*I think my game is definitely innovative!*"), while a UB teacher stated that "*there exist very few teaching resources for this type of content, the game is innovative in comparison to what I have seen before, and to what students usually do with the computer*". To some teachers, the novelty character is related to their teaching practice, but

not to what exists on the educational market. In addition, most teachers considered their games adapted to their teaching contexts: "*I am not sure wether the game is innovative, but it is useful in my teaching context"* (A Spanish school teacher). UNINA trainers considered their games as innovative and useful and ready to be implemented in real settings: "*It is perfect for my learning scenario".*

Reusability: When it comes to share it with others, teachers and trainers are usually open to distribution. They think that their games can be applied to wider audiences and that they may be useful in wider educational contexts. For a Spanish school teacher, "*the game is valid for the educational community in general*". This value is especially relevant for UCM and UNINA, taking into account the high level of specialization in the Erasmus segment. However, some teachers argue that their games would need to be adpated to fit other learning settings.

P2. Are the metaphors present in the process of designing a GBL scenario?

The evaluation has shown that, as a central topic in the game design process, the five learning metaphors are present, helping to foster educators' reflection on possible new ways of teaching.

Indeed, most of the teachers interviewed said they took into account the metaphors during the design process, both as a starting point and as criteria for evaluating the work done: "*metaphors were a reference while we were designing, the game emerged from them*"; "*when designing, we were constantly thinking of the different learning styles: participation, imitation, imitation, etc. We were thinking about them in a continuous way in order to plan the right strategy*" (quotes from Spanish teachers interviewed); "*the role of the metaphor was very important, because we referred to them for starting the game design process*" [quote from an Italian teacher interviewed]; "*I discover that if I take into consideration the learning metaphors, my game will be much valuable and unexpected results will arise*" (quote from a Romanian teacher interviewed).

Teachers found it "*a good idea*" to work with the metaphors, as they enabled them to consider new teaching forms and possibilities during the GBL design process.

However, some interviewed teachers mentioned that they did not take the metaphors into account during the design process. They considered secondary the role of the metaphors in the GBL design. But afterwards reflecting on the role of the learning metaphors they traced back the game created to the metaphors. Interviews showed that the choice of the metaphors depends on the subject matter of the game and the content to be learnt: one participant who taught a legal discipline considers this subject "*a bit dry and boring*" (quote from Italian teacher interviewed) so she tried to involve the students through the use of simulations and role plays that required participation and collaboration. In one case, the teacher chose the metaphors for her game for a personal preference: the metaphors of the game are the same metaphors of her teaching practice; she usually uses the discovery and experimentation metaphors because in her opinion those are the best ways for fostering students' creativity and abilities; she chose these metaphors also because she learns in these way: "*I hate handbooks and manuals, I always learn everything by myself*» [quote from an Italian teacher interviewed].

In many instances, participants reflected about their working experience before the project and found that they tend to use different teaching approaches for different purposes, such as fostering students' learning, despite some of them not being aware of the exact model and not talking in terms of "metaphors" before the ProActive project. During a discussion on teaching practices, the main topic was about the traditional teaching method (transfering information to learners who act as passive receivers) against the teaching practices that include alternative ways of learning and the use of several tools. A teacher gave an example of this: "*I get bored explaining, I prefer suggesting problems and motivating the students to find the solutions… I always try to do something different, not transmit notions that the students have to acquire, but sharpen and excite them*" (quote from Italian teacher interviewed).

P3. To what extent is the GBL scenario designed adapted to teachers' specific teaching contexts?

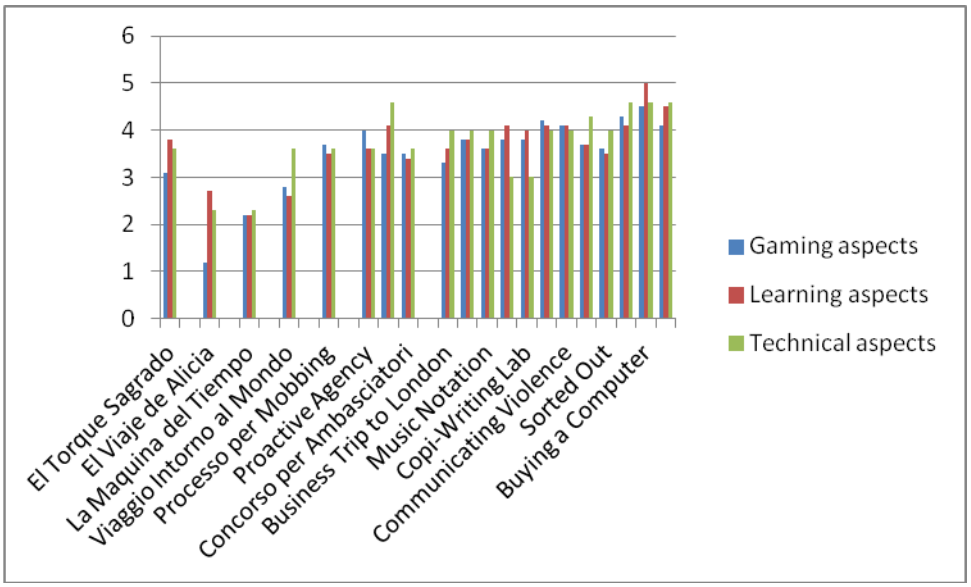
This research question aims to analyze the adequacy of the GBL scenarios created for a specific teaching context through the use of the GBL questionnaire filled out by experts engaged by partners who evaluated the games according to three dimensions: gaming, learning and technical aspects.

This section provides a summary of the evaluation of the GBL scenarios identified by the experts. The following table shows the average scores assigned (from 1 to 5) for the dimensions of every GBL scenarios analyzed.

Table 2. Results from the GBL questionnaires

Partners	GBL scenarios	Gaming aspects	Learning aspects	Technical aspects
UB	El Torque Sagrado (The Holy Torq)	3,1	3,8	3,6
UB	El Viaje de Alicia (Alice's Trip)	1,2	2,7	2,3
UB	La Maquina del Tiempo (The Time Machine)	2,2	2,2	2,3
DPPSS	Viaggio Intorno al Mondo (Tour Around the World)	2,8	2,6	3,6
DPPSS	Processo per Mobbing (Trial for Mobbing)	3,7	3,5	3,6
DPPSS	Proactive Agency	4	3,6	3,6
DPPSS	Scratch the Surface!	3,5	4,1	4,6
DPPSS	Concorso per Ambasciatori (Contest for Ambassadors)	3,5	3,4	3,6
UCM	Business Trip to London	3,3	3,6	4
UCM	Clinical Surgery	3,8	3,8	4
UCM	Music Notation	3,6	3,6	4
UNINA	Deus Ex Machina	3,8	4,1	3
UNINA	Copi-Writing Lab	3,8	4	3
UNINA	Prevention of Risk Behaviours in Adolescence	4,2	4,1	4
UNINA	Communicating Violence	4,1	4,1	4
CAST	House of Cain	3,7	3,7	4,3

CAST	Sorted Out	3,6	3,5	4
UNIBUC	Board Meeting	4,3	4,1	4,6
UNIBUC	Buying a Computer	4,5	5	4,6
UNIBUC	Photoshop	4,1	4,5	4,6



a) Gaming aspects

- Rules and goals: Experts found that 15 games out of 20 present clear goals and objectives, and 17 games out of 20 have clear and consistent rules throughout the whole game.

But there is a remark to be considered: EUTOPIA game editor requires defining the storyboard (as the narrative structure of the game) and the goals to be attained by players being at any time available to the players; while in the cases of <e-Adventure> games, the designer is free to present more or less clear goals and rules or leave them implicit.

The goals to be attained can be both specific and general: specific goals to achieve for bringing the game to an end related to different tasks, and wider learning objectives to achieve through the GBL activity: for example, in the GBL scenario *Proactive Agency* players should attain a set of results related to the different stages of the game and through the use of this scenario they should acquire knowledge and skills connected with the subject matter of the game.

- Challenge and competition: The GBL questionnaires collected show that 14 games out of 20 get high scores (4 and 5) considering the challenges included in the GBL scenarios, while 10 games get high scores (4 and 5) regarding the good competition that can be between peers in multiplayers games or against oneself through game scoring or ranking system.

Experts have evaluated the challenges included in the games considering the features of the target groups (such as age, previous knowledge, presumed use of technologies) and on this basis they found that the challenges embedded in some games are not appropriate: "*I consider that challenge is not appropriate. It is quite easy for children of 10 or 11 years old that are used to playing videogames and computers*" (comment of the expert from GBL questionnaire) or adapted to the users: "*The game mechanics are based on the presentation and resolution of different challenging scenarios, with different levels of difficulty*" (comment

of the expert from GBL questionnaire). Experts found that 4 out of 20 GBL scenarios evaluated do not include competition aspects: "*There is not a real game challenge, the child can pass levels in a random way*" (comment from GBL questionnaire), partly because role plays have been developed to foster collaboration between players more than competition.

It is also possible that game challenge and competition between players dovetail: as in the GBL scenario *Processo per Mobbing* during which students play different roles, each of them with specific goals that clash with other players' goals.

- Feedback and rewards: Despite the importance of feedback to make players able to perceive the impact and consequences that their actions have in the game world, in order to be informed on how they are performing, check their progress continuously, and enable them to eventually adjust their actions, not all games include a comprehensive and consistent feedback system: "*Very accurate feedback is provided after each attempt, informing student about actions that were correctly cconducted, and pointing out mistakes*" (comment of the expert from the GBL questionnaire). In fact, some games do not provide feedback («*The player does not have any feedback when fails the question, the child only must to repeat, the feedback is poor*» [comment of the expert from the GBL questionnaire]) or provide them but not in a constant manner. Experts have assigned medium-low scores (from 1 to 3) to 8 games out of 20.

In some EUTOPIA games, the teacher as tutor of the game session has the task of giving feedback to the players: "*Quality and quantity of feedbacks and rewards are also connected to the coaching style adopted by the tutor during the session*" (comment of the expert from the GBL questionnaire).

<e-Adventure> game editor allows the designer to define a set of feedback for every action done (both mistakes and achievements) by the players throughout the whole game path, but not all participants use it.

Regarding the reward, that helps players in the achievement of the objectives and acts as a mechanism to increase engagement and immersion; it can be inside the game as scores assigned for the challenges faced, or out of the game.

- Gaming experience: The gaming experience includes aspects connected to the capacity of the games to engage and immerse the player through different techniques (interesting plot / story, appealing environment / virtual world, contextualization, challenging goals, etc.), the level of entertainment, and the variation of the game experience between players (on the basis of their knowledge and ability) or between different game runs.

Regarding the engagement of the player within the game, experts assigned high scores (4 and 5) to 12 games out of 20 considering if they immerse the player: "*The first-person perspective and the exploratory type of game are engaging and immersive*"; "*It is a very well written story, with challenge and unexpected events which maintain interest for a long time*" (comments of the experts from GBL questionnaire).

Most of the GBL scenarios evaluated provide a medium-high level of entertainment to the users (the average score is 3,1 out of 5) that come from different aspects connected with the game (such as humour aspects, funny dialogue, light-hearted characters and expressions etc.) or with the GBL activities: "*The topic is not inherently fun, but it is treated with humour*"; "*There is entertainment in navigating the game – searching for the outcomes*"; "*The entertainment can come from the use of the game software as learning tools*" (comments of the experts from the GBL questionnaire).

b) Learning aspects

- Educational affordances: Experts have evaluated the educational affordances of the games to allow the students to achieve the educational objectives defined by the designer and have assigned high scores (4

and 5) to 18 games out of 20 regarding this question of the GBL questionnaire: "How well does the game fit with your educational objectives?".

Learning resources: The GBL questionnaires collected show that only a few games (5 out of 20) do not provide relevant learning resources (internally, during the learning activities before the game or as a link) necessary for achieving the educational objective.

Adaptation to students' profile: Experts found that 16 games out of 20 are adapted and comprehensible to the specific students' profile: "*It is in perfect accordance with learning objectives*"; "*it is even if it has to respond to a large range of students*"; "*The game is very focused on a specific user profile*" (comments of the experts from the GBL questionnaire).

As the game can provide a personalized learning process on the basis of students' profile (age, previous knowledge, speed of knowledge acquisition, skills, etc.) using several levels of access or different game paths, experts have evaluated this aspect and found that only a few games (5 out of 20) present this factor.

- Evaluation methodology: Considering the specific evaluation methodology included in the game or embedded in the wider learning scenarios, experts have assigned medium-high scores (from 3 to 5) to 15 games out of 20.

The assessment methods chosen by designers and identified by the experts are several, both through the use of software functionalities (i.e. final assessment report, record of the game session, etc.) and documents provided by the teacher, and also through students' self-evaluation and group discussion to reflect about the game experience.

- Learning scenario: Most of the games created (17 out of 20) are included in learning scenarios defined by the teachers / trainers embedding learning activities before and after the game session: "*The scenario was developed on the basis of a specific educational curriculum and it includes learning activities before (acquisition of the knowledge needed) and after (evaluation) the session*" (comment of the experts from the GBL questionnaire).

- Progressive acquisition of knowledge: Considering the progressive acquisition of knowledge allowed by the games, the experts have assigned medium-high scores (from 3 to 5) to 14 games: "*the game is divided in different phases and the players have to attain the goals of the game phase to carry on. So the scenario allows a progressive acquisition both of knowledge and ability*"; "*The game structure includes growing difficulty steps*"; "*The tutorial is linear and exposes concepts step by step, always providing proper feedback*" (comments of the experts from GBL questionnaire). On the contrary, some games have been developed for the "*consolidation of knowledge and it is a way to put the knowledge and the ability into practice*" (comment of the expert from the GBL questionnaire).

- Level of autonomy: Most of the games evaluated (14 out of 20) promote the autonomy of the players who are free to explore the game without the requirement of an intervention by the instructor: "*Teacher defined the main aspects of the game (goals, characters, phases) but the game leaves the players free to identify and use resources and decide how to attain the goals*"; "*The game mechanics and objective are simple enough to allow students to play by themselves*"; "*The player is responsible for the outcomes in the game. He/she has autonomy therein*"; "*Players have different paths to achieve the final scope. The player is independent and he can make his own cho*ices" (comments of the experts from the GBL questionnaire).

- Students' motivation: Experts have evaluated the capacity of the games to enhance students' motivation to employ themselves in the learning activity that constitutes a crucial factor for achieving the educational objectives. The scores assigned considering this aspect are high for most games (17 out of 20) and the

comments provided by the experts explain how the games enhance motivation: "*the game opens the possibility of putting the knowledge and the ability into practice for the creation of a product (the advertising campaign) through cooperation between players*"; "*Students should be motivated toward the score assignment*"; "*Replacing traditional fill-in-the-blank tests with an interactive game/simulation improves learners' motivation*"; "*The game scenario enhances students' motivation by promoting peer competition*" (comments of the experts from the GBL questionnaire).

c) Technical aspects

- Usability of the game: Regarding the usability of games, experts assigned high scores (4 and 5) to 16 games out of 20, considering them user-friendly: "*The game always provides gameplay and feedback mechanisms to let the player know how to proceed*"; "*It is easy to use, and also has clear indication about the interaction with objects/characters*" (comments of the experts from the GBL questionnaire).

- Graphic: One of the technical aspects evaluated is the graphic that can be more or less adapted to the target group.

<e-Adventure> game editor allows designers to determinate all the graphic aspects of the games (i.e. scene, cursor, characters' appearance, etc.) whereas EUTOPIA doesn't afford it. So in the cases of EUTOPIA games, the appropriateness of the graphic to the target group does not result from teachers' choice.

Experts assigned medium-high scores (from 3 to 5) to 15 games considering their graphic aspect suitable for the users.

- Further use in different contexts: Experts have provided their opinion about the possibility of using the games developed by participants in different contexts without the need of complex and costly modification to suit particular groups, and they found that most games (17 out of 20) allow it through the modification of the elements (i.e. conversations, characters, books, etc.), although some of them were developed for specific purposes and addressed to specific target groups: "*This scenario uses characters of a particular ethnic background and so might not be suitable to other contexts*" (comment of the expert from GBL questionnaire).

P4. How are the metaphors present in the GBL scenario created?

This research question aims to analyze the way the five learning metaphors are used in the GBL scenarios. Even though not all participants have taken the metaphors into consideration during the design process, the experts have traced back the dimensions of the GBL scenarios developed to predominant metaphors through the use of the Metaphors table.

In Deliverable 6.2 – Report on evaluation data, the dominant metaphors for each GBL scenario evaluated are identified. The following is a summary of the presence of the learning metaphors in the games created within the project, considering that the scenarios analysed contains several metaphors combined in different way.

a) Acquisition

Although the acquisition metaphor is present in all games, as they include a set of content to be transmitted, more or less specific and connected with different fields and subjects, this metaphor is evident in the games developed with <e-Adventure> more than in EUTOPIA games and it describes the following aspects: learning objectives (to acquire notions and contents), learning strategy (view of the contents, possible multiple review of the data) and what promotes learning (trying to reach a reward or a high score).

b) Participation

The participation metaphor is mainly present in the games developed with EUTOPIA and it is connected with both learning objectives (learn to be a part of the community), role of the teacher as tutor of the game session to facilitate the interaction and collaboration between players, the role of the learner who should contribute by interacting with the development of the tasks and the attainment of the game goals; participation also describes the nature of the task, and what promotes learning is the feeling of being a part of the community.

c) Discovery

The discovery metaphor is present in <e-Adventure> games more than in EUTOPIA games, as point-and-click games well fit with it and in this kind of games it is connected with the following dimensions: learning objectives as recognition or creation of new relations between objects/concepts; the role of the learner that includes discovery / construction of meaning within the game environment; the learning strategy through manipulation, exploration and deep understanding; dominant gaming aspects such as rules, engagement / emersion, flexibility, manipulability, interactivity; what promotes learning identified as the experience of a feeling of mastery over the game world, curiosity, intrinsic motivation to experiment.

d) Imitation

This metaphor is less present in the games created than the others. In some cases it was identified in the game representation (location for observation and repetition of other's experience), learning objectives (to gain expertise).

e) Experimentation

As a general rule, experimentation is a basic metaphor that describes the game representation and the learning objectives because the GBL scenarios have been developed as safe environments where errors can be experienced, players can put their knowledge and abilities into practice with a high level of

autonomy, learning through the experience of the consequences of the action taken, and where the role of the teacher is to give tasks and introduce challenges and let the learner experience it within the game.

P5. How do teachers experience the implementation of the GBL scenario?

The following table shows the pilot sites that have implemented GBL scenarios in real teaching settings.

Table 3. List of the pilot sites involved in the project

Partners	Pilot sites	GBL scenarios
UB	*IES de Sabón* upper secondary school (23 students – 4 teachers)	*- Alice's Trip* *- The Time Machine* *- Tuning the Bicycle*
	CEIP Ponte dos Brozos fifth grade of primary education (24 students – 1 teacher)	*The Holy Torq*
DPPSS	*- Sisto V* high school (8 students – 2 teachers) *- Federico Cesi* high school (8 students – 2 teachers)	*Proactive Agency*
	Ro Ferrarese primary school (15 students – 1 teacher)	*Viaggio Intorno al Mondo (Tour Around the World)*
CAST	--	--
UNINA	--	--
UCM	*- Ramiro de Maeztu* primary school - School of Medicine of UCM *- CATEDU (Centro Aragonés de Tecnologías Educativas)*	
UNIBUC		*- Buying a computer* *- Installing a pc*
		Connectivity troubleshooting

a) Role of the teachers during the implementation

In general at the beginning of the session, teachers introduced the scenarios to the students involved in order to present the game structure, the learning goals and the use of the software.

As preliminary remark, it is necessary to consider that the role of the teacher / trainer during the implementation of the game depends on the software used: as EUTOPIA games require, teachers and trainers have taken part in the implementation as tutors of the game sessions for the support, supervision and evaluation of the game interaction. While in the cases of <e-Adventure> games, the teachers and trainers have attended the GBL activity so to help students, provide feedback and check on students' progress in the game.

b) Challenges faced

Participants reported several kind of challenge faced during the implementation of the GBL scenarios: some of them found difficulties trying to get the support and the involvement of their institutions and co-

workers; as much as possible this hurdle was cleared through the negotiation thanks to teachers' efforts and perseverance.

Moreover, most participants stressed the lack of time available for attending the project activities: "*time is always the greatest challenge that we face here in developing anything new*" (quote from English teacher interviewed)

Also, some participants mentioned that planning the activity was more stressful than the activity itself, because its organization required work and efforts: for example, it was difficult to have the computer lab available in the institutions, set the date for the game sessions, synchronize students' access to the EUTOPIA platform, etc.

Another challenge faced by participants is connected with technical problems that arose using the software which have been solved by teachers by themselves or with the help of the project teams.

c) Opinion about the implementation experience

One of the questions included in the teachers' interview is related to the lesson learnt during the project experience and the implementation phase. Participants have answered pointing out different aspects: they highly valued the fact of having learnt how to use videogames as a teaching tool, as they have to constantly evolve, renew and mature their teaching practices; the project gave them the opportunity to share experiences with other teachers, but also with researchers and with students; their active involvement in the process, designing the game, reviewing prototypes, making small changes, has made them more creative in their teaching practices.

As the personal involvement in the project is considered in a positive manner, some participants said they would like to repeat the experience, so the interviewers asked them what they would do differently next time and the answers are several: some teachers mentioned that they would like to proceed to some changes in their games: "*I would create a more complex game; we are currently working on a new version with my colleagues. I would put more adventure in my game, I mean I would add other gaming elements that questions, such as strategy and enigmas. We will also have to work on the evaluation system of the game*" (quote from Spanish teacher interviewed) plus further modifications and improvements of the game, especially as a consequence of the future enrichment of the game editors functionalities, also taking into account students' feedback.

A teacher said that the game design process should involve the students in order to improve the final product as in her opinion they are "game experts", they know game software functionalities and features, and very probably they will not decline the possibility of helping the teachers in the game development.

Other participants suggest using the games outside the classroom, as homework, for the next time.

Teachers who tested the games without their corresponding learning scenario expressed their wish to conduct activities before and after the games, so to enable students to play in a meaningful way and to make the best use of the created games.

P6. How do students experience the GBL process?

Students involved in the implementation of the GBL scenarios developed by teachers and trainers are from the pilot sites presented in table 2.

Students played games individually (one computer per student) or in sets of two, according to the computers available for the session and to the decision taken by the teachers, within the classroom or at home through the online sessions.

Students' involvement in the game session

During the GBL activities a high level of students' involvement was observed: players were focused on the game paths or on the interaction. Also, in some cases players collaborated in a rich and frequent manner in order to check personal progress in the game path and solve the problems together.

Regarding the use of the software, students quickly understood how to interact with the interface and they didn't find difficulties, also thanks to the instructions provided by teachers and project teams.

Some of the students wanted to play again for different reasons, such as practice, obtain a better score / time, and they asked to repeat the experience.

As a general rule, students' reaction to the games was very positive: they were responsive and open to the GBL activity and asked to repeat the experience and to use games as learning tools within their course of study.

The positive impact and the benefit obtained from the games are also connected to the achievement of the foreseen learning objective: students effectively learnt the knowledge included in the game related to the specific subject matter/field and they practiced thinking logically, to make different connections using the existing information and to take initiative.

Students' opinion about the GBL activity

Broadly, students' experience in the GBL activities is valued positively and the games seem to have a positive impact: they found the activity engaging and entertaining, they acquired the knowledge embedded in the games and they would like to repeat the experience. Indeed, they expressed that the activity is more pleasant and fun to them than "*hearing a teacher explaining something*" (quote from Spanish student interviewed), and that it is a new way to learn; they stated that they learn better with games, as they are more actively involved in the activity than in a lecture. They valued the learning processes as richer and easier with games and these quotes from students' interviews convey the idea perfectly: "*I have the impression that I am more attentive with the game*"; "*The information is easier to remember with the game*" (quotes from Spanish students interviewed); "*This type of activity will always be attractive and makes the most bored student to be interested*"; "*I didn't sit down and listen to the trainer as usually but I had fun also. Knowledge gained unwillingly was like a bonus*" (quotes from Romanian students interviewed).

For some students (in Italian pilot sites and in Romanian pilot sites) this activity was the first experience with an educational game, and they appreciated the novelty of this initiative.

As a general rule, students considered the implementation experience very positive, while the students from one pilot site mentioned that they found the games long and complicated when they were not interested in the topic.

Students sometimes pointed out negative aspects from the games (such as the music and the graphical elements) giving relevant feedback and suggestions for the improvement of both games and software functionalities.

4. TECHNICAL EVALUATION

This section aims to present the data collected by partners regarding the ProActive technical evaluation. Within this dimension, the aim was to answer, for each game editor used within the project (EUTOPIA and <e-Adventure>), the research questions below.

- T1. Do the game-editors support the creation of a creative educational game?
- T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)?

In order to answer both questions, two questionnaires were designed (one for each editor) and filled in by teachers and trainers after the GBL design process. In total, 38 questionnaires have been collected (15 for EUTOPIA and 23 for <e-Adventure>).

T1. Do the game-editors support the creation of a creative educational game?

a) <e-Adventure>

For evaluating <e-Adventure>, a quantitative approach was followed. Values of Likert items were aggregated to calculate summative scales, used to evaluate three different factors:

- S1: "The <e-Adventure> game Model". It is the results of adding Q1, Q2, Q3 and Q4 (4 questions).
- S2: "General perception of usefulness of <e-Adventure>". It is the results of summing up Q5-Q8 (4 questions).
- S3: "<e-Adventure> functionalities". Results from adding Q9 to Q13 (5 questions).

S1 and S3 are used as a means to evaluate research question 1, as specified in Deliverable D6.1 - Evaluation framework: *"T1. Do the game-editors support the creation of a creative GBL game?"*.

S2 and S3 are used as a means to evaluate research question 2, as specified in Deliverable D6.1 - Evaluation framework: *"T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)?"*.

For each item (Q1...Q13) an aggregated value is calculated by summing up all the responses to this question (each question could be given a value ranging from 1 - Strongly Disagree to 5 - Strongly agree). The subscale is calculated by adding all items in the subscale and dividing by the number of responses. The resulting value is the average of each participant's subscale, ranging from 1*NItems to 5*NItems. Questionnaires provided by all partners were considering, a total of 62 valid responses.

The next table provides the frequency of the questionnaire (number of people that rated each item for each value). These values are used to calculate aggregated values for each item, and then the subscale. The meaning of each column is explained as follows:

- 1. SD: Number of people that rated the item/question as "1-Strongly disagree".
- 2. D: Number of people that rated the item/question as "2-Disagree".
- 3. D/A: Number of people that rated the item/question as "3-Nor agree or disagree".
- 4. A: Number of people that rated the item/question as "4-Agree".
- 5. SA: Number of people that rated the item/question as "5-Strongly agree".
- 6. Total number of valid responses. $N = \sum SD, D, DA, A, SA$
- 7. Aggregated value for the item. TOTAL = SD*1+D*2+D/A*3+A*4+SA*5
- 8. Average for the item. AVG = TOTAL/N
- 9. Aggregated value of all average values for the items in the subscale. SubScale= $\sum_{i=1}^{i=NItems} AVG(i)$

- 10. Range for the subscale, determined by the maximum value it could get. MAX=NItems * 5.

Table 1. Left part of the table provides accumulative frequencies for answers to the <e-Adventure> questionnaire. Right part of the table calculates aggregated values for each subscale.

			SD[1]	D[2]	D/A[3]	A[4]	SA[5]	N[6]	TOTAL[7]	AVG[8]	SubScale[9]	MAX[10]
S1	Q1	I think the models of educational games that can be created with <e-Adventure> are easy to understand	1	2	10	28	21	62	252	4,06	16,25	20
	Q2	I think that it is possible to create educational games useful for different domains with <e-Adventure>	1	1	8	21	31	62	266	4,29		
	Q3	I think it is possible to create educational games that are fun with <e-Adventure>	1	1	11	19	30	62	262	4,23		
	Q4	I think it is possible to evaluate the students' progress easily with <e-Adventure>	2	6	18	18	16	60	220	3,67		
S2	Q5	The <e-Adventure> editor supports the easy creation of games	6	8	13	13	21	61	218	3,57	15,12	20
	Q6	It is easy to create a game with <e-Adventure> if the game storyboard is already available	2	3	22	12	22	61	232	3,80		
	Q7	With <e-Adventure> it is easy to modify existing games and adapt them to my own needs	3	8	15	14	19	59	215	3,64		
	Q8	I'm willing to use <e-Adventure> to create contents	2	3	8	21	26	60	246	4,10		
S3	Q9	The virtual world creation system (scenes, exits, etc.)	1	4	6	23	28	62	259	4,18	19,33	25
	Q10	The interactive elements (items, characters, active areas, etc.)	1	7	5	24	25	62	251	4,05		
	Q11	The narrative support system (flags, variables and conditions)	5	10	7	19	20	61	222	3,64		
	Q12	The tracking, assessment and reporting system	1	11	13	14	14	53	188	3,55		
	Q13	The integration with e-Learning environments (Moodle, LAMS, etc.)	1	4	9	17	16	47	184	3,91		

The results are very positive:

		Subscale	Results	Max possible
	T1	S1: "The <e-Adventure> game Model"	16,25	20
T2		S3: "<e-Adventure> functionalities"	19,33	25

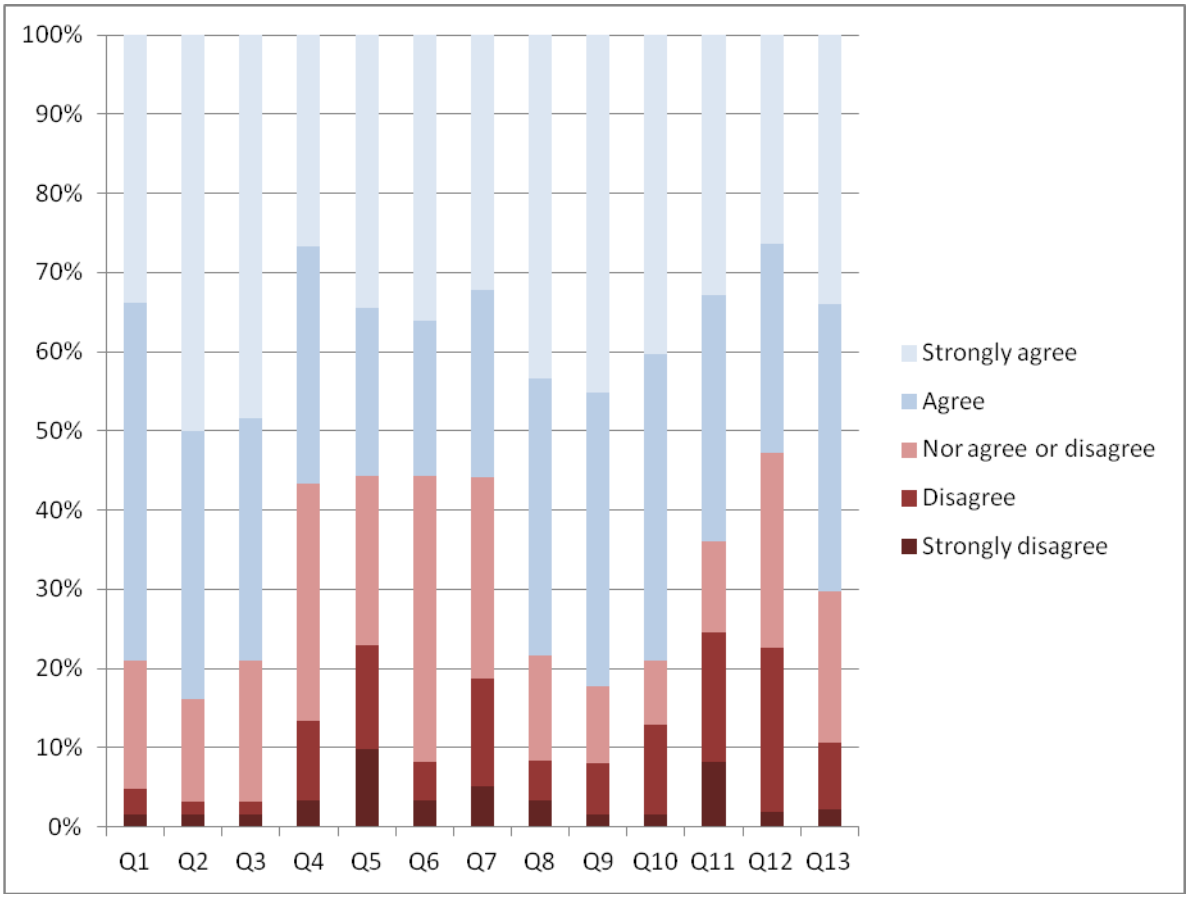
		S2: "General perception of usefulness of <e-Adventure>"	15,12	20

Being S1 16.25 out of 20 and S3 19.33 out of 25 we can presume that T1 is validated: <e-Adventure> supports the creation of a creative GBL game.

The same conclusion can be extracted for question T2: <e-Adventure> is considered to be user friendly.

Figure below also supports these conclusions, as it provides relative frequency diagrams for each item in the questionnaire. All questions were rated with values 4 or 5 in more than 50% of the cases, reaching in some cases even more than 80%. Negative values appear in less than 30% of the responses.

Figure 1. Accumulative frequency table for individual responses to the <e-Adventure> questionnaire. Blue colors mean "good responses" (values 4 and 5) - the brighter the better. Red colours mean "bad responses" (values 3, 4 and 5). The darker the worse.



b) EUTOPIA

Within the EUTOPIA questionnaire, four items aimed to assess how suitable the editor is considering the needs of its target users, i.e. the design of an educational game. Participants graded each item in a scale between 1 (total agreement) and 5 (strong disagreement).

In general, results suggest that the editor supports the creation of a creative educational game, as the overall average for this block among partners is 2.2 (see table 1). Spanish Comenius teachers, Italian

Erasmus teachers and Romanian Leonardo trainers are the most positive, as their averages for this block are below 2. In contrast, the answers from Italian Comenius teachers average of 4.

	UB	DPPSS	UNINA	UNIBUC	Total
Average	1.5	4	1.8	1.5	2.2

Table 2: Aggregated averages per partner and total for the block on games created

A closer look at the items in this block enables seeing which kind of games the editor allows one to create. As shown in table 2, participants from most countries strongly agreed that with EUTOPIA it is possible to create useful games for different subjects (averages below 1.75) that are fun (averages below 1.5). Remarkably, Italian Comenius teachers disagree with these items with means of 4 and 3.75 respectively.

Finally, opinions on the possibility to evaluate students' progress with this platform are rather diverse. Whereas Spanish and Italian Comenius teachers disagree with this point, Italian Erasmus teachers and Romanian trainers agree with averages of 2 and 1.25 respectively.

Item/partner	UB	DPPSS	UNINA	UNIBUC
The models of video games that you can create are easy to understand	1	3.75	2	1.5
You can create useful learning games for different subjects	1	4	1.5	1.75
It is possible to create games that are fun with EUTOPIA	1	3.75	1.3	1.5
It is possible to evaluate the progress of the students with EUTOPIA	3	4.5	2	1.25

Table 3: Averages for each item in the block on games created per partner

T2. How easy are the game editors to use from the viewpoint of the users (user-friendliness)?

<e-Adventure>

UCM section

This question was answered in the section above.

EUTOPIA

In general, the software has been considered easy to use and participants experienced positive emotions (*affection/happiness/optimism*) after using it. In a scale from 1 (totally agree) to 5 (strongly disagree), all Spanish Comenius teachers, Italian Erasmus teachers and Romanian trainers give scores below 2 to the item "Installation was simple and straightforward" (see table 3). Italian Comenius teachers, in contrast, graded this item on average 3.5. Participants from all relevant partners strongly agree with the item "The graphics were attractive and engaging". However, most suggestions for improving the software refer to the graphical appearance. As an example, a Spanish Comenius teacher suggests "*improving the readability of the texts emitted by the avatars*" and Italian Comenius teachers recommend *"improving the graphics"* and *"adding a wider range of characters/ environments / moods / gestures"*.

Item/partner	UB	DPPSS	UNINA	UNIBUC

The software was easy to use	1	3.75	1.3	1.25
The graphics were attractive and engaging	2	2	2.83	2
Functions were easy to execute	1	3.75	1.5	1.25
Installation was simple and straightforward	1	3.5	1.5	1

Table 4: Selection of items from the block aimed at assessing EUTOPIA software features

The interface of the game editor has been assessed through 8 items in the questionnaire. Participants graded each item in a scale between 1 (strong disagreement) and 5 (total agreement). Tutors from all partners generally found the interface intuitive, as they agree with that statement with averages above 4.17 (see table 4). More specifically, most teachers / trainers believe that commands are understandable (averages above 4) and easy to use (averages above 3.83). The stories, goals, and roles of the characters were clear, especially for Spanish and Italian Comenius teachers and Romanian Leonardo trainers, who agree with this item with averages higher than 4.25. Those who run game sessions believe that it was easy to send and receive messages, make gestures and expressions, whereas it was more difficult to control the avatars and interact with other avatars. As an example, Italian Comenius teachers include *"adding more movement of the avatars"* in their suggestions to improve the software.

Item/partner	UB	DPPSS	UNINA	UNIBUC
The interface was intuitive	5	4,25	4,17	4.5
The stories, goals, and roles of the characters were clear	5	4,25	3,83	4.75
I understood the commands	5	4,5	4	4.75
The commands were easy to use	5	4,5	3,83	4.5
It was easy to send messages	5	5	4	4
It was easy to read and interpret messages	4	5	4,5	4.25
It was easy to control the movement and gestures of the avatar	5	2	3,5	3.75
It was easy to communicate and interact with other avatars	3	3	3,5	4

Table 5: Averages per partner for items assessing EUTOPIA interface

The positive opinions on the aspects above contrast with participants' report on technical difficulties. In a scale of 1 (never) to 5 (very often), tutors encountered them with an average frequency of 2.56. As an example, Romanian trainers report that the editor has crashed with an average frequency of 3.25. Another technical issue affects the EUTOPIA server. A Spanish Comenius teacher and a Romanian trainer report bugs when launching the session with students, and Italian Comenius teachers state that they were *"ready to test the game but the platform was not working"*. Negative emotions (*Anger/aggression*, *Frustration/helplessness*) are usually related to technical problems/difficulties. However, some tutors report problems in areas where other tutors did not find any trouble. This suggests that further inquiry is needed to understand, for instance, whether the characteristics of the computers and networks used have influenced the performance of EUTOPIA.

4. IMPACT EVALUATION

This dimension aims to assess the effects of ProActive in the target communities, by answering the following research questions:

- IM1. Did project participants' knowledge, attitudes, beliefs, or behaviours change as a result of the implementation?
- IM2. Did the project meet the expectations of the participants?

To answer IM1 and IM2, participants' opinions in two different points in time were contrasted. The first set of data (or baseline) was collected in the preliminary focus groups (T3.2). New measurements were made after the co-design and training workshops through interviews. Then, the two data sets were compared. Results are presented below.

IM1. Did project participants' knowledge, attitudes, beliefs, or behaviours change as a result of the implementation?

Increase in teachers' knowledge

Evaluation shows that, generally, teachers' knowledge has increased as a result of the project implementation. In the focus groups carried out before the project implementation, it was found that teachers had a good level of practice in using ICT (PowerPoint Presentation, Google scholar, Moodle, Internet search, e-mails, forum and others) but little expertise in GBL. More specifically, very few people in the groups had developed their own videogame to support specific subjects.

In contrast, teachers interviewed at the end of the project declared having acquired knowledge on GBL design, development and implementation. As an example of the first, a Spanish Comenius teacher reports having learnt that it is important to find a balance between learning objectives and gaming objectives in order to create an adapted GBL scenario. Similarly, one Erasmus teacher from Spain reports having learnt how gaming aspects, like competition, collaboration, rewards, etc. can be used to increase students' motivation. Comenius teachers from Spain and Italy, as well as Leonardo trainers from Romania, affirmed having learnt how to use the game editors. In this sense, we can say that their knowledge on GBL development has increased.

Results also show that the implementation allowed participants from all countries to learn how to carry out GBL activities in the classroom. For instance, some Italian professional trainers have realized that splitting students into groups was an effective strategy to adopt in the daily teaching practice.

As an example of how participants can apply the knowledge acquired in ProActive in their practice, Comenius teachers from Spain have expressed their desire to use what they have learnt in the future. Similarly, trainers from the UK show their will to keep using GBL in other projects within the institutions.

Change of attitude towards the use of GBL

For instance, Comenius teachers from Italy agreed that the game succeeds in keeping students involved and satisfied, and trainers from the UK appreciate that GBL is a way to engage students in learning. In some cases, the implementation of GBL scenarios allowed teachers to see the strengths of some aspects of it. Participants' beliefs about GBL have also changed as a result of the ProActive implementation. Results have highlighted that teachers now consider videogames as effective educational tools feasible to

implement in the classroom. Through the focus groups, we learnt that teachers from all participating countries wanted to raise students' interest, but were worried about how to use technologies with a high number of students. This contrasts with the opinion of Spanish Comenius teachers' towards the end of the project. After having carried out a GBL session with more than 25 students, one teacher declared that, thanks to ProActive, he had been able to experience "*a possible way to use videogames in the classroom*". Likewise, Romanian professional trainers have become interested in creating new learning environments in the classes.

Another concern at the start of the project was teacher and trainers' fear of not achieving lesson objectives through GBL. This differs from the statement by Italian Comenius teachers, who state that GBL is not a waste of time. Similarly, trainers from most sites in the UK realize that GBL can be a way to apply knowledge to practical situations. Further, trainers from one pilot site in the UK mentioned that GBL is more appropriate than the tools they were using before to work on the same skills.

Some trainers report that participating in ProActive has made them reconsider their beliefs about how students learn. Whereas a Spanish teacher declares having "*rethought the learning process of his students*", a trainer from Romania has realized that "*students are more than information receivers*".

Increase in teachers' flexibility

Generally, participating in ProActive seems to have affected teachers and trainers' behaviours and flexibility in teaching. Participants pointed out various ways in which they have become more flexible. For some, their involvement in the GBL design process was considered as a change from their usual teaching practices. More specifically, a Spanish Erasmus teacher stated that being exposed to innovation and pioneer educational technologies made him more flexible since he now has more ideas for planning his teaching activities. Likewise, one Italian trainer believes that her flexibility has increased as a consequence of the experience because it has made her consider new strategies to reach her students. Italian Comenius teachers stressed that learning to use new tools like the game editors has increased their technical abilities and thus it has enhanced their flexibility. From a different perspective, trainers from the UK think that GBL makes teaching and learning more flexible when used online.

To sum up, the strongest impact of ProActive has been in participants' knowledge and beliefs. The comparison between the focus groups and the interviews shows that teachers and trainers of all countries have both increased their skills and changed their opinions towards GBL design, development and implementation. Participants' attitudes have also changed but are dependent on teachers and trainers' particular understanding of flexibility in teaching.

Opportunities for collaboration among teachers

As a positive outcome of the project, teachers have mentioned the opportunity to learn from peers". In a Spanish Comenius teacher's words: "*the project generated, in my school, a sharing climate among teachers, a synergy of team work, as well as the elaboration of a viable project*". Teachers highly valued the fact to get to know other teachers who share the same motivations and methodologies: "*I felt recognized*". Almost all interviewed Spanish teachers highlighted teamwork as a skill they practiced during the project. Furthermore, in a Romanian trainer's words: it is necessary to "*encourage cooperation between trainers, thus creating a community of practice*".

Interviews with Spanish teachers and Romanian trainers confirmed the outcome of the focus groups that the game editors can enhance individual but also collaborative learning. Almost all interviewed Spanish

teachers highlighted teamwork as a skill they practiced during the project, and a Romanian trainer stated that it is necessary to "*encourage cooperation between trainers, thus creating a community of practice*".

IM2. Did the project meet the expectations of the participants?

Through interviews, teachers have recalled the expectations they had at the beginning of ProActive and reflected on whether they have been accomplished.

Learning about GBL as a new teaching methodology

One expectation has to do with curiosity towards concepts behind ProActive and discovering new teaching methodologies, i.e. GBL. This has been accomplished as reported by trainers from the UK, who feel that they now understand much more about game-based learning than they did before.

Some Spanish teachers and Romanian trainers already had some knowledge on GBL and thus their expectation was to increase it. These participants said that their hopes had been satisfied by being able to participate in a game design and development process. Similarly, trainers from the UK fulfilled their desire to learn how to create educational games. They are more confident now in two major aspects of game development: their capacity to design educational games that incorporate the main features of GBL and also the development of graphical approaches to be used in games. Trainers from one pilot site from the UK obtained more than they had hoped. In short, they had not expected that they could design and help implement a game of the size that "House of Cain" (name of a GBL scenario created by the UK target group) ended up being.

Learning how to use game editors

Participants from Italy and Romania wanted to learn how to use the game editors. This has been achieved to a different extent depending on the country and the game editor. Trainers from Italy report being satisfied with the training received on this regard, whereas Romanian trainers observe that, although they are satisfied, they still need more time to explore both game editors in depth. The main negatives from the experience refer to limitations for the design and implementation of GBL coming from the organization of the institution. More specifically, Spanish Comenius teachers mentioned as a negative that the game editor used implies a high amount of time and work, and that some tools could be improved.

Creating useful learning resources

Educators are generally happy to have participated in ProActive and satisfied with the GBL scenarios and games they have created and implemented. Finally, some trainers from the UK had hoped to complete a greater number of scenarios. This may be understood considering that the software emerged as too difficult for them to use without assistance. Comenius and Erasmus teachers from Spain, as well as trainers from the UK point out the lack of time to develop the games.

5. SYNTHESIS ANS CONCLUSIONS

On the basis of results presented in the last section, the present synthesis aims to make evident the main findings related to the ProActive evaluation.

5.1. The pedagogical framework

The creative process of GBL design

Different factors appeared as critical during the GBL design process. First, motivation appeared as a critical factor to keep teachers engaged in the game design process. Motivation was both intrinsic (teachers were personally interested in games *per-se*, and enjoyed designing their own) and extrinsic (teachers were interested in the outcome of the process: a new teaching resource that is useful and engaging for their students). Second, collaboration positively impacted on the game design process. Indeed, sharing opinions among teachers and with students enhanced the processes of generation and evaluation of ideas. Furthermore, game editors' affordances acted as mediators by shaping the game dynamics and profiling its mechanisms, as well as facilitating the production of ideas. Finally, external resources, such as time and materials available, influenced the design process, as teachers often adapted their initial ideas accordingly. The GBL design process was considered as pleasant and challenging, and teachers are usually satisfied with the outcome, which is mostly considered as innovative and adapted their educational goals.

The five learning metaphors

The five learning metaphors adopted in ProActive (Acquisition, Imitation, Experimentation, Participation, and Discovery) appeared to foster educators' reflection on possible new ways of teaching during the game-design process. Most of the teachers considered metaphors as a starting point for design, and as criteria for evaluating their games.

Metaphors that were most used in GBL scenarios were experimentation (games provide safe environments where errors can be experienced, and players can put their knowledge and abilities into practice with a high level of autonomy) and acquisition (all games include a set of content to be transmitted). Furthermore, GBL scenarios developed with EUTOPIA editor strongly rely on the participation metaphor, while point and click games developed with <e-Adventure> involve more importantly discovery.

The GBL scenarios created

The GBL scenarios developed by participants were positively valued by the experts engaged by partners. They present several success factors connected with gaming, learning and technical aspects, which make them good learning tools that can also be used in different educational contexts.

As a general rule, the games are considered well-framed: they present specific and defined rules to be followed and goals to be attained by the players, they are adapted to the target group (considering age, course of study, previous knowledge and skills), they fit with the educational objectives defined by the designers and they are included in the wider scenarios that embed learning activities before (such as lessons for acquiring the knowledge needed to play the game) and after the game (such as evaluation session, discussion and reflection about the GBL activity).

Considering the structure and the different elements of the game, experts evaluated the games as tools that can immerse the players and enhance their motivation to employ themselves in the learning activity that constitutes a relevant factor for achieving the educational objectives.

The Implementation of GBL scenarios in teaching settings

From teachers' points of view

Despite the different kinds of challenges faced during the GBL design process and the implementation of the scenarios developed (connected with the use of the game editors, the lack of time available and institutional constraints), teachers and trainers involved in the ProActive project who attended the implementation phase considered the experience in a positive manner: they highly valued the fact of having learnt how to use digital games as learning tools, the chance given by the project to reflect on their teaching practices and improve them through the employment of the GBL activities. In addition, participants mentioned the opportunity to share experiences and collaborate with other teachers, researchers and students as positive aspect of their involvement in the project.

From students' point of view

Students' involvement in the implementation of the GBL scenario developed by participants from the different pilot sites had a positive impact and the games tested are considered engaging, useful and entertaining. Students were effectively involved in the GBL activities; they acquired the knowledge included in the games and attained the learning objectives set by the designers. Most of them recognized the usefulness and the benefits of the games and they asked to repeat the experience again and include the use of games in the course of study, because for some of them it was the first experience with the use of digital games as educational activity.

5.2. Technical evaluation

<e-Adventure>

The <e-Adventure> game editor was positively valued by teachers who used it to create their learning games. The editor is considered as a useful tool to easily create fun educational games useful for different domains. Furthermore, the editor's functionalities (i.e. the virtual world creation system, the interactive elements, the narrative support system, the tracking, assessment and reporting system and the integration with e-Learning environments) were positively evaluated by teachers. The editor was considered easy to use from users' point of view.

EUTOPIA

Overall, teachers and trainers from all partners think that EUTOPIA is intuitive, easy to use with the help of the manual and that it has a smooth installation procedure. Importantly, they also believe that the editor allows creating educational games that are fun and useful, i.e. adapted to their teaching needs. However, the test with these users has also revealed technical issues when trying to launch the game session at educational institutions from various partners. This issue should be further researched to achieve the maximum satisfaction level with the editor and therefore a wider use of GBL as a teaching methodology.

5.3. The project impact

Evaluation performed shows that the biggest impact of ProActive has been in participants' knowledge and beliefs. Teachers and trainers from all countries and educational levels have both increased their skills and changed their opinions towards GBL design, development and implementation. In other words, having

participated in ProActive seems to have succeeded in introducing educators to GBL as a teaching methodology, as they can now explain what they have learnt and outline what they would do differently if they were to do it again. The ProActive approach to GBL design has challenged participants' skills; they appreciate having learnt how to use the game editors and having collaborated with their colleagues. To sum up, as one Comenius teacher puts it, ProActive enabled him to participate in "*a possible way to use videogames in the classroom*".

APPENDIX 1: THE GBL DESIGN CREATIVE PROCESS QUESTIONNAIRE

The questionnaire aims to answer to the following research question: *What are the characteristics of the GBL design creative process?*

It is based on different models on the creative process (especially Wallas, 1926; Amabile, 1983; Shneiderman, 2000). These models involve different phases. However, the goal of this tool is not to see if participants pass by each phase. Rather, it wants to analyse participants' mindsets / activities through these phases, to see to what extent they were in a creative state along the process.

Amabile's componential model of creativity

The model consists of the following stages:

- *The Problem or Task Presentation stage*: task motivation has an important influence at this stage. If a person has a high level of intrinsic interest in the task, this interest will often be sufficient to begin the creative process. In general, an externally posed problem is less likely to be intrinsically interesting than an internally generated one.
- *The Preparation stage* is about building up and/or reactivating a store of relevant information and response algorithms. If the person's domain relevant skills are lacking from the outset, then this stage could potentially be quite long while learning is taking place. However if their domain relevant skills are already high enough to explore the range of possibilities, then reactivation of their store of relevant information may occur instantaneously.
- *The Response Generation stage* is about searching memory and immediate environment to generate response possibility. At this stage, the individual generates response possibilities by searching through available pathways and exploring features of the environment that are relevant to the task at hand. This stage can be directly compared to the transformation of conceptual spaces as in both cases the individual is searching pathways for ideas relevant to the task. Both creativity relevant skills and task motivation play an important role at this stage according to Amabile. Creativity relevant skills determine their flexibility in exploring cognitive pathways, the attention they give to particular aspects of the task, and the extent to which she follows a particular pathway in pursuit of a product. Finally, if task motivation is intrinsic rather than extrinsic, it can add a willingness to take risks with the particular task and to notice aspects of the task that might not be obviously relevant to creating the final product.
- *The Response Validation stage* is about testing the response possibility against factual knowledge and other criteria. Domain relevant skills figure prominently in this stage. It is about the validation of the possibility that has been chosen on a particular trial. Using their knowledge of the domain, the individual tests the response possibility for correctness or appropriateness, given their particular set of goals. Thus it is at this stage that determines whether the product or response will be appropriate, useful, correct, or valuable, together with novelty, is essential for the product to be considered creative.
- *The Outcome stage* represents the decision making that must be carried out on the basis of the test performed in the last stage. If the individual feels that they have attained their goal, the process terminates. If they see complete failure and no reasonable response possibility has been generated, the process is terminated. If however they sense that some progress towards the goal has been made, the process returns to the first stage, where the problem is once again posed. In this case, information gained from the trial is added to the person's domain relevant skills. It is essential that if the person is starting again from the first stage, their intrinsic motivation is high otherwise they may give up on the task.

Wallas model (1926): Preparation, Incubation, Illumination, and Verification.

- *Preparation* is the initial stage where a person becomes familiar with the content area. It is only once the person has an understanding of the content that they are able to use the information in an attempt to discover a solution to the problem.
- *Incubation* is the stage whereby the person churns through the information that they have prepared. This stage goes on until the person has found a solution.
- Illumination is where the creative insight occurs. The person identifies the idea as a solution to the problem.
- *Verification* is the stage in which the person tests the solution to ensure it is an appropriate solution to the problem.

Shneiderman (2000) proposes a four stage model of the creative process:

- *The Collect stage* is the point in which the person is learning from previous works stored in libraries, the Web, and other sources.
- *The Create stage* is about exploring, composing and evaluating possible solutions.
- *The Donate stage* is where the person disseminates the results and contributes them to libraries, the Web, and other sources.
- *The Relate stage* is a stage which can occur during the Collect, Create, and Donate stage and refers to the consultation with peers and mentors at early, middle, and late stages.

The three process models were analysed in detail and the various phases were compared and then grouped. It was then possible to create four major groupings, which arguably represent the major phases of a creative process.

<table>
<tr><th>Models</th><th colspan="2">Analysis phase</th><th colspan="2">Generation phase</th><th>Evaluation phase</th><th>Communication / implementation phase</th></tr>
<tr><td>Wallas (1926)</td><td colspan="2">Preparation</td><td>Incubation</td><td>Illumination</td><td>Verification</td><td>X</td></tr>
<tr><td>Amabile (1983)</td><td>Problem or task presentation</td><td>Preparation</td><td colspan="2">Response generation</td><td>Response validation</td><td>Outcome</td></tr>
<tr><td rowspan="2">Shneiderman (2000)</td><td colspan="3">Collect</td><td colspan="2">Create</td><td rowspan="2">Donate</td></tr>
<tr><td colspan="5">Relate</td></tr>
</table>

Table 1: Comparison of creative process models

INSTRUMENT

Instructions: For each item, please chose between the different options and provide a short comment to explain your choice. It is possible to select the two options.

	OPTION 1	OPTION 2	COMMENTS
1	I chose to create my own GBL scenario because I needed to develop new resources for my class that are useful / motivating for the students' learning	I chose to create my own GBL scenario because I am personally interested in games	
2	I received sufficient information / training to be able to start creating my game	I needed more information / training to be able to start creating my game	
3	I found it useful to consult examples of existing educational games for inspiration	I didn't find it very useful to look at examples of existing educational games	
4	At the beginning, I generated the idea for my game considering my specific educational goals (concepts to be taught / subject / skills /profile of my students)	At the beginning, I had many ideas (maybe some of them irrelevant to my educational goals), and only later I selected which ones to implement	
5	Before starting to develop my game, I took into account the resources I had available: the amount of time, the material and the functionalities of the game editor	I preferred to leave my ideas flow naturally and only later to look for the available resources	
6	Since the beginning, I followed one specific idea because it was the only one appropriate to my goals and resources	I didn't stick with the first idea I got, I preferred to play around first, asking myself "what if…?"	
7	I didn't mind if my idea was a little difficult to develop	I preferred to choose an idea which was simple to develop	
8	I thought about scenarios that are similar to the ones I usually plan in my teaching practices	I enjoyed trying unusual or unconventional ideas for my game	
9	At the beginning, I had no idea / expectation of what my game would look like	Since early stages, I could imagine what my game will look like and how I would teach my students with it	
10	I found it useful to draw a storyboard / conceptual map	I preferred to directly work my ideas on the game editor	
11	I enjoyed designing my game	I found the process rather boring and / or frustrating	
12	Sometimes ideas and solutions popped into my mind	I didn't experience any sudden flash of insight or enlightenment during the development process	
13	New ideas for my GBL scenario sometimes	When I took a break, I always completely forgot	

	came to mind when I was away from it	about the GBL design	
14	The opinion of others helped me in the GBL design process	I preferred to rely on my own judgment and I did well by myself	
15	I often reviewed my GBL scenario against the success factors for GBL	I didn't consider the success factors for GBL	
16	I reviewed my GBL scenario regarding my specific learning goals and teaching context	I didn't go through test and improvement cycle(s) while designing my game	
17	I think that my game is innovative and useful for my teaching context	I think that my game is not really innovative and / or useful	
18	I think that my game can be applied to wider audiences and that it may be useful in wider educational contexts	I prefer to keep my game for me and my students	
19	After this experience, I would like to design a new GBL scenario	I would not repeat this experience	
20	I feel that I have reached my goal, and I am happy with the game I made	I did not reach my goal, and I concluded it was not possible to reach it	I did not reach my goal, but I progressed and I would like to finish at some point in time

APPENDIX 2: METAPHORS' TABLE INSTRUMENT

	ACQUISITION	PARTICIPATION	DISCOVERY	IMITATION	EXPERIMENTATION
Learning objectives	To acquire notions and contents	To be part of community of practice	To recognize / create new relations between objects/concepts	To gain expertise	To gain expertise / fluency
Role of the teacher	To explain, question and evaluate through the game	To facilitate the interaction between peers in the game	To create a game environment full of undiscovered meaning	To show / create a model for the learner's actions	To give a task and let the learner experience it within the game
Role of the learner	To pass levels, advance in the game or reach the highest score by using the acquired knowledge or by answering the game questions	To contribute by interacting to the development of the task	To discover / construct meaning within the game environment	To make a perfect or improved copy of the model to go on in the game	To practice and experiment the task within the game
Game representation	book, learning material/content to be learned	Virtual environment to construct and share with others	World with its own rules / meanings to be discovered /created	Location for observation and repetition of other's experience	Safe environment where errors can be experienced
Learning strategy	View of the contents, possible multiple review of the data	Interdependence, sharing of meaning	Manipulation, exploration, deep understanding	Repetition of models and reward	Trial and error
Dominant gaming aspects	Rewarding system/short feedback cycle; clear goals, possibility for automatic and randomized Q&A	Competition / collaboration; adaptability / flexibility, goals common to the community	Rules, engagement / emersion, flexibility, manipulability, interactivity	Reward system, short feedback cycle, replayability	Challenge and replayability, feedback (automatic or manual with cycle length depending of the activity), positive / negative rewards
What promotes learning	The trying to reach a reward or an high score	The feeling of being part of a community of practice	The experience of a feeling of mastery over the game world, curiosity, intrinsic motivation to experiment	The credibility of the model, student's respect towards him/her as expert and consideration for the role-model	The experience of the consequences of the action taken
Nature of the task	Closed	Open	open	Closed	closed

APPENDIX 3: THE GBL QUESTIONNAIRE

GAMING ASPECTS		1	2	3	4	5	COMMENTS
1.	**Does the game present clear goals and objectives that the player will have to accomplish in order to complete the game?** Comments: The game should include final objectives, but might also have intermediate / short-term goals in order to facilitate the player in reaching the final ones.						
2.	**Are the game's rules clear and consistent throughout the whole game?** Comments: To achieve the goals proposed the player has to operate according to the rules of the game, which define what can and cannot be done in the game universe. The game's rules should be clear and consistent along the whole game.						
3.	**Is the challenge in the game appropriate?** Comments: The player should be continuously challenged. Players should strive for continuous improvement. This can be achieved by increasing level of difficulty. However, the level of challenge should not surpass the level of possibilities, in order to not discourage the player.						
4.	**Does the game offer sufficient feedback / rewards?** Comments: Players should be able to perceive the impact and consequences that their actions have in the game world, in order to be informed on how they are performing, check their progress continuously, and enable them to eventually adjust their actions. Positive feedbacks are often associated with rewards, which helps players in the achievement of the objectives and acts as a mechanism to increase engagement and immersion.						
5.	**Does the game engage / immerge the player?** Comments: The game should engage the player, which can be achieved through different techniques: interesting plot / story, appealing environment / virtual world, contextualization, challenging goals, etc. Immersion is good way to stimulate the player's engagement into the game.						
6.	**Does the game experience vary from one player to another and between different game runs?** Comments: Adaptability is often achieved by varying the challenge depending on the player's skills and knowledge. As an example, the game might offer several levels of access based on user skills (e.g. beginner, advanced, professional). In simulations, it would be crucial not to predefine the paths for reaching the correct solution.						
7.	**Is the game replayable?** Comments: The player should be able to play the game more than once. Replayability is a result of a good design and an appropriate balance of characteristics such as adaptability (presenting different challenges each time) and engagement.						
8.	**Does the game scenario promote "good" competition?** Comments: Competition could happen between peers (in multiplayers games) or against the self through game scoring or ranking systems. Collaboration could be between peers playing the same game, but could also happen outside the game with players discussing the game's strategies / solutions either online or face to face.						

9.	**Does the game provide entertainment to the user?** Comments: The game should provide entertainment to the user, which can be achieved in very different manners. For example, it can be achieved directly by including humorous aspects in the plot, but also by combining several of the aspects listed above.						
LEARNING ASPECTS		**1**	**2**	**3**	**4**	**5**	**COMMENTS**
10.	**How well does the game fit with your educational objectives?** Comments: Clear educational objectives should be predefined. The educational affordances of the game should allow for the students to achieve these objectives.						
11.	**Is the game adapted / comprehensible to the specific students' profile?** Comments: The students' age / skills / knowledge level / socio-cultural profile, should be taken into account when designing the learning scenario and the game.						
12.	**Does the scenario provide (internally or as links) relevant learning resources necessary for achieving the educational objectives?**						
13.	**Does the scenario consider a specific evaluation methodology?** Comments: The learning scenario should consider a specific evaluation methodology. In Game-Based Learning scenario, this evaluation method might drastically differ for traditional approaches, such as tests or exams. In Game-Based Learning, the rewarding system could be adapted to evaluate the players' performance within the game. This approach is much less invasive, in the sense that students might not be aware of the pedagogical evaluation process, but only aiming at reach the game objectives. This approach is especially suitable for reaching less performing students. Furthermore, Game-Based Learning allows for implementing immediate feedback systems, which might help learners to check their progress continuously.						
14.	**Is the game embedded in a comprehensive learning scenario?** Comments: The game might be embedded in a predefined wider learning scenario which might include other learning activities (e.g. further discussion / reflection session in the classroom, group activities, reports, presentations, homeworks, etc.).						
15.	**Does the game allow for a progressive acquisition of knowledge?** Comments: at any point of the GBL scenario, the level of challenge of the learning experience should be high enough to keep students engaged and motivated but without surpassing their abilities so they do not become frustrated.						
16.	**Does the game provide a personalized learning process according the students' profile?** Comments: The game might provide a personalized learning process according the students' profile. This might include the student's age, previous knowledge speed of knowledge acquisition, skills, etc. As an example, the game might offer several levels of access (beginner, advanced, professional).						
17.	**Does the game provide a context in which the level of autonomy of the learner is high?** Comments: This factor should be predefined and depend on the educational context. GBL environments usually promote the autonomy of learners, who are free to explore the game without the requirement of an intervention by an instructor.						
18.	**Does the GBL scenario enhance students' motivation?** Comments: Students' motivation to employ themselves in the learning activity constitutes a crucial factor for achieving the educational objectives. The motivation would depend on a good						

	combination of the above listed factors and on a balance between the educational and gaming aspects.						
TECHNICAL ASPECTS		**1**	**2**	**3**	**4**	**5**	**COMMENTS**
19.	**Is the game user friendly and easy to use so that the player can concentrate on the objectives set within the game without frustration?** Comments: The game functionalities should be easy to learn. There should be clarity in the interactions, and the navigation should not present any errors. Moreover, the game might include, if necessary, a user guide or any additional help in order to assist the player.						
20.	**How appropriate are the graphics for the target group?** Comments: The visual aspects of the game should be attractive in order to engage users. Moreover, certain scenarios might require a high level of realism. Such attractiveness could be reached whether by using high quality graphical elements, or by employing familiar objects.						
21.	**Can the game potentially be used in different contexts without the need of complex and costly modifications to suit particular groups?** Comments: This characteristic makes games attractive as learning tools as it helps to reduce costs by increasing the amortization of the initial investment.						

APPENDIX 4: EUTOPIA PARTICIPANTS' SELF-ASSESSMENT TOOL

AGE _____

PROFESSION _____

Technical issues

1. Indicate on a scale from 1 [never] to 5 [very often] the frequency with which the following technical issues occurred.

- Blocks of the program [1] [2] [3] [4] [5]

(Please describe _____)

- Excessive delays in the program [1] [2] [3] [4] [5]
- Other technical issues [1] [2] [3] [4] [5]

(Please describe _____)

Software

2. I used the following software functions during the course

- Group simulations [YES] [NO]
- Session recording [YES] [NO]
- Playback of recorded sessions [YES] [NO]

3. Having used the software throughout the course, I think:

- The software was easy to use [1] [2] [3] [4] [5]
- The graphics were attractive and engaging [1] [2] [3] [4] [5]
- Functions were easy to execute [1] [2] [3] [4] [5]
- Installation was simple and straightforward [1] [2] [3] [4] [5]

Games created

4. Having created a game with Eutopia, I think:

- The models of video games that you can create are easy to understand [1] [2] [3] [4] [5]
- You can create useful learning games for different subjects [1] [2] [3] [4] [5]
- It is possible to create games that are fun with Eutopia [1] [2] [3] [4] [5]
- It is possible to evaluate the progress of the students with Eutopia [1] [2] [3] [4] [5]

Interface

5. Indicate on a scale from 1 [not at all] to 5 [very much] your agreement with the following statements.

- The interface was intuitive [1] [2] [3] [4] [5]
- The stories, goals, and roles of the characters were clear [1] [2] [3] [4] [5]
- I understood the commands [1] [2] [3] [4] [5]
- The commands were easy to use [1] [2] [3] [4] [5]
- It was easy to send messages [1] [2] [3] [4] [5]
- It was easy to read and interpret messages [1] [2] [3] [4] [5]
- It was easy to control the movement and gestures of the avatar [1] [2] [3] [4] [5]
- It was easy to communicate and interact with other avatars [1] [2] [3] [4] [5]

Final considerations

5. Indicate on a scale from 1 [not at all] to 5 [very much] your agreement with the following statements.

- I would like to repeat this experience [1] [2] [3] [4] [5]
- I would like to use the same methodology for other training activities [1] [2] [3] [4] [5]

6. Indicate on a scale from 1 [not at all] to 5 [very strongly] the extent to which you experienced the following emotions during the group simulations:

- Affection [1] [2] [3] [4] [5]
- Anger/aggression [1] [2] [3] [4] [5]
- Frustration/helplessness [1] [2] [3] [4] [5]
- Happiness/optimism [1] [2] [3] [4] [5]

7. Why? _____

_____

8. Did you consider the presence of your tutor useful throughout the successive simulation phases?
_____

_____

9. Did you find the manual/vademecum a useful tool? _____

10. Suggestions for improving the software

_____

_____

11. Any further comments you would like to add

_____
_____

APPENDIX 5: <E-ADVENTURE> EVALUATION FORM

Please rate from 1 to 10 the following statements, taking into account that 1 is the lowest score (e.g. I strongly disagree) and 10 is the highest score (e.g. I strongly agree)

1. What do you think about the games you can create with <e-Adventure>

The models of video games that you can create with <e-Adventure> are easy to understand	1 2 3 4 5
I think you can create useful learning games for different subjects	1 2 3 4 5
I think it is possible to create games that are fun with <e-Adventure>	1 2 3 4 5
I think it is possible to evaluate the progress of the students with <e-Adventure>	1 2 3 4 5

2. What do you think about the <e-Adventure> authoring tool

The game editor allows the creation of games easily with no technical background	1 2 3 4 5
If a story board is available it is easy to implement a game using the editor	1 2 3 4 5
With <e-Adventure> it is easy to adapt or modify an existing game	1 2 3 4 5
I'm willing to use <e-Adventure> to create my own game	1 2 3 4 5

3. Considerations about the features of <e-Adventure>

Please rate from 1 (the most negative) to 5 (the most positive) these features of the <e-Adventure> platform

The system that allows the creation of the *virtual world* (i.e. the scenes)	1 2 3 4 5
The *interactive elements* (items, characters, active areas, etc.)	1 2 3 4 5
The *flags and variables* system that allows the implementation of the narrative structure of the games	1 2 3 4 5
The *assessment* and report generation system	1 2 3 4 5
The *integration* with e-Learning Systems (Moodle, LAMS, etc.)	1 2 3 4 5

4. Considerations about the materials provided

Please rate from 1 (the most negative) to 5 (the most positive) the perceived usefulness of the next materials provided in the creation of Game-Based Learning scenarios with <e-Adventure>

The teachers' handbook about GBL 1 2 3 4 5

The <e-Adventure> user's manual 1 2 3 4 5

The built-in help system in <e-Adventure> 1 2 3 4 5

General comments/suggestions about the written materials provided _____

_____

_____

5. Final remarks

Suggestions for improving the <e-Adventure> software

_____

_____

Any further comments you would like to add

_____

_____

APPENDIX 6: TEACHER INTERVIEW GUIDE

Evaluation of the pedagogical framework (P2):

1- What was the role of the learning metaphors during the design / development of your GBL scenario?

Evaluation of the pedagogical framework (P4):

2- What challenges did you face during the implementation of the scenario you have developed in your educational context? How did you solve the problems that arose?

3- What positive experiences would you point out from the implementation of the scenario you have developed in your educational context? Could you explain why?

4- Can you summarize the lessons learnt from this teaching experience?

5- Now that you have implemented your own scenario, what would you do differently next time? Why?

6- Would you say that the GBL session was effective in achieving its learning objectives?

7- How do you think students feel about this GBL activity?

Evaluation of the impact of the project (IM1):

8- Has the project made you reconsider any of your beliefs about teaching and learning?

9- What did you learn in this project that can be useful for your practice?

10- Did ProActive enhance your flexibility in teaching? How?

Evaluation of the impact of the project (IM2):

11- What were your needs and expectations at the beginning of the project? Have those needs and expectations been satisfied?

12- What were your positive and negative experiences during ProActive project?

APPENDIX 7: OBSERVATION GRID

Time (every time the subject changes)	Subject	Actor involved	Short summary of the discussion	Relevant sentence (to quote)	Comments/observations of the assistant moderator (i.e.: non verbal dealing, participation level, competence level, empasis, etc.)
i.e.: 10:28	i.e.: Eutopia editor	i.e.: Trainer			
	i.e.: Participation metaphor	i.e.: Participant 1			

APPENDIX 8: GUIDE TO INTERVIEWS TO STUDENTS

Question 1: Did you enjoy the GBL experience?

Question 2: Would you like to participate in a GBL session again?

Question 3: Did you feel you learnt anything?

Question 4: In your opinion, why was this session different from the rest of lessons you usually have?