

Educators knowledge, Attitudes and Skills.

A Pedagogical Framework for Facilitating Educational Escape
Room Activities

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UNLOCK

Creativity through game-based learning at
higher education

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PROJECT PARTNERS



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EXECUTIVE SUMMARY

The following report was prepared as part of the Erasmus+ UNLOCK project, to understand the new role of educators when facilitating game-based learning (GBL) activities, namely educational escape rooms (EERs) in higher education institutions (HEIs) and examining the role of educators in those activities. The document presents a review of the existing body of academic literature on educators' competencies for using EERs in the various consortium countries (Denmark, Germany, Netherlands, Lithuania, Portugal, Spain) and an empirical survey with practitioners from the educational and commercial sector on the difficulties, challenges, knowledge, competences, and attitudes towards EER practice.

The literature review provides an overview of the status-quo regarding the competencies that need to be developed by the educators to use EERs and based on this review, interviews, and questionnaires we propose a pedagogical framework and different profiles of educators using EER. This result will be important to help design the next steps followed by the UNLOCK project.

DEFINITIONS

Term	Description
Conceptual Framework	A conceptual framework provides a resource to define and illustrate the relevant variables of the study and map out how these may relate to each other.
Educational games	These are games that have formal objectives, designed to help people learn about specific subjects, expand concepts, reinforce development, or help them learn a skill while playing.
Educational escape room	Educational Escape rooms are games designed for teaching consisting of challenges played in groups where the participants are asked to solve a series of clues and puzzles in a limited amount of time to "escape the room".
Game-Based Learning	A type of learning game with defined learning outcomes. Can include different types of games such as puzzles, board games, digital games, and others.
Gamification	Using game elements, such as incentive systems, to motivate players to engage in a task they would not otherwise find attractive.
Innovation	Implementation of ideas and practice of creativity that result in the introduction of new teaching methodologies and process improvement.
Institutional Support	Set of policies, practices, physical facilities, software, or processes, made available by the organization, which enable successful learning.
Professional Development	The set of tools, resources, and training sessions for educators to improve their teaching quality and effectiveness.
Teacher Competences	The combination of knowledge, skills, attitudes, values, and personal characteristics, enabling the teacher to act professionally and appropriately in a situation.

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1. INTRODUCTION

In a fast-evolving educational scenario, where new challenges and skills are put at stake, the knowledge and mastery of new pedagogical strategies are critical to the quality of the student's formation. Being GBL, one methodology that has been regarded with an increased potential to motivate students and to promote the development of important skills, it is essential to identify educators' skills and possible training needs concerning GBL, to foster its usage. Once identified it is necessary to develop and implement teacher training programs to spread and facilitate the use of GBL (Kamışlı, 2019). For these skills to be developed different variables are important, such as environment, resources, professional and personal elements. In determining the success of GBL activities, educators must bring together not only knowledge about games, but also pedagogy and content knowledge (Nousiainen et al., 2018).

Nowadays it is being asked for teachers to adapt new technologies and teaching methodologies, and thus continually develop their skills and reformulate their identity as educators. According to Foster and Shah (2020), this new adaptation is a creative direction for self-development.

GBL practices are considered new teaching methodologies, which challenge educators and make them think about better practices in adapting the use of games with teaching content (Romero & Kalmpourtzis, 2020). It also raises their professional skills and motivation as an educator, while this new approach also brings motivation and engagement in students to learn content (Shah & Foster, 2015).

In this environment of innovation and new active teaching methodologies, escape rooms are emerging in the educational scenario. EERs are an active teaching methodology, but they are not a classic game in many aspects. Its different peculiarities such as game narrative, time limit, stress conditions, and quick thinking should be emphasized and analyzed separately from traditional GBLs (Tercanlı et al., 2021).

So, initially from a literature review on educators' competences for GBL, and then with the focus on studies on EER, we intend to propose the main competences needed for an educator to feel confident in using EERs. By the similarity in some aspects of the GBL methodology, but also based on the opinion of experts and professionals applying EER, we found a pedagogical framework and defined different personas to help develop the pedagogical material and the MOOC for the European project UNLOCK.

1.1 The aim and the objectives of the study

This work package aims to define, first, based on the former WP and further literature review, the framework, and role of educators in GBL and EER activities. Second, through additional research and surveys, to collect information from experts and practitioners to

develop a pedagogical framework to define the knowledge, attitudes, and skills that HEI educators should have as instructors, game developers, guides, and explorers when conducting EER activities in an educational context. This framework will support the development of the pedagogical framework and its learning content, to enable educators to facilitate games in the classroom. Through this structure, the profile of a game facilitator with the necessary characteristics and knowledge that an educator must have to carry out these activities efficiently will be presented.

To achieve its aim, the study has been therefore designed to:

- Frame and contextualize the results from the previous research: understanding the new role of educators when facilitating GBL activities.
- Elaborate a Pedagogical framework: Identifying the knowledge, the attitudes, and the skills HEIs' educators must develop to be able to facilitate EER in learning activities.
- Develop the educators' profile, as facilitators of EER activities: the knowledge, attitudes, and skills defined in the framework, a profile of the educator, as a facilitator of EER activities, will be suggested.

1.2 Methodology

To identify the role of the educator, in activities of GBL and EERs, we follow the subsequent methodology. First, we seek to identify, in the research report conducted by members of the project, some results on skills and obstacles for educators in EER activities. Then we conducted further research, with the inputs of all partners in the consortium, to identify studies that have a focus on educators' skills. Therefore, our approach is beyond the traditional one that usually is focused on identifying skills that are developed in students through EER. The methodology of the study is described in Figure 1.

The development of the framework has comprised the following steps:

1. A review was conducted by the consortium team and 37 case studies from experts and EER developers.
2. A complementary study on a literature review focusing on educators' competences, through the analysis of research aimed at understanding the educator's role, while facilitating new pedagogical approaches, especially EER activities.
3. After a detailed study of scientific articles, and interviews with experts, over 70 competences and challenges for an EER facilitator were selected.
4. After analysis and discussion of the main competences and skills and challenges encountered in GBL and EER facilitation, 16 competences and 6 institutional contents were selected as more relevant. The relevance was justified by the frequency mentioned in the literature, and in the interviews with experts. These competences

were divided into 3 groups: pedagogical, technological and social ones. A group of institutional support was additionally proposed as relevant in EER, using context. Subsequently to this selection, we create two questionnaires aimed at experts, practitioners and users of EER and others educators in HEI, respectively, for the validation of these chosen competences.

5. Finally, we propose the pedagogical framework and the different educators' profiles.

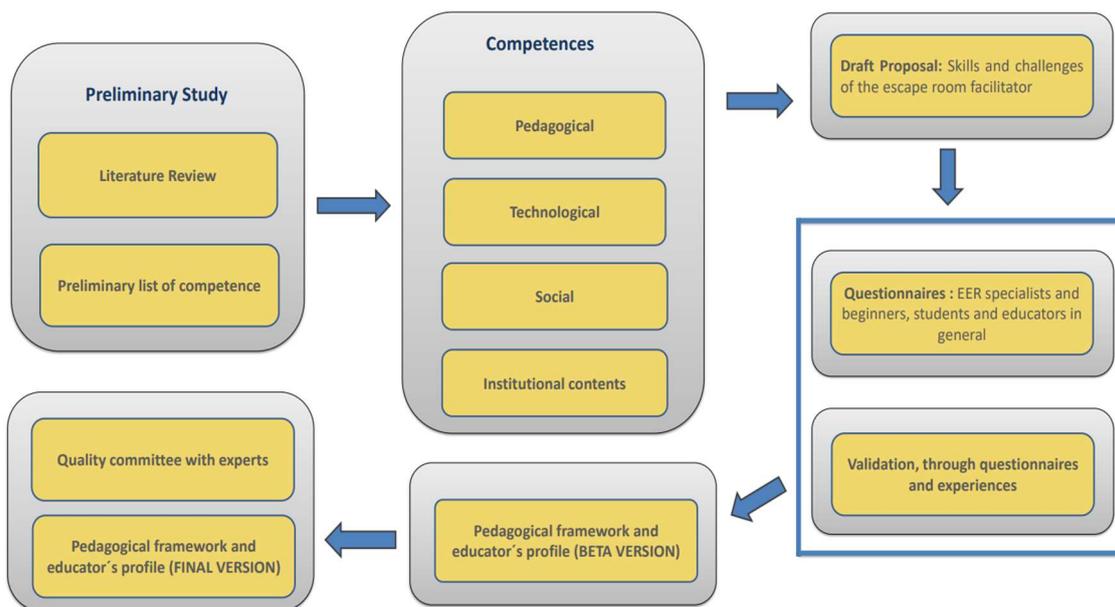


Figure1. Steps to collect information for the proposal of the pedagogical framework and educators' profiles.

1.3 Structure of the report

Following Chapter 2 provides a review of EERs in practice, in which first the EERs and their particularities were addressed, in comparison with other active teaching methodologies. In the following chapter we present a review of identified educator competences through 37 case studies with experts from the six UNLOCK consortium countries, namely Denmark, Germany, Netherlands, Lithuania, Portugal, and Spain. Chapter 3 presents the complementary literature review on the competences of educators for the development and use of GBL and EER as facilitators. In chapter 4 we additionally use the data from the questionnaires (to experts and EER users) to validate the main competences and skills for the educators as mediators in the classroom's EER activities. Chapter 5 reports on experiences and good practice, with real cases, emphasizing the use of these skills in higher education educators as they create and conduct EERs in class. We present the pedagogical framework, the conceptual model and the descriptions of each of the competences in Chapter 6. Chapter 7 presents three profiles of educators using EER activities based on the knowledge, attitudes and skills reported. Finally, the conclusions of this research are presented.

2. LITERATURE REVIEW: EDUCATIONAL ESCAPE ROOM IN PRACTICE

2.1 EER is not a classical game

Educational Escape rooms are games designed for teaching consisting of challenges played in groups where the participants are asked to solve a series of clues and puzzles in a limited amount of time to "escape the room" (Nicholson, 2018). Currently, the final objectives do not necessarily need to be to escape the room, as the goals are more diversified; players may break into a vault, solve a murder mystery or defuse an explosive device. It will all depend on the initial narrative of the game (Veldkamp et al., 2020).

EERs bring a creative learning atmosphere that can be designed for any educational level and use the characteristics of escape room design that will be incorporated into the specific aims and educational elements (Anguas-Gracia et al., 2021). In recent years, escape rooms began to become of interest to academia. Despite being still a very small field in research, the amount of literature on this topic is rapidly growing, in different areas of education. From primary, secondary, higher, and vocational education, especially in the areas of health and engineering (Lathwesen & Belova, 2021; Manzano-León et al., 2021).

Existing experience and research results support that the EER is adaptable to any teaching area and is student-centered, promoting the research mindset, creativity, logical thinking, critical thinking, and problem-solving (Lee, 2019; Berthod et al., 2019). Furthermore, EERs are implemented at different stages of the learning process. Some scenarios aim to introduce and familiarise participants with certain topics. Others aim to teach or reinforce learned course content. However, one cannot draw a clear line between EERs only teaching soft skills and that only teaching knowledge. Most of the time there are interrelations between both aspects (Tercanli et al., 2021).

In this context, it is also important to emphasize Digital EERs (DEERs). The EERs developed in a digital environment is immersive, not unlike ER games. They use a combination of free web-based applications to simulate a series of locks to be opened, puzzles to be solved and goals to be carried out. DEERs are an innovative way to bring technology and critical thinking to the online classroom, and their benefits are manifold. Thus, this methodology, like the physical EERs, seeks to promote a learning environment and the development of social skills (Makri et al., 2021; Dittman et al., 2021).

EERs are considered one of the tools of GBL. But as an active teaching methodology, they have some distinguishing features that are considered essential for their success. Key aspects of EERs for developing social skills and learning include immersion and discovery-oriented experience, interactivity, progression, and increasing complexity, learning structure (repetition, feedback, rewards, debriefing), limited time, alignment with the curriculum (not replicable for different fields of knowledge) and the presence of

a game master to give hints and help in the feedback and reflection process (Gordillo & Barra, 2021; Eukel & Morrell, 2021).

The process of immersion and interactivity, participation, and engagement is one of the characteristics of this methodology (Monnot et al., 2020). This aspect provides the retention of content with a real experience, which becomes very useful for some specific contents, as reported, for example, by the authors in the area of health (Moore & Campbell, 2021), engineering (Giang et al., 2020) and social sciences (Lathwesen & Belova, 2021). EERs differ according to the challenges they pose to players, but each ER encourages players to use divergent thinking, unconventional and from a new perspective (Clarke et al., 2017). An intrinsic feature of this activity is that it is played as a team and the puzzles tend to be designed to ensure that each team member must have a significant contribution. Studies report that the greater the diversity of knowledge among participants, the greater the chance of success in completing the game (Martina, 2020; Eukel & Morrell, 2021).

One of the powerful aspects of EER is the learning structure that the methodology offers (Nicholson, 2018). The process creates a flowing experience among the participants, as the progression and complexity of the challenges and puzzles are exposed (Wild et al., 2021). Through the system of task repetition, the participant learns through trial and error. Completing a task usually unlocks a new task, information, or tool needed. This unlocking usually takes place when a task is solved correctly. This structure provides students with immediate feedback on the correctness of their solutions (Gordillo & Barra, 2021). Therefore, in this tool, the presence of a game master is essential during the activity. The game master, which in EERS will usually be the educator, will observe the progress of the game, release clues (that can be previously decided the rules for their release), and help in the process of reflection and evaluation of the experience (Gordon et al., 2019; Eukel & Morrell, 2021).

Furthermore, the limited time may develop too much pressure on the participants and thus bring about a stressful situation. For this reason, the level of complexity of the game needs to be in line with the knowledge of the participants (this includes age and area of knowledge). The game also cannot be too easy as it will be considered boring or too difficult that they fail to pass the level and become frustrated with the experience (Sánchez-Martín et al., 2020; Avargil et al., 2021).

For these different reasons, EER has not been considered a classic game and in most cases is not replicable, as it needs to be designed according to a specific learning objective. Thus, many educators report difficulty in experimenting and adopting this methodology (Eukel & Morrell, 2018; Fotaris & Mastoras, 2019). In the next topic, we will explain the difficulties and the main knowledge and skills needed to implement EER in the European context.

2.2 EERs in higher education institutions in the European context

In this section, we will present a contextualization, based on a previous literature review conducted by the team (Tercanli et al., 2021), with a focus on the new role of educators, with the background of the different countries on the consortium. Moreover, our research identifies several supporting factors that contribute to the development and successful implementation of EER in educational settings, as well as negative factors. The educators interviewed had different levels of experience, regarding the implementation and usage of EERs. Most have previous experience on EERs, design methodologies, or knowledge about the topic. They were asked about skills and competencies needed such as creativity, flexibility, writing skills, technical skills, and design skills.

Through interviews with experts, we aim to understand the main competences, skills and positive factors and challenges related to the implementation of GBL and more specifically on EER.

The main factors, mentioned in the interviews, as **motivating and positive factors** for the educators to implement and use EER are summarised as:

- **Educators' knowledge, skills, and attitudes:** Experts identify a range of knowledge on EERs and their design methodologies and competences and skills needed.
- **Institutional factors:** From the interviews, we conclude that institutions introducing Continuing Professional Development (CPD) courses & learning labs, with the availability of relevant workshops, where there is institutional recognition, where institutional and regional funding is available, and the availability of courses in which the EERs may be embedded are factors prone to help the use of EER.
- **Methodological factors:** Involving students in the game design, integrating different stakeholders, both inside and outside educational institutions, creating a network of educators and stakeholders interested in using and sharing knowledge it is mentioned to be crucial for the success in the implementation of EERs.
- **Resource and community factors:** Having examples of EER packages, guidebooks, communities, and networks to discuss it, blueprint and/or elaborated the systematic plan, online resource platforms, toolboxes are also pointed out as positive to the implementation of EER.

The research shows that educators seek to use GBL and EER methodologies in teaching for different reasons. This is a new and innovative approach to teach, which is student-centered (knowledge); it is connected to acquiring skills and competencies for using innovative pedagogies (skills); it means increasing enthusiasm, and awareness about issues such as, for example, student academic and cultural diversity (attitude).

In contrast, the negative factors that are inhibiting the use of GBL and EER approaches, reported by experts, include factors about educators' own skills, institutional barriers, student preparation, and lack of resources. The main factors are summarized as:

- **Educators' knowledge skills and attitudes:** The difficulty in adopting new methodologies, difficulties in creating a successful string of puzzles, and setting up a digital EER. The difficulty in adjusting the level of complexity, in managing cultural and personality combinations in teams, and the lack of technical competences and storytelling skills were mentioned.
- **Institutional factors:** Bureaucracy in finding available spaces in which the game is planned to be played; conflicting approaches to education and meeting strict regulations.
- **Students:** Unfamiliarity with the concept of EER games; lack of inspiration/interest/creativity.
- **Resources:** Lacking time and budget for the development and maintenance of an EER; unsustainable use of tools; time invested in the supervision of the games; technical problems with electronic devices.

Funding, training, coaching, and online resources are all important. Nevertheless, it is stressed by the experts, that it is the attitude and open-minded approach of educators bringing these resources together, and creatively designing their own games for their own purposes, that makes the difference in teaching and the learning process, when choosing this method. The impact of adopting EER practices on educators is reported to include increased awareness and effective practice of innovative pedagogies, development of own professional portfolio, increased familiarity with wide-ranging resources in order to support effective content delivery, as well as knowledge and ability to implement active and collaborative educational methodologies. All the positive and negative aspects for the implementation of GBL and EER come from the case studies, provided by the Unlock team in the 6 countries of the consortium (Tercanli et al., 2021).

In the following stage, we sought to summarise according to the experts' view, the main success factors and difficulties reported in each country for the adoption of GBL and EERs.

2.2.1 Denmark

One of the big challenges reported by experts in **Denmark** was finding the right balance, between content and games, namely as the development of puzzles may change the content to be taught. As an educator, making the puzzles sufficiently appealing, testing, and ensuring that the tasks are clear, accessible, and may be solved in essential steps is a very important task. Moreover, puzzles that are too accessible and undemanding may result in a lack of motivation by the students.

It is also necessary for educators to become properly familiar with GBL activities and group work strategies. According to the experts interviewed, it is of utmost importance to be part of a group/network interested in the same methodology and this may, in fact, be the secret of success for the implementation of EER.

Another competence needed for the educator adopting this teaching methodology is to have the ability to remain open-minded in the process of developing the escape games and, at the same time, to have also an open attitude thought out the learning process, trusting that students will learn differently.

The study reports that, in Denmark, there is still a substantial lack of information on the appropriate use, institutional support and integration with the curriculum, and the most needed skills, knowledge, and attitude on the part of educators.

REAL SITUATIONS/ GOOD PRACTICES

House of Science, Sønderborg Municipality, Rubi Lee's Escape House

Summary: In this EER, students self-design, execute and play escape rooms, and get acquainted with course topics (especially coding and encryption) in a motivating and hands-on way.

Challenges: In terms of EER-design, the authors considers whether their approach might be too "advanced and complex" in terms of using the EER since it focuses not on introducing nor evaluating a subject like math but instead on gamifying the learning content through the EER: "Our EER-version is perhaps too advanced. Or advanced in another way by having this innovative process where the students tried the learning through gamification, but not as an evaluation of what was learned.

Supporting factors: Clear communication and responsibility between different stakeholders. Each stakeholder was only involved in the project because each stakeholder benefitted from the collaboration. House of Science invested a lot of resources in the development of teaching material but expresses the frustration of lacking communication skills, i.e. having a website to showcase material.

(For the complete study, please refer to the UNLOCK Case Study Report, case #04, available in <http://www.un-lock.eu/reports.html>)

2.2.2 Germany

In **Germany**, the interviews reported that despite awareness about the availability of online EER guidelines, resources, and tools, German educators barely used this methodology in the design of their courses. The main obstacle pointed out is that, often, having to adapt, redesign, and prototype may cost educators many hours of work before a game could be implemented. This seems to inhibit the choice of using EER.

Regarding educators' skills, creating EERs requires facilitators to have digital skills, namely in the new pandemic context. To create digital challenges, using digital tools, or just to solve technical issues, a particular level of technical expertise is required. The lack of IT infrastructure may also be an inhibiting factor in the development of escape room games. Furthermore, in order to design immersive puzzles, creativity is pointed out as a

very important competence. It is important to be analytical, open to criticism and be willing to take risks to experiment new concepts. Consequently, lacking these skills or experience may prevent educators from adopting the escape room in their teaching.

In addition to the creative and technical skills needed to develop escape rooms, it is beneficial for educators creating escape rooms to gain knowledge and experience in game design. To begin with, it is suggested that educators experience EER themselves, to become familiar with the game working structures. Consequently, teachers need manuals and guidance on how to integrate this methodology into their classes and should experience it themselves before becoming facilitators.

REAL SITUATIONS/ GOOD PRACTICES

[CanyouEscape. Freiburg University of Education, International Centre for STEM Education](#)

Summary: The breakout box aims to address diversity in classroom teaching regarding academic achievement and different student backgrounds. Further the project uses the escape room games to show that science can be fun, and help increase interest in the STEM subjects among school students.

Challenges: Developing the Escape Room riddles is hard if there is not a target group in mind. The team found it challenging to identify riddles and puzzles that could be appropriate for different age/ knowledge groups. For the start they wanted to keep the diversity of participants broad, thus currently even adults can play the games originally devised for the children. The teachers who are in the in-service training report that they find it challenging to develop games from scratch, due to time constraints.

Supporting factors: What is the status-quo of the use of ER activities in education in the German context? Most teachers are interested in using it in their classrooms, however, it is a problem with the time constraints that they are not able to get involved in such activities as much as they want. Another observation shared is that the ER methodology is being used for the sake of being used as an alternative methodology, sometimes resulting in the content not being delivered in a meaningful way. Implementing an ER activity, therefore, should be well planned and the purpose for the implementation should be clear.

(For the complete study, please refer to the UNLOCK Case Study Report, case #07, available in <http://www.un-lock.eu/reports.html>)

Thus, it is important to understand the dynamics first and maximize one's knowledge in designing EERs. Although there is plenty of materials and lesson plans available online, there needs to be more offer for the educators to gather the adequate resources and exploit them for their own use efficiently and creatively.

The findings from the interviews conducted in Germany may be grouped into three dimensions, concerning support to educators: (i) encouragement to change their

understanding and approach to EERs, (ii) provision of resources on game design and EER pedagogies, and (iii) creation of a resource center, including access to customizable materials, and networking with people who would be interested in discussing and providing guidance on designing EERs.

2.2.3 Lithuania

In **Lithuania**, experts agree that it takes a creative educator to adopt an efficient methodology to suit a specific content and to design an EER, both in a physical or virtual environment. GBL in a digital environment may be a powerful methodology for educators, as the digital environment is being explored more and more every day, also due to the pandemic context.

The role and commitment of the educator are very important to guarantee student engagement. These are also pointed out as the key factors for the efficiency of using educational GBL. Thus, it is advisable to integrate the methods for reinforcing educational relationships within the gamified system. Feedback should be informative, timely and fair, regarding the users of the system. This requires teachers to have access, test the games and also be aware of the gaming experiences offered.

Thus, results in Lithuania emphasize that the most important aspects of the educators' role are the following: (i) being mentors for students during the game and having experienced the game before; (ii) being the game planners of the educational process to ensure that the implemented game aligns with the course syllabus; (iii) being the educators the ones who provide feedback to students on their achievements and behaviors.

The facilitating factors, for the educators reported, are that the implementation of GBL and EER should be based on the initiative of active educators who are willing to introduce new teaching and learning methods, showing a positive attitude. This means that there is a willingness to learn new skill sets and acquire new knowledge. It is the positive attitudes of teachers and their willingness to learn new competence that leads to the growing interest of students in trying out new learning experiences and high skills in using technologies. Moreover, the support for innovative teaching and learning at a higher level of university hierarchy and the existence of an institutional reward and recognition system may also facilitate the choice and use of EER.

Among the inhibiting factors, from the perspective of educators, are the high time consumption on the development of EERs is, adding to the current situation in universities in which educators already have a very high teaching load. Therefore, adding to preparing classes, conducting research activities and other responsibilities, the time needed for preparing the EER seems to be a very important inhibiting factor. Another inhibiting factor may be the relatively low visibility and reward for these strategies of teaching activities. Thus, the lack of active professionals integrating EERs in their subjects and the lack of such teacher training courses may be considered as the main inhibiting factors for

introducing EERs on a larger scale. The increasing adoption and visibility of GBL hopefully may solve this obstacle.

REAL SITUATIONS/ GOOD PRACTICES

Escape Room “Escape the Lab”, Kaunas University of Technology

Summary: The main concept of the game was taken from laboratory facilities of the Chemical Engineering Faculty. With additional features, these facilities have been turned into a gamified Virtual Reality Escape Room type of experience that is based on real chemical experiments.

Challenges: The player must have virtual reality devices or have access to them to play the game. This is a challenge, as the implementation of the game is limited to the availability of the devices. In general, the challenges were mostly related to software development.

Regarding the software development part, as the game is based a lot on the liquids in the laboratory, it was a challenge to implement liquids in the game correctly, e.g. filling a flask with water, or pouring them into another flask.

Supporting factors: The availability of the VR Laboratory equipment was helpful. Additional financial support from the university and teachers and from the competitions they participated supported with the realisation of the project.

An additional supporting factor was an IT subject in the study programme of those students where they could choose anything they wanted to develop from software even to a game. Integrating the VR ER development in a university course motivated the students even more. The development, therefore, became somewhat professional.

(For the complete study, please refer to the UNLOCK Case Study Report, case #12, available in <http://www.un-lock.eu/reports.html>).

2.2.4 The Netherlands

In **The Netherlands**, developing and implementing EER is mentioned as a new way of promoting didactics in education. However, it still requires new skills development and knowledge for educators, as it is not yet included in the teacher education formal curriculum.

Examples of such knowledge and skills are design skills, solution-oriented skills, creativity, information technology (IT) skills, etc. Educators are still looking for a balance between the time investment needed to implement EER and the cognitive development of their students' knowledge and skills. For this, the teacher's assessment or belief in the added value of an EER on learning performance is vital.

Experts mention that educators are often enthusiastic, so they often develop EER in their own spare time and invest their own resources. However, there is a great need for an

elaborated concept/plan, and/or step-by-step plan that any educator may use for their context. Since there is a lot involved in developing and implementing an EER, it is also seen as a complex and time-consuming process on all their stages: designing, testing, editing the puzzles, and determining the assessment takes a lot of time. Involving students in the development of the EER may be a solution to this obstacle.

To develop and implement EERs, experts mentioned that several skills are important, such as game design, creativity, and curriculum design. It is crucial, not only to know about game design but also fundamental pedagogical skills.

To support educators in acquiring these skills, four support mechanisms were identified from the interviews with experts, in the Netherlands. On one hand, it is crucial to play and acquire experience with EERs, as playing an EER allows reducing the negative image that educators may have. On the other hand, the experts indicated that educators also need to experience the creation of an EER. The development of an EER has been suggested as a trial-by-error process. It is not considered a difficult process, but it is proven to be a repetitive and time-consuming process of creation and testing.

REAL SITUATIONS/ GOOD PRACTICES

Escape the Classroom, Segbroek College

Summary: The EER is integrated in the teaching of a biology class as a core educational activity. By applying a more playful teaching approach, this EER aims to promote out-of-the-box thinking, problem solving and to encourage students to take on new perspectives next to teaching course content.

Challenges: According to Mr Koot, there were a number of challenges. First, the number of puzzles in an escape room is difficult to predict. A solution for this is that you test the designed escape room with, for example, your colleagues. Second, it is difficult to predict where the students will get stuck. A solution for this is also testing the games and the complete escape room. Third, making the games was a challenge, but it was also fun. The challenge was mainly the time and limited resources.

Supporting factors: To face the financial challenge, Mr Koot suggests to apply for external financing. In this case, they applied for the LOF grant. In addition, by using sustainable materials and clever design, the puzzles can be reused. For example, the puzzles are laminated in clear plastics and the riddles are written with removable markers. This choice enabled Mr Koot and colleagues to use the games for several years. Mr. Koot has received funding from the LOF. Everything is developed with this funding.

(For the complete study, please refer to the UNLOCK Case Study Report, case #16, available in <http://www.un-lock.eu/reports.html>).

Second, training, workshops, and conferences may also facilitate the development of EERs. Especially workshops on the pedagogy of EERs were pointed out as important. However, training and workshops should not necessarily focus on the development of EERs but may also focus on the skills needed to develop and implement EERs. Third, training may also be used to assist educators in acquiring skills for developing EERs. Colleagues who are already experienced in EERs may train beginners who would like to engage in this teaching method.

Finally, experts from the Netherlands almost unanimously agreed that EER examples, including corresponding projects, design frameworks, roadmaps, and lesson plans, are of immense value to educators who want to develop an EER. There is a need for a European EER toolbox, i.e. a platform that includes fully developed EER examples offers a wide selection of materials (e.g. puzzles, boxes, and key locks), and is accessible to all. The platform should be flexible, so that each educator may adapt it to their teaching needs. A database with puzzles is also suggested as a facilitator.

2.2.5 Portugal

In **Portugal**, the experts' interviews emphasize the importance of the educators' previous and continued experience in different gamified learning approaches. Also, being willing to innovate with groups of particularly resistant students is an essential factor for the success of these experiences. It is also important to mention educators' collaboration and the interdisciplinarity among the promoters for the success of GBL activities in education.

From the perspective of the experts interviewed, one of the facilitating factors of these activities is the professional development of educators regarding the opportunity to become familiar with and to train these gamified approaches for their teaching practices. The implementation of this approach may also promote educators' motivation by also approaching the emotional dimension of teaching. Knowing that the methodology is flexible, its adaptation to different levels of education and different areas of knowledge lends even greater merit to its use.

The impact of using EER is also significant for educators, as it promotes skills such as the ability to motivate the students to use digital technologies inside and outside the classroom, the knowledge of diverse web resources to complement different subject contents, the knowledge and ability to implement active and collaborative educational methodologies in the digital era, the ability to formulate and specify technology-mediated practices and implement them in class, skills in software, hardware, and management of specific applications and the ability to use digital technologies to design resources and implement practical activities.

As an inhibiting factor in adopting GBL and EER in teaching methodologies, experts point out that the Escape Room methodology is time-consuming. The main challenge is to conceive the idea of what is intended with the EER and adapt it to the required teaching content. Other challenges, pointed out by the experts, is the time needed to think about

the narrative, to find the puzzles and the tests related to the syllabus contents. Thus, in Portugal there is an urgent need for dissemination, demonstration, material development, and teacher training so that the full potential of this methodology reaches the largest audience, thus improving the learning and teaching journey. Furthermore, it is necessary to profile the educators involved and create guidelines to facilitate the implementation of both EER and GBL.

REAL SITUATIONS/ GOOD PRACTICES

Escaping from the traditional classroom, School of Education of the Polytechnic of Oporto

Summary: The foreign language EER was conducted to investigate the perceptions of students about EERs in an educational context. In particular, it was of interest which skills students are developing when participating in EERs and what strategies and designs are most successful when implementing EERs. The EER was a wrap-up activity for students to undertake self-assessment of their Spanish language skills.

Challenges: The Escape Room methodology is a time-consuming one. This was the main challenge encountered. Groups bigger than six members also proved to be too large to facilitate collaborative practices

Supporting factors: Students shall be involved from scratch in the activity by engaging them since the very first moment within the activity.

With regard to the methodologies used to achieve these objectives, it was necessary, first, to understand what the teaching of foreign languages and cultures should be like in the 21st century, to gather information on pedagogical approaches appropriate to this type of teaching and to analyse those with which escape rooms are related and help to explain why reasons can be effective. As such, a documentary analysis was carried out on articles and books related to the escape room methodology, considering their characteristics and their application in teaching and learning contexts. This analysis contributed to the planning of an escape room and its achievement in a context of formal education, during which some field notes were taken.

(For the complete study, please refer to the UNLOCK Case Study Report, case #22, available in <http://www.un-lock.eu/reports.html>).

2.2.6 Spain

In **Spain**, regarding the facilitating factors, the main factor pointed out by the interviewees is the motivation of the actors. Another important factor reported is the fact that educators must feel supported by their department. Additionally, the importance of having previous knowledge about GBL experiences is also emphasized, this factor contributing to the success of the class method.

Educators who wish to implement gamified approaches in classes, have to dedicate some time to their own training on GBL and EERs, and also digital tools such as video recording and editing, applications for creating QR codes, quizzes, and virtual locks, tools for 3D visualization, among other things. After the training, they will feel more secure and confident to design the activities. In this sense, it is important to point out that, as educators, the interviewees try to "keep up to date with educational trends" and that is why they have decided to use these EER and GBL strategies in their pedagogical activities.

In this respect, all the interviewees from Spain agree about a large amount of time, in many cases, several months, invested in planning the Escape Room, which may be an inhibiting factor. In addition to being time-consuming, some limitations must be addressed before the implementation activity. One has to consider that the development of the Escape Room as a practical lesson has some constraints: i.e. the fact that the number of members per group should be reduced, the level of scientific knowledge of the participants should be similar, or a fair distribution of work among the members should be sought.

Finally, one of the most common inhibiting factors mentioned is the lack of funding, as many of the educators have not received financial support for the creation of the EER. This means that the educators have to do it at their own cost. Educators also report a heavy workload in higher education and the difficulty in accommodating teaching, research, and the implementation of innovative approaches and methodologies, such as GBL in education, is continuously mentioned as an obstacle. Therefore, an educator that intends to use EER needs to have a very rigorous plan.

In summary, from the reports of experts and educators using GBL and in particular EER, in **all countries of the consortium**, there is an urgency to support educators in their preparation in game design theory and EERs as innovative pedagogies. This may be accomplished by providing relevant knowledge and opportunities for educators in the experience of EERs themselves, and in experiencing the development of EERs towards developing a theoretical understanding of the approach, gaining practical experience, and developing an entrepreneurial attitude themselves. In the context of HEI, this support may be organized as part of continuing professional development programs offered to educators.

The creation of a European online EER platform for sharing and disseminating EER tools and methodologies is emphasized as crucial. Such a platform is suggested to contain examples of EER, together with projects, design schemes, and replicable EER modules, classified according to disciplines and curriculum considerations across European regions. Moreover, manuals and guidance for educators on how to modify and integrate the examples into their courses should also be included in the EER platform. This suggested platform should work as a network hub, bringing together educators, EER games creators, and practitioners, and every stakeholder interested in EER, leading to the

creation of new synergies and collaborations among the participants (Tercanli et al., 2021).

REAL SITUATIONS/ GOOD PRACTICES

The Florence Nightingale Code - Nursing, University of Granada

Summary: In addition to promoting motivation, the EER is used to assess cross-curricular competences such as leadership, communication, and observation skills. Escape Rooms are considered to allow to go beyond traditional exams and offer huge range of resources regarding the assessment of cross-curricular competences. Thus, the EER is designed as an evaluative activity where students must demonstrate their acquired knowledge during practical seminars.

Challenges: One of the challenges the authors report was the fact that students were too excited when they finished and they were too noisy, therefore, some teachers from the offices nearby were disturbed and he had to ask students to contain their excitement.

In addition, he states that the planning and preparation of the Escape Room requires a considerable amount of time (several months) to devise and interconnect the tests involved. Its application also entails extra time for the teacher when compared to the delivery of lectures in a 'master class' format since each group is composed of just five students who have 30 min to solve the game, after which 15 more minutes are needed to prepare everything for the next group. He spent two full days to carry out the Escape Rooms, which entails a lot of extra hours, not officially recognized by the institution.

Supporting factors: The authors state the low cost of the Escape Room as a positive aspect, an inversion between 50-100€ was made to purchase some materials needed for the Escape Room (padlocks, etc.). The Escape Room was developed in the Nursing classroom and the other materials used were available as the HEI provides them for practical classes. However, the Escape Room did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

(For the complete study, please refer to the UNLOCK Case Study Report, case #28, available in <http://www.un-lock.eu/reports.html>).

3. EDUCATORS' KNOWLEDGE, ATTITUDES AND SKILLS: LESSONS LEARNED

From the case studies analyzed and considering the feedback provided by the experts in the interviews, it was found that it is easier to define a set of developed competences, making the application of this type of learning in practice even more relevant.

To complement this study, we have searched in the literature for scientific works on the subject to propose a more integrated set of competences for GBL and the elaboration of the questionnaires for validation. After a detailed review, we found over 70 competencies and challenges for a GBL facilitator. These competences and skills were gathered into 3 groups: Pedagogical, Technological, and Social. The main institutional contexts and support are also reported.

From this set, we sought to identify the most relevant competences specifically for EER, helped by the (few) research available and the results of the questionnaires to experts and practitioners. From this stepwise process, we achieved a set of 22 competences for an EER facilitator, appropriately described in the following parts.

3.1 Pedagogical Competences

One of the groups identified in our analysis was pedagogical competencies. It is essential that educators possess these skills to carry out different GBL activities. These skills include syllabus-based game learning, mentoring and assessment (Nousiainen et al., 2018). The pedagogical basis is essential to enable appropriate guidance according to the content throughout the teaching and learning process (Marklund & Taylor, 2015).

Educators need skills to plan meaningful game-based activities in the syllabus (Urh et al., 2015). This implies being open to new methodologies and also understanding the strengths and limitations of game-based approaches (Dabbagh et al., 2015). Teachers' experience in using games for instruction, not only requires them to be able to choose games with appropriate features but also to ensure synergy between student involvement and games (Foster, 2015; Molin, 2017).

The ability to plan GBL activities includes the competence to integrate the approach according to the objectives of the syllabus, with the demographic and socio-cultural preferences and differences of the students (Iosup & Epema, 2014). It also seeks to plan activities in ways that explore subject-specific objectives and in ways that provide cross-curricular competences in learners (Nousiainen et al., 2018).

The educator needs to have the sensitivity to identify learnable moments during the game (Foster & Shah, 2020). The approach needs to be oriented towards the learning process (Bourgonjon & Hanghoi, 2011). Thus, the educator needs to find a way and space to insert new teaching approaches in the context of a solid educational framework, identifying the

types of game methodologies that their agenda and curriculum allow (Molin, 2017; Frossard, 2013). Table 1 shows the main competencies found in the literature review.

Table 1. Pedagogical competences

Competences
Ability to design supplemental activities
Ability to explain a new system to students
Ability to give rapid and positive feedback
Ability to identify new strategies and methodologies
Awareness of the game approach to guide the learning processes effectively
Be able to set the gaming experience in a sound overall educational framework
Engage in mediation, foster post-game discussion, encourage reflection
Help students to see the relevance of their acquired knowledge beyond the classroom
Identify what kinds of gaming sessions their schedule and curriculum allow for
Know how to establish an alignment between the games, the curricula, and learning outcomes
Know to guide and support the students during the game sessions
Pedagogical content knowledge
Tailor the material to the demographic (age group, familiarity, educational pre-text) so that the material is neither too difficult for, nor too familiar to the learner
The ability to lead new experiences that consider the learning environment and the needs of the students
The need for professional development
Understand different student skill-levels and personalities
Planning and establishment of clear pedagogical aims
Identifying appropriate assessments
Reach a balance between fun and learning

For a pedagogical competence to be effective there must be, in addition to planning, the monitoring of activities in order to assure the achievement of the intended goals (Raziunaite et al., 2018). Educators must be motivators and supporters (Arnab et al., 2019). They must be able to explain the new method to the student and give students space to take responsibility during this process (Iosup & Epema, 2014), must know how

to support and motivate the student, which also means to give freedom and trust in the process (Bourgonjon & Hanghoi, 2011; Charlo et al., 2021), should understand that students will learn with this methodology, but also that the educator in several moments will need to provide quick support and positive feedbacks, so that demotivation does not occur (Urh et al., 2015; Franco & Deluca, 2019). Thus, mentoring is an essential competence in this process (Carlos et al., 2018).

Observation during the game by the educator, should be focused on the competences and objectives intended during the planning phase (Molin, 2017). The educator should engage in the mediation process in order to foster post-game discussion and encourage reflection (Arnab et al., 2019). It is also critical to help students to observe and reflect on the knowledge and skills acquired beyond the classroom (Cejudo et al., 2019). The assessment phase also involves understanding different levels of student knowledge and personalities and motivation for this type of activity, as measuring individual student performance may be difficult, it is important to focus on the overall performance of the teaching and learning activity (Chen et al., 2020).

To acquire or develop these skills, the educator first needs to know the pedagogical content and establish an alignment between games, syllabus and learning outcomes (Bourgonjon & Hanghoi, 2011; Gordillo & Barra, 2021). In GBL activities the educator needs to play an active role in order to facilitate learning. In conclusion, he needs to be a facilitator with acquired skills and competences. For Foster and Shah (2020), regardless of the game approach chosen, a pedagogically competent educator will be able to plan, implement and evaluate GBL and unite it with the intended curriculum. The Table 1 shows the main competences found in the literature review.

3.2 Technological Competences

Technological knowledge and digital skills are of great importance during an educator's professional development, namely to use games effectively (Shah & Foster, 2015). However, the ability to flexibly overcome technology-related obstacles is also very important (Hurtado & González, 2017). Educators who have more familiarity with digital technologies and media tend to show more competence in the knowledge of games (Linderoth & Sjöblom, 2019).

In addition, the educator needs to have experience with games or some basic literacy about different game approaches (Chen et al., 2020). These experiences will be indispensable when preparing an EER (Guigon et al., 2018). If educators enjoy the activities they are doing and they become fans of the approach, this may also help students to enjoy it and to facilitate teaching and learning through games (Nousiainen et al., 2018).

Therefore, Becker (2007) mentions that, in addition to basic knowledge in games, the educator must have training in GBL and be familiar with the different concepts of the subject, to carefully analyze the strengths and weaknesses of this methodology and know-how to better incorporate them into the content of the courses in order to maximize

learning and make the experience useful for student motivation and development (Chen et al., 2020). Educators' knowledge of GBL evolves time and teachers' professional identities impact GBL practice (Grove et al., 2013; Giang et al., 2020).

No matter how prepared an educator may be with technological resources when applying GBL, unforeseen events may occur, so the educator needs skills to quickly formulate a new strategy, improvising and modifying the objectives and tools during the process (Molin, 2017; Franco & Deluca, 2019). Thus, it is important for the educator to know alternative methods and always have partners who may help, namely with technical problems that are difficult to solve (Linderoth & Sjöblom, 2019).

Table 2. Technological competences

Competences
Basic games literacy
Careful analysis of the strengths and weaknesses of the media
Identifying personal training needs
Incorporating practical activities into personal training
Keep updated with experts and professionals in game design
Knowledge and differentiation between gamification and Game-based learning
Knowledge and skill in-game analysis
Knowledge and skills to incorporate games by repurposing existing games
Provide technical assistance when needed
Technological know-how
Understandings of the knowledge related to games, GBL and EER
Digital competences

Thus, knowledge and skills in analyzing games, as well as the ability to incorporate them efficiently into the curriculum, are essential skills for educators (Foster & Shah, 2020). Besides theoretical training, the most important thing to implement this method is practical examples of application, planning, and control of activities, knowing how to reconcile these activities in the curriculum, knowing how to involve students in these activities, and also knowing how to proceed with assessment and how to give feedback to students (Kamışlı, 2019; Sánchez-Mena et al., 2019). Many educators report avoiding this type of method in education because they do not sufficiently master its use (Marklund & Alklind Taylor, 2016) and many of the items mentioned above. Therefore, training emerges with such importance to build trust among educators and clarify its use in

education (Hsu et al., 2020). In Table 2, key technological competences identified for GBL facilitators are listed, as found in the literature.

To obtain this specific knowledge, educators should keep up to date with gaming experts and professionals (Hurtado & González, 2017). Several studies report that educators seek an online training program once the needs have been identified, and the creation of a platform for sharing practical experiences after training, where different play processes could be grouped to provide support to different stages educators. This provides some help to those who are starting to implement these strategies, but also to the ones that want to always improve it (Nicholson, 2015; Marklund & Alklind Taylor, 2016; Foster & Shah, 2020).

3.3 Collaborative, creative, and social Competences

In addition to pedagogical and technological competences, another group of essential skills for the GBL facilitator involves creative, collaborative, and social skills (Nousiainen et al., 2018). All of these skills are interconnected, as the GBL facilitator needs to have all the skills jointly to provide a complete and effective experience when conducting activities (Clarke et al., 2017).

Creativity, adaptation, and flexibility, are essential competences for every educator (Grove et al., 2013; Wiemker et al., 2015). To facilitate GBL activities these skills will need to be further developed (Sailer & Homner, 2020). It is necessary to have the ability to innovate, to be curious, and to understand game trends that can be useful to collaborate with educational practices (Hanghøj et al., 2020; Pellas et al., 2019).

The ability to explore new teaching alternatives and methodologies and to improvise their way of teaching, without worrying about failure, may be fun and motivating for the educator if they are open to new experiences (Chen et al., 2020; Jana, 2016). If the experiments are successful, the educator will increase his confidence in his ability to use games effectively to improve learning (Frossard, 2013; Nousiainen et al., 2018).

When educators adopt these methodologies in teaching, they need to step out of their comfort zone, of the traditional methods of teaching and encourage new activities (Nicholson, 2018). It is often necessary to learn from mistakes, be persistent, and insist on new activities despite failure (Jana, 2016). Encouraging student participation also involves being authoritative when necessary, so that the activity is not only a pleasurable moment but also a time for learning and developing skills among students (Hirumi & Stapleton, 2009; Marklund & Taylor, 2015). This is why the establishment of defined rules and objectives is so important (Clarke et al., 2017; Avargil et al., 2021).

This competency is manifested as the ability to take a playful stance, explore and improvise and for some educators is something natural and is related to their interests (Frossard, 2013; Romero & Kalmpourtzis, 2020). However, for other authors this process

must be developed slowly, experimenting with small steps at a pace they feel comfortable and confident with (Weitze, 2016; Jana, 2016).

This process of the educator as a facilitator of games in class is new and it will occur in a way that promotes the teacher's creative orientation towards self-development (Hanghøj et al., 2020). Each educator must understand their potential and limitations as a GBL facilitator, reflect on it, and in this way, reshape their identity as an educator (Hunter, 2020). The use of GBL methodologies in teaching challenges educators to rethink and improve their practices to find pedagogical ways of using games in teaching (Weitze, 2016). Table 3 presents the main collaborative, creative, and social competences found for a GBL facilitator.

Table 3. Creative and Social competences

Competences
Adapt tasks to skill levels to students
Adaptive expertise
Adeptness in identifying and leveraging teachable moments
Be able to take an active role when facilitating the game
Be authoritarian when needed
Capacity to innovate
Collaboration among colleagues to create such learning environments together
Confidence in dealing with unexpected events or requests
Confidence in their ability to use games effectively to enhance learning.
Creativity, curiosity
Designing games considering students' interests and abilities
Encourage activities despite the failure
Find different paths to the main goal
Motivated to learn and leave their comfort zone
Persistence
Understand which trends are taking place in their culture
Understanding their potential and limitations as a facilitator
Versatility
Willingness to explore, share and learn from mistakes
Enthusiastic to use technology and games in class

GBL can become widely used as it spreads from a small group of teachers to colleagues within and outside teaching environments (Nousiainen et al., 2015). However, fostering cooperation among teachers may be challenging (Jana, 2016), but collaboration is necessary to introduce GBL into the teaching culture and especially to make it a sustainable practice (Ferreiro-González et al., 2019).

The ability and willingness to share are still considered areas for improvement among educators (González et al., 2016; Dittman et al., 2021). As a way of improving collaborative competition, teachers emphasized mutual support, the joint creation of ideas, and the demonstration of concrete practices (Buchner & Zumbach, 2020). Collaboration among colleagues to jointly create such learning environments is paramount for the success, dissemination, and sustainability of this practice in teaching (Kamışlı, 2019).

3.4 Institutional context and support

The institutional context and support play an important success factor for the uptake and sustainability of GBL and EER activities in HEIs. The advancement of GBL use in institutions and the growth of this methodology in formal education shows that institutions are embracing and are more open to experimenting and supporting these activities (Pellas & Mystakidis, 2020).

Literature indicates that GBL has received increasing attention, some researchers report that educational games are one of the biggest "hypes" of the last decade in the educational context (Lathwesen & Belova, 2021). EERs have emerged as an engaging way to "gamify" learning (Moore & Campbell, 2021). As of 2016, the number of studies on the topic is on the rise, however, a more systematic approach, as well as more empirical evidence of their use, is needed. Particularly in areas of knowledge where we still observe few studies, such as in the social sciences and humanities (Fotaris & Mastoras, 2019).

However, the introduction of GBL, in particular EER, in education may be difficult, especially if there is no institutional support (Iosup & Epema, 2014). Despite the increasing use of games and financial and institutional support in some countries, most studies still report a lack of institutional support as one of the limitations hindering the use of GBL by educators (Molin, 2017). This is not a competence himself, but if educators have institutional support they will be more able to use and seize all the benefits of GBL and also EER.

The lack of planning and establishment of clear pedagogical objectives, as well as the difficulty in finding suitable games and fitting them into the curriculum, is one of the great difficulties encountered by educators (Foster & Shah, 2020). These difficulties may emerge because of a lack of knowledge about GBL (Becker, 2007; Marklund & Taylor, 2015). However, they may also be due to a lack of guidelines to help teachers adopt pedagogical strategies that foster creativity. Marklund and Alklind Taylor (2016) build

upon the lack of institutional support. In Table 4, we list the main institutional support elements reported in research that are mentioned to affect the use of GBL activities, within the institutional context.

Table 4. Institutional context and support

Contents
Institutional pressures
Lack of cooperation among teachers
Lack of ability to analyze the use of the game in an educational context
Lack of familiarity and confidence in using games for learning
Lack of guidelines for helping teachers to adopt pedagogical strategies that foster creativity
Lack of regular and ongoing professional development
Lack of supportive materials
Lack of tech resources
Limited time to prepare and play a game
Limited university support
No previous experience using games in the classroom
Students apathy (lack of interest)
Teachers' acceptance of games
Teachers' lack of sufficient game literacy
The lack of openness of the institution to new educational methods
Uncertainty of how to integrate them into the curriculum
Unprepared students for new activities

Lack of institutional support and institutional pressures ultimately discourage experimentation and the use of this method in teaching (Bourgonjon et al., 2013; Jana, 2016). Educators report that they do not have enough time to prepare a game and to reconcile them with the various other teaching and research activities (Becker, 2007; Kamyşlı, 2019). Some games demand time and other support materials, as well as personal and technological resources (Dabbagh et al., 2015).

In addition to these factors, many educators report not feeling the enthusiasm to use technology and games in class (Hanghøj et al., 2020). This lack of motivation may be caused by a variety of factors (Jana, 2016), from the lack of support from the institution

to encourage professional development courses, to the institutions' lack of openness to new ways of teaching (Iosup & Epema, 2014). Moreover, it may come from the lack of acceptance by more fellow educators and the apathy of students to new activities, which ends up demotivating the enthusiasts who initiate these activities in the institution (Bourgonjon et al., 2013).

All competences are interconnected. For an educator to become a GBL facilitator all four groups of competences (pedagogical, technological, creative, collaborative, and institutional context and support) need to be developed (Shah & Foster, 2015). All of them need to be aligned with the specific intended teaching and learning objectives.

4. VALIDATION OF THE OF COMPETENCES: FINAL LIST OF COMPETENCES

After the analysis of the main research findings and the interviews with the experts, two questionnaires (Appendix 1 and Appendix 2) were designed for the validation of the main competences found in the literature and the case studies. The results of the questionnaires are presented in the follow-up of the study.

4.1 Questionnaire 1: Use of Game-Based Learning

The questionnaires were applied in digital format. **Questionnaire 1** was aimed at **all educators in general and was focused on GBL**. We sought to identify among educators whether there is a great appeal for this methodology, and among those who do not use it, which are the main reasons for not using it.

Concerning demographic data in questionnaire 1, most of the respondents are male (59.5%) and aged between 40 and 60 years (60%). The minimum age was 23 years and the maximum 67 years (see Table 5). We also asked the level of education at which the educator teaches. Thus, of the total respondents, 32 respondents (76.2%) teach in higher education, 8 (19%) in basic or secondary education, and 2 (4.8%) in others.

Table 5. Demographic characteristics

Demographic characteristics	Frequency	Percent
Gender		
Female	17	40.5
Male	25	59.5
Age		
Between 20 and 30	7	16.4
Between 31 and 40	7	16.4
Between 41 and 50	15	36.0
Between 51 and 60	10	24.0
Above 60	3	7.2
Total	42	100%

According to Table 6, about 83% of the respondents answered that the concept of GBL is familiar to them, but only 48% have used some GBL activity in their activities as educators. Of these respondents, the most mentioned type of GBL used was digital games, followed by puzzles and board games, and lastly the escape room. This small sample of 42 educators shows that the Escape room is of little use as an active learning methodology. Among the other games mentioned, simulations and the use of gamification elements stand out.

Table 6. Use of GBL

	Familiar GBL		Use GBL		Digital Games		Puzzles		Board Games		Escape Room		Others	
	N	%	F	%	F	%	F	%	F	%	F	%	F	%
Yes	35	83.3	22	47.6	17	40.5	6	14.3	6	14.3	2	4.8	5	12
No	7	16.7	20	52.4										

In Table 7, we identify the main advantages reported by educators in the use of this methodology (GBL). Among those who have already used GBL, most totally agree on scale 4 (in the scale 1 - 5) that the use of GBL **increases students' motivation, improves students' participation in class, enables the development of soft skills, develops teamwork, and is an innovative teaching method that improves students' knowledge on specific topics**. Even for the ones that have never used GBL, on a five-point scale, most respondents agree (scale 4) that the methodology may bring these benefits.

Table 7. Advantages associate with the implementation of GBL

Advantages associate with the implementation of GBL	Use Game-Based learning									
	Yes					No				
	1	2	3	4	5	1	2	3	4	5
Increased student motivation	-	-	-	20%	80%	-	-	27%	46%	27%
Active participation of students in the teaching-learning process	-	-	-	40%	60%	-	-	9%	64%	27%
Possibility of developing transversal competences	-	-	20%	20%	60%	-	9%	19%	36%	36%
Development of teamwork competences	-	-	20%	20%	60%	-	-	9%	64%	27%
Implementation of innovative methods	-	-	20%	20%	60%	-	9%	27%	46%	18%
A better understanding of content	-	-	20%	20%	60%	-	18%	45%	27%	9%

In Table 8, we identify the main inhibiting factors for GBL implementation. Among those who already use the methodology, most respondents agree (4-point scale) that **lack of time, lack of resources, excessive class size in classes, and lack of adequate training** are factors that hinder the use of GBL in the classroom.

Among those who have never used the methodology, most respondents agree that the lack of specific training in GBL may be a factor that hinders the use of the methodology (scale 5 points). It can be seen that the variation in responses among participants who have already used GBL, is much smaller in contrast to those who have never used it.

This factor may emerge because respondents who have already used it, are more aware of the difficulties and obstacles, while those who have never used it find it difficult to make this analysis.

Table 8. Obstacles identified with the implementation of GBL

Obstacles identified with the implementation of GBL	Use Game-based learning									
	Yes					No				
	1	2	3	4	5	1	2	3	4	5
Lack of framework/adequacy with programmatic contents	-	-	100%	-	-	-	18%	36%	27%	18%
Scarcity of time	-	-	-	60%	40%	9%	-	19%	36%	36%
Lack of resources (e.g. rooms, equipment, utensils, materials, etc.)	-	40%	-	40%	20%	18%	9%	27%	37%	9%
Excessive class size	-	20%	-	40%	40%	-	-	27%	46%	27%
Program/time charge does not allow activities of this nature to be combined	-	20%	60%	-	20%	18%	18%	27%	9%	28%
Lack of specific training in GBL	20%	-	20%	40%	20%	-	9%	18%	27%	46%

Finally, about the question on the reason, they have never used GBL the reply was the lack of training opportunities. The results show that 70% of the respondents mentioned that if they had training opportunities, they would feel motivated to start introducing and developing this methodology in their teaching (see Table 9). Therefore, the development of teaching materials, teaching guidance is pointed out as one of the main enablers for the increase in using GBL, and EER, in a classroom context.

Table 9. Training opportunities

If you could have access to training and development opportunities in applying GBL		
	Yes	No
Start introducing this methodology in my classes	70.3	13.5
Be very motivated to develop the methodology	70.3	13.5

4.2 Questionnaire 2: Use of Educational Escape Room

Questionnaire 2, was developed **specifically for users of EER**. Both beginners and experts. The aim was to identify the knowledge, skills, and main difficulties reported by those using EER.

Regarding the demographic data in questionnaire 2, concerning gender, the percentage was balanced, with 52.4% of respondents being male and 47.6% female. The minimum age was 23 years and the maximum age was 60 years (see Table 10).

Table 10. Demographic characteristics

Demographic characteristics	Frequency	Percent
Gender		
Female	20	47.6
Male	22	52.4
Age		
Between 20 and 30	7	16.4
Between 31 and 40	9	21.2
Between 41 and 50	15	36.0
Between 51 and 60	11	26.4
Total	42	100%

About the level of education at which the educator teaches, 25 (59.5 %) teach in higher education, 7 (16.7%) in basic or secondary education, and 10 (23.8%) in others. In others, we have answers from researchers applying EER and educators in technical and vocational education.

Table 11. Experience in EER

Beginner or Specialist									
Applying					Developing				
1	2	3	4	5	1	2	3	4	5
23.8%	7.1%	7.1%	35.7%	23.8%	21.4%	4.8%	14.3%	31%	28.5%

Respondents were asked about their opinion on the application and development of EER, whether they consider themselves beginners or experts (a 5-point Likert scale, where 1 represents beginner and 5 experts). Mostly, consider themselves experts (Table 11).

Following this, we aimed to understand in which scientific fields are this type of games, such as educational escape rooms, applied. We formulated this question as a simple “Yes or No”, to conclude about which scientific field is more prone to the use of EER.

The respondents could answer “Yes” more than one time if they thought the methodology could be used in more than one field. According to the respondents, Natural Sciences, Engineering and Technology, and Arts and Humanities are the areas more prone to the application of these activities, with Agricultural Sciences being the least considered area when applying these methodologies. Table 12, presents these results.

Table 12. Most cited scientific fields for EER use

EER fields of application	Yes	No
Natural Sciences	17	25
Engineering and Technology	20	22
Medical and Health Sciences	10	32
Agricultural Sciences	4	38
Social Sciences	10	32
Arts and Humanities	16	27

We used closed questions in which the respondents had to rank, with a 5-point scale a list of competences, reported in the research and case studies. The aim is to identify which are the competences for using EER. Regarding pedagogical competences, the most mentioned by the educators that use EER are **mentoring, the alignment between the games and learning, identify new methodologies, and post-game assessment.** The results can be found in Figure 2.

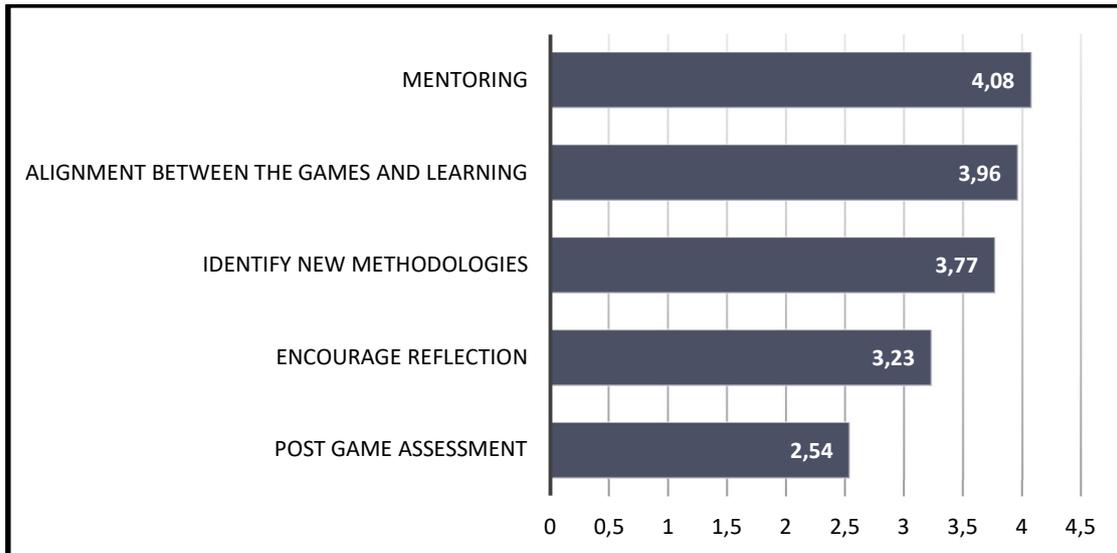


Figure 2. Pedagogical competences: identified by experts as most important

Concerning the technological competences, the ones mentioned as more relevant are **deep content knowledge, experience with games and GBL, design thinking, digital self-efficacy, and technological know-how** (see Figure 3).

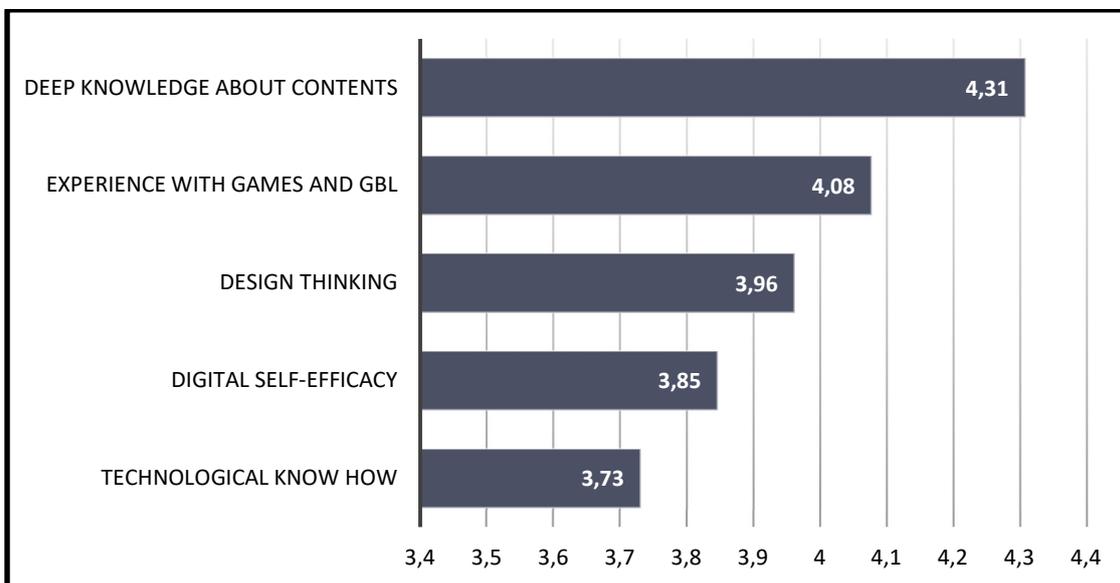


Figure 3. Technological competences: identified by experts as most important

On social and collaborative competences, the experts identify as the most relevant **open mindset, perseverance, and self-confidence, creativity, capacity to innovate, teamwork and flexibility, and adaptation** (see Figure 4).

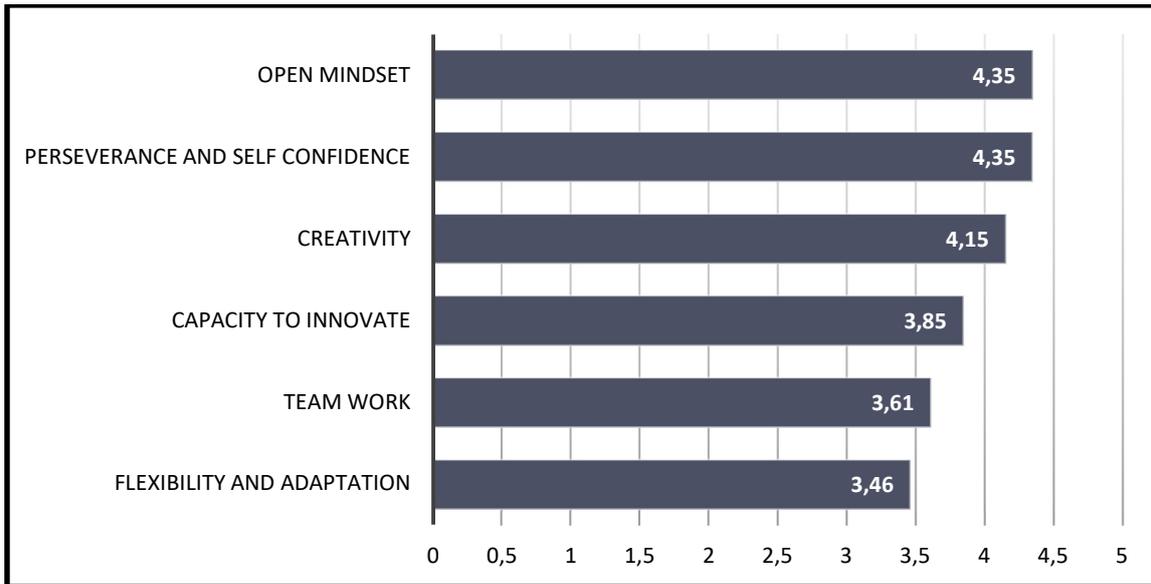


Figure 4. Social competences: identified by experts as most important

We also identified institutional context and support that may inhibit the development of EER activities. **Cooperation among teachers, time management, guidelines and university support, appropriate environment, and availability of tools and resources** (see Figure 5).

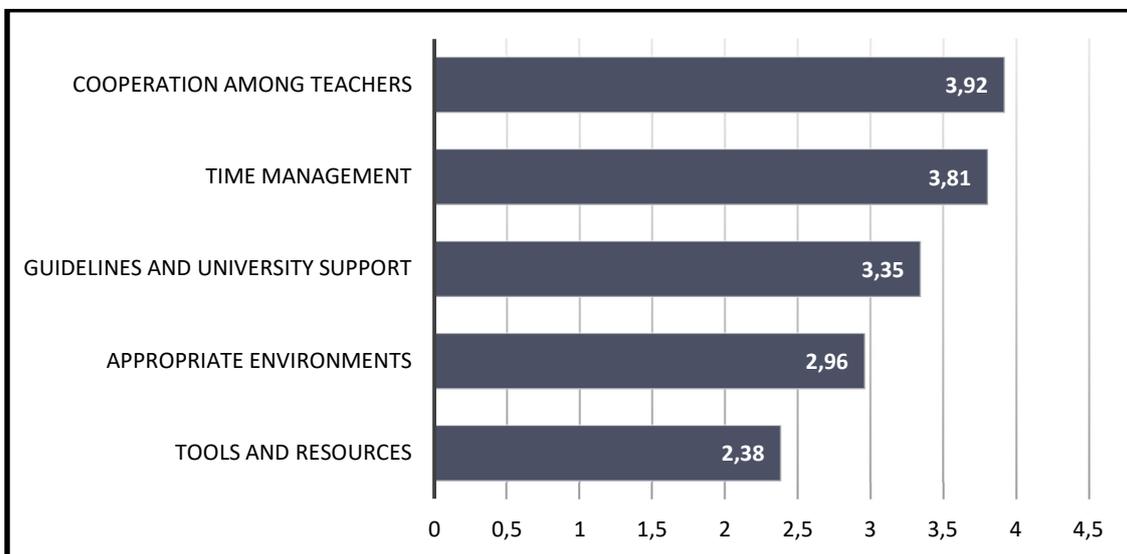


Figure 5. Institutional context and support: identified by experts as most important

Based on the results of the questionnaires, we were able to validate and highlight 16 main pedagogical, technological, and social competences that are needed by facilitators of EER activities. We stress the importance of the 6 factors related to institutional context and support, several times mentioned in studies, interviews, and questionnaires. The institutional context is not considered a competence, but they are facilitators of the use and success of the EERs activities.

In the questionnaire, we asked open questions for respondents to add information about the competences they consider important, and which were not mentioned in the questions. **We can highlight competences that were widely cited such as empathy, curiosity, resilience, patience, problem-solving, communication, and passion.** These results suggest that in addition to the technical and pedagogical skills to facilitate EERs, the educator needs to have a genuine desire to test the methodology and learn from mistakes. It is also extremely important to develop social, creative, and cooperative competences in their academic environment.

5. COMPETENCES ANALYSED FROM EXPERIENCES AT THE TIME OF THE PROJECT

The partners of the UNLOCK project in Granada developed a Digital Educational Escape Room (DEER). During the creation, we asked the partners to record the process of the design of the EER and the attitudes, knowledge, and obstacles encountered during this activity.

One of the great difficulties reported was to design the narrative of the EER, aligning the physical contents with the game and ensuring the consistency of the teaching method with the fun “The hard part is finding a gamified method that achieves both consistency and fun”. The challenge encountered in this process of narrative design went through ways of finding gaps in traditional teaching that could work better with GBL and of searching in theory for all the justification for the game design “The difficulty that we have encountered when consistently designing the narrative has been to find purely theoretical and mathematical justifications for constructing the laws of physics. From my point of view, it is the most important part”. In the creation process, doubts also emerge about the insertion of the methodology, since the difficulties encountered in the process “Let us remember that methodologies based on gamification are not always better alternatives to the classic method. The big question is: when are they useful? This question comes up again and again when you are developing the narrative, especially when the plot becomes complex and wonder whether it’s worth gamifying.”

During this activity, it was possible to identify the concern with several competences reported in the study. In the pedagogical competences, we can mention the concern with the alignment of the games and the students' post-game assessment. In the technological competences, we highlight the design thinking, the familiarity with digital tools and GBL, and the deep knowledge about the content, that made the experience easier to be executed. In the social competences, we can identify creativity, the ability to innovate, perseverance, and confidence in accepting the proposed challenge and completed the experience. Furthermore, the cooperation with other partners is fundamental, in this case, other educators and experts in EER were invited to evaluate the tool created before it was directly executed with the students of the institution (see Appendix 3).

6. PEDAGOGICAL FRAMEWORK

The pedagogical framework is an instrument to integrate the various competences of educators. This framework may guide educators and institutions with the necessary competences to be developed to facilitate GBL in teaching and learning, with the final goal of improving student learning (Young & Bush, 2004).

Thus, this pedagogical framework emerges with the aim of establishing a common framework of competences needed to be developed for an educator to be a GBL facilitator, in particular, in the EER activities, and to be used in the development of the MOOC (Massive Open Online Courses).

These competences apply to educators in all fields of education, social sciences, natural sciences, exact and health sciences. In our research, we obtained feedback from educators from these various domains. This list of competences is also applied to the institutional system and to those involved in supporting education. It seeks to assist education stakeholders to support educators in developing the various competences they need to become EER facilitators.

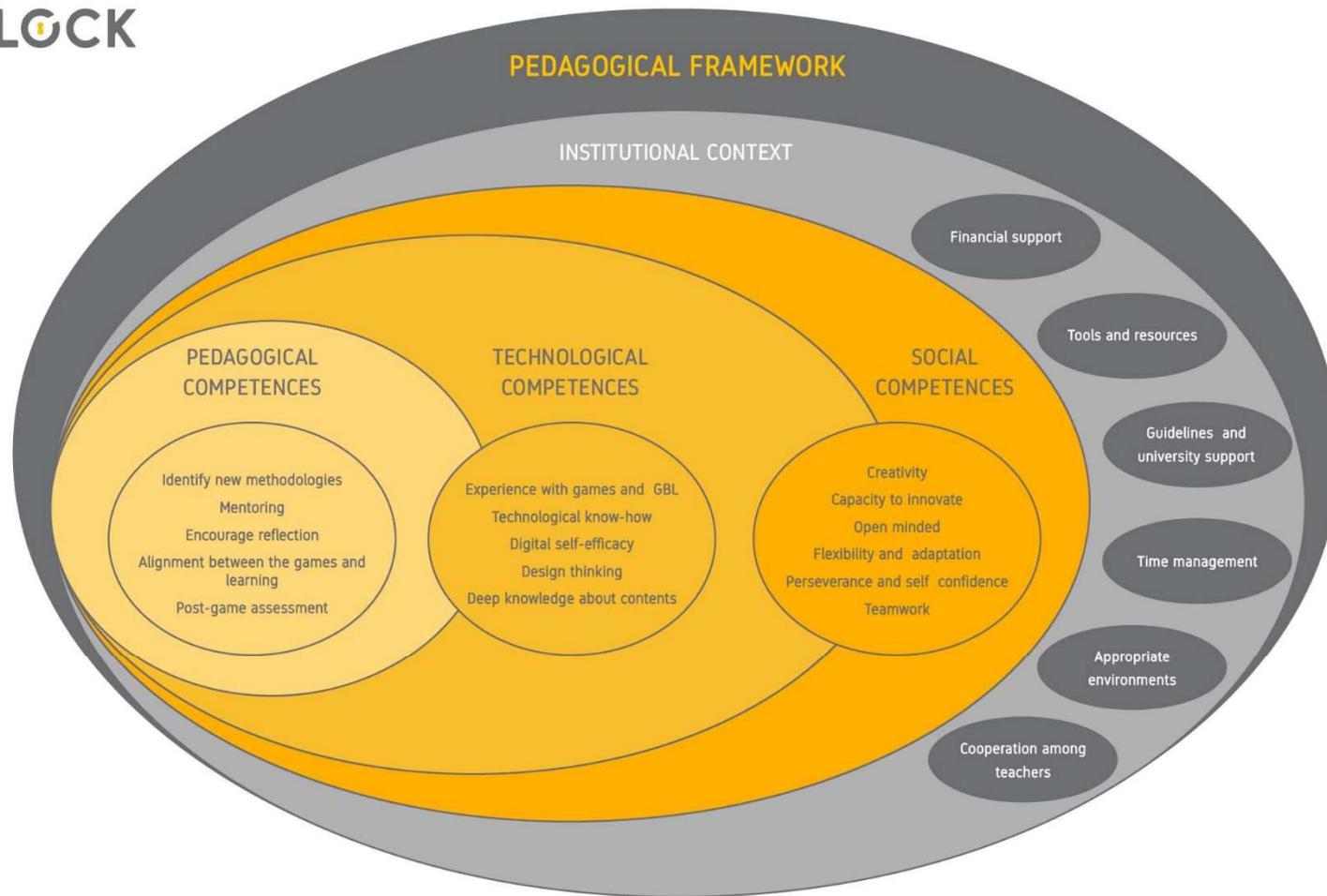
It is important to note that EER has different characteristics in physical and virtual environments. And the educator needs to have different skills, competences, and attitudes in both domains. Examples of the application of different skills in different environments will be developed in the MOOC that will be developed in the UNLOCK project with free access for educators who wish to apply and develop EER in their institutions.

6.1 Conceptual pedagogical framework: our proposal

Our proposal for the conceptual pedagogical framework is described in Figure 6. Our reasoning is based on the above methodology to find the set of competences that need to be developed and also on the institutional context and support (enablers).

All 3 areas are interconnected and the 22 competences are related. They must all be treated as part of a whole. Even the institutional support content needs to be related for the GBL methodology to be effective and be sustained in the long term.

In the questionnaire, we identified the degree of importance of the competences, but depending on the context of adoption, it is reasonable to expect that more emphasis will be placed on some of the competences and less on others. Or else that the competences are simplified in the adoption of EER activities. In other words, this Pedagogical Framework can be seen as a starting point for interpreting educators' competence, which over time will be further elaborated and refined to meet the particular needs of specific target groups.



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Figure 6. Conceptual Pedagogical Framework

6.2 Description of competences

In Table 13 all the competences are listed, and each one is accompanied by its description and a brief suggestion so that it can be put into practice by educators.

Pedagogical skills are one of the most important competences to be developed in the GBL methodology. It is considered the differentiating factor between games for fun, and games for learning environments. Educators, in general, have these skills and knowledge and apply them in their classes in different activities. During GBL activities the same happens, the pedagogical approach needs to be present, focusing on learning, but actively.

Table 13a. Description of competences

PEDAGOGICAL		
Knowing how to identify new methodologies	<ul style="list-style-type: none"> To identify and plan meaningful activities for teaching; To understand how the new methodology may help in the teaching and learning process. 	<ul style="list-style-type: none"> Identify the strengths and limitations of new methodologies; Plan the objectives you want to achieve with this methodology.
Mentoring	<ul style="list-style-type: none"> The educator needs some sense of the abilities of their students, to determine the length, complexity, and/or difficulty of 	<ul style="list-style-type: none"> Engage, guide and support students, to the success of the methodology; Monitoring of activities in order to ensure the achievement of the intended objectives.
Encourage reflection	<ul style="list-style-type: none"> Need to guide the game approach to the learning process; Ability to identify moments of learning and reflection during the games. 	<ul style="list-style-type: none"> Ensure effective communication; Ensure synergy between student engagement and games; Be motivating and supportive.
Alignment between the games and learning	<ul style="list-style-type: none"> Ability to align EER activities to the learning outcomes; Integrate the approach according to the curriculum objectives, with the students' preferences and demographic and socio-cultural differences. 	<ul style="list-style-type: none"> Evaluate the curriculum content and use of EER to influence the promotion development of students' basic skills.
Post-game assessment	<ul style="list-style-type: none"> Identify, report and collaborate in the treatment of learning; Identifying and planning the resolution of educational situations that affect students with different abilities and different learning rates; Ensure the evaluation of the activity. 	<ul style="list-style-type: none"> Needs an effective debrief/reflection strategy to highlight the learning goals; Observation.

Table 13b. Description of competences

TECHNOLOGICAL		
Experience with games and GBL	<ul style="list-style-type: none"> • Experience with games or some basic literacy about different game approaches; • Playfulness; • Playing skills; • Aptitude for games. 	<ul style="list-style-type: none"> • Playing escape rooms • Enjoy the activities they are doing
Technological know-how	<ul style="list-style-type: none"> • Being able to troubleshoot technical challenges. 	<ul style="list-style-type: none"> • The educator needs to know alternative tools; • It is useful to always have partners who may help; • Be prepared for the unexpected.
Digital self-efficacy	<ul style="list-style-type: none"> • Digital competences; • Familiarity with digital technologies and media. 	<ul style="list-style-type: none"> • The educator should keep up to date with the latest digital trends
Design thinking	<ul style="list-style-type: none"> • Knowing the and practical process for developing the narrative and game activities. 	<ul style="list-style-type: none"> • Create/Idealise the idea to be developed in the games; • Test the idea and make sure the narrative is well constructed.
Deep knowledge about contents	<ul style="list-style-type: none"> • Master the use of the tool. • Understanding the basic principles and fundamental laws of the active learning process. • Ensure the evaluation of the activity. 	<ul style="list-style-type: none"> • The educator needs to keep updates about with experts and professionals in game design, by knowing experts and professional work; • Identifying your training needs.

Technological and technical skills include the ability to develop games, design thinking, and the facility to use digital systems for the creation, development, and application of GBL and EER. These skills can be acquired through training and increased familiarity with the applications. In the MOOC examples for using and training these skills will be exposed.

Table 13c. Description of competences

SOCIAL		
Creativity	<ul style="list-style-type: none"> • Creative thinking; • Ability to discover new and original ideas, connections and solutions to problems. 	<ul style="list-style-type: none"> • Be curious, use your imagination; • Be communicative, empathetic and a storyteller.
Capacity to Innovate	<ul style="list-style-type: none"> • Ability to encourage new activities in teaching; • Getting out of the conventional teaching methods. 	<ul style="list-style-type: none"> • Understand game trends that can be useful to collaborate with educational practices.
Open minded	<ul style="list-style-type: none"> • To be open to new teaching methodologies; • Motivation to learn and leave their comfort zone. 	<ul style="list-style-type: none"> • Think out of the box; • Be enthusiastic and energetic to conduct activities
Flexibility and adaptation	<ul style="list-style-type: none"> • Think and act under pressure; • Logical thinking; • Problem-solving skills. 	<ul style="list-style-type: none"> • Adapt to the situation; • Improve; • Be authoritative during the activity, if necessary.
Perseverance and self confidence	<ul style="list-style-type: none"> • Be persistent and not to be afraid of failing; • Failure resilience; • The educator needs to his own potential to be an EER facilitator. 	<ul style="list-style-type: none"> • Be disciplined and organised; • Be patient; • Willing to try and fail and try again.
Teamwork	<ul style="list-style-type: none"> • Working and mobilizing others; • Cooperation; • Collaborative effort to develop and implement EER activities. 	<ul style="list-style-type: none"> • Meet and promote interaction processes, cooperation strategies and teamworking; • Create ideas together.

Social, creative, and collaborative skills are attitudes and competences developed throughout life. It can be difficult to arouse interest and collaboration in individuals who are intrinsically unmotivated to use this methodology.

However, in conducting this study through testimonials we found that even individuals who are unmotivated to use this methodology may be more likely to experiment if they

have institutional support, support from a community and colleagues in the institution and platforms which help them to develop the necessary knowledge and feel confident in experimenting with this active teaching methodology.

Table 13d. Description of competences

INSTITUTIONAL SUPPORT		
Guidelines and university support	<ul style="list-style-type: none"> • Harmony with school administration aims; • Guidelines to help teachers adopt pedagogical strategies that foster creativity. 	<ul style="list-style-type: none"> • Establish clear pedagogical objectives; • Provide institutional support for teaching innovation.
Tools and resources	<ul style="list-style-type: none"> • Physical resources, equipment, tools for game creation. Human resources. 	<ul style="list-style-type: none"> • Be an institution that encourages professional development courses; • Providing research on gaming activities.
Financial support	<ul style="list-style-type: none"> • Financial support to encourage and promote sustainability of EER activities. 	<ul style="list-style-type: none"> • Provide additional support for the acquisition of materials, training and human resources for the development of these activities.
Time management	<ul style="list-style-type: none"> • Sufficient time to prepare a game, and to reconcile them with the various other teaching and research activities. 	<ul style="list-style-type: none"> • Provide reconciliation of the time needed by educators in teaching and research activities.
Cooperation among teachers	<ul style="list-style-type: none"> • Engagement of colleagues on the institution; • Acceptance and rewarding of educators using these activities. 	<ul style="list-style-type: none"> • Motivation for educators to use new teaching approaches. • Fostering cooperation.
Appropriate environments	<ul style="list-style-type: none"> • Appropriate environment for EER activities. 	<ul style="list-style-type: none"> • Provide an environment that can be used by various classes in the institution and adapted for various themes.

6.3 Competences according to the phases of the EER

In our study, after the definition and organization of the competences according to a specific group, it was observed that although the competences are necessary throughout the process of the EER, some of them have greater prominence and are more often mentioned in specific phases of the adoption of this methodology. The main phases reported can be summarized in planning, game design and creation of puzzles, execution, and post-game phase.

In Figure 7, we present the competences previously defined in the pedagogical framework according to need at each stage of the EER methodology.



Figure 7. Most frequently competences in each phase of the EER

Once the educator decides to create an escape room, the **planning** phase is essential. This implies being **open to new methodologies** and identifying the types of game methodologies that their agenda and curriculum allow. Teachers' experience in using games for instruction not only require them to be able to choose games with appropriate characteristics but also to ensure **alignment between the games and learning**, thus, first of all, the educator needs to **know the pedagogical content** in order to be able to establish an alignment between games, curricula and learning outcomes (Molin, 2017).

For an EER to be adequately developed it should be planned according to the needs of the participants, the age group, and the level of difficulty of your audience should be considered, to create a pleasant experience with the expectations of the users. **The capacity to innovate** and be **open-minded** is essential for an EER facilitator.

The educator must think “outside the box” and create purposeful learning environments. As with any lesson plan, it is important to establish tangible learning and skill development objectives and how these objectives will be achieved. This phase should take into account some important points such as encouraging active learning, communication, creativity, collaboration, and critical thinking, and at the same time be

effective on the applied knowledge related to the area for which the escape room is being designed (Clarke et al., 2017).

Once the planning has been defined and the intended objectives have been aligned, **the game design and the creation of the puzzles** or the choice of these must be done. For this, it is important that the educator, in addition to **creativity**, to develop an immersive game narrative, and consistent with the intended objectives should have some **experience with GBL** (Eukel et al., 2020).

In this sense, some basic literacy about different gaming approaches aligned with some knowledge of **design thinking** will lead the educator to possess greater confidence in designing and creating a gamified experience. Training in specific courses on GBL and EER will lead the educator to be familiar with the different concepts of the subject, and so they can carefully analyze the strengths and weaknesses of each methodology and know how best to incorporate them into their content to maximize learning and make the experience useful for student motivation and development (Chen et al., 2020).

In the creation phase possessing **digital self-efficacy** is beneficial for the educator. **Technological knowledge** and **digital skills** are of great importance during the development of EER. Educators who have more familiarity with digital technologies and media tend to show more competence in games knowledge (Linderoth & Sjöblom, 2019).

Having a support network that assists the educator in the design and organization phase of the ER will facilitate the development process. Several studies show that students themselves, researchers, and other stakeholders assist the educator in this process. Mobilizing partners to assist in developing ideas and collaborating in the process is critical to the success and sustainability of this methodology (Nousiainen et al., 2018).

Now, we seek to postulate the necessary competences for the **execution** phase of the EER. As the third part of the process itself, the execution is where all of the preparation unfolds, and the game is played by the students. While the escape room is being played, the educator will have to supervise the participants' actions and guide them, providing them with hints if they get stuck. While it is usually the purpose of hints to ease the difficulty of the game, creating paths to confuse the players can provide an additional challenge and thus, increase the difficulty of the game. However, this methodology should be implemented with caution, as it may be a reason for confusion and frustration (Nicholson, 2016).

For this part, some specific competences stand out: the educator needs **technological know-how** to provide technical assistance when needed and be able to solve simple technical problems during the game. The facilitators need to know how to find different paths to the main goal during the activity and need to be prepared for the unexpected, to be **flexible and adaptable** to different situations, to improvise, and to act under pressure.

At this stage, another key competence is **mentoring** for know how-to guide and support the students during the game sessions. The students need to feel engaged and supported during the activity, and the narrator must be clear and coherent with the tasks performed,

whether it is giving hints or guidance, to avoid confusion among the players (Järveläinen & Paavilainen-Mäntymäki, 2019). At this stage it is also crucial that the educator **engages in teamwork**, mobilizing support and collaboration for the implementation of the activity.

When the game is finished, the **post-game assessment** phase starts. Here, the educator will conclude the experience, discuss it with the students and grade them. Many ways of grading an EER were proposed, like Ho (2018) who proposes a grading scheme based not only on the performance within the escape game but also on other factors such as preparation and post reflection.

Nicholson (2018) argues that escape games serve the purpose of supporting students to develop an intrinsic learning motivation that is guided by curiosity instead of motivating them with grades. Moreover, grading the students' performance in the escape game might increase the anxiety of the participants.

So, to grade and maximize the students' experience, the facilitator needs to develop some specific competencies. Knowledge and skill in-game analysis is important so that the educator can draw the right conclusions on each student. The educator must also foster post-game discussion, and **encourage reflection**, allowing the students to understand the whole process and the most important takeaways.

The facilitator will need to help students to see the relevance of this acquired knowledge beyond the classroom, as EER is an innovative teaching method, and usually, it is expected that the students develop some soft skills beyond purely academic knowledge.

In the case of the students who cannot solve the ER, the educator needs to encourage future activity despite the failure, to **be perseverant and self-confident** keeping in mind that even if the outcomes of the escape room are binary, meaning that either the student escapes it or he does not, it is not only the outcome that is important, instead, the whole experience must be accounted for, meaning that both the student and the educator benefit from the ER and develop skills, even if the former fails the activity.

Guidelines and institutional support will linearly support the entire process. To develop and apply an EER the educator will need **tools and resources, financial support, an appropriate environment, time** - to plan, design, apply and evaluate an ER - and **collaboration with other partners**. Educators need to know more about this approach and the potential of this methodology to engage other colleagues and supporters and to foster a support network and community for the further development of this methodology in HEIs.

7. PERSONA: OUR PROPOSALS

The Persona for this study sought to identify and reflect the profile of the educator that may act as a facilitator in EER activities (knowledge, attitudes, skills, roles). The

information for creating the persona was identified from the previous research activity, case studies, questionnaires and summarised in an appealing format of a real educator profile.

These Personas will present the main content in the pedagogical framework in a more accessible way and for general educators to relate to their work. Ultimately, these personas aim to motivate European educators and educational agents to develop the profile of game-based facilitators to perform and benefit from these activities, promoting their growth and long-term sustainability.

Personas in the context of development/application of GBL, and in particular EER, approaches, and methodologies can be framed by (at least) two criteria (that emerged as relevant in the previous desk research):

- The first criteria relate to the inherent characteristics of the professor/educator (variables to characterize this dimension involve technology competence, innovation profile, experience, etc.)
- The second criteria refer to the educational/institutional context (e.g. being in an HEI where the environment and incentives are more favorable to the experimentation with new methodologies and teaching and learning approaches).

The conceptual proposal initially created by the team can be seen in Figure 8.

Consequently, the educator's 'persona' can be positioned in different quadrants (e.g. innovative educator (+/-) versus innovation-friendly environment (+/-)).

In this study, we summarise 3 proposals for the profile of educators who can be facilitators of GBL and EER methodologies. We consider the competences, attitudes, and motivations when the educator is prone to adopt the methodology and when he/she is not, but has a favorable environment for its use.

- Persona 1/Type 1 - (educator motivated (+) / favourable environment (+))
- Persona 2/Type 2 - (educator motivated (+) / unfavourable environment (-))
- Persona 3/Type 3 - (unmotivated educator (-) / favourable environment (+))

Clearly and visually, through the highlighted skills of each persona, your expectations, resources, and motivations, the UNLOCK project sought to exemplify some of the profiles of educators who can use this methodology in their classes. The final proposals of the personas can be seen in Figures 9, 10, and 11.

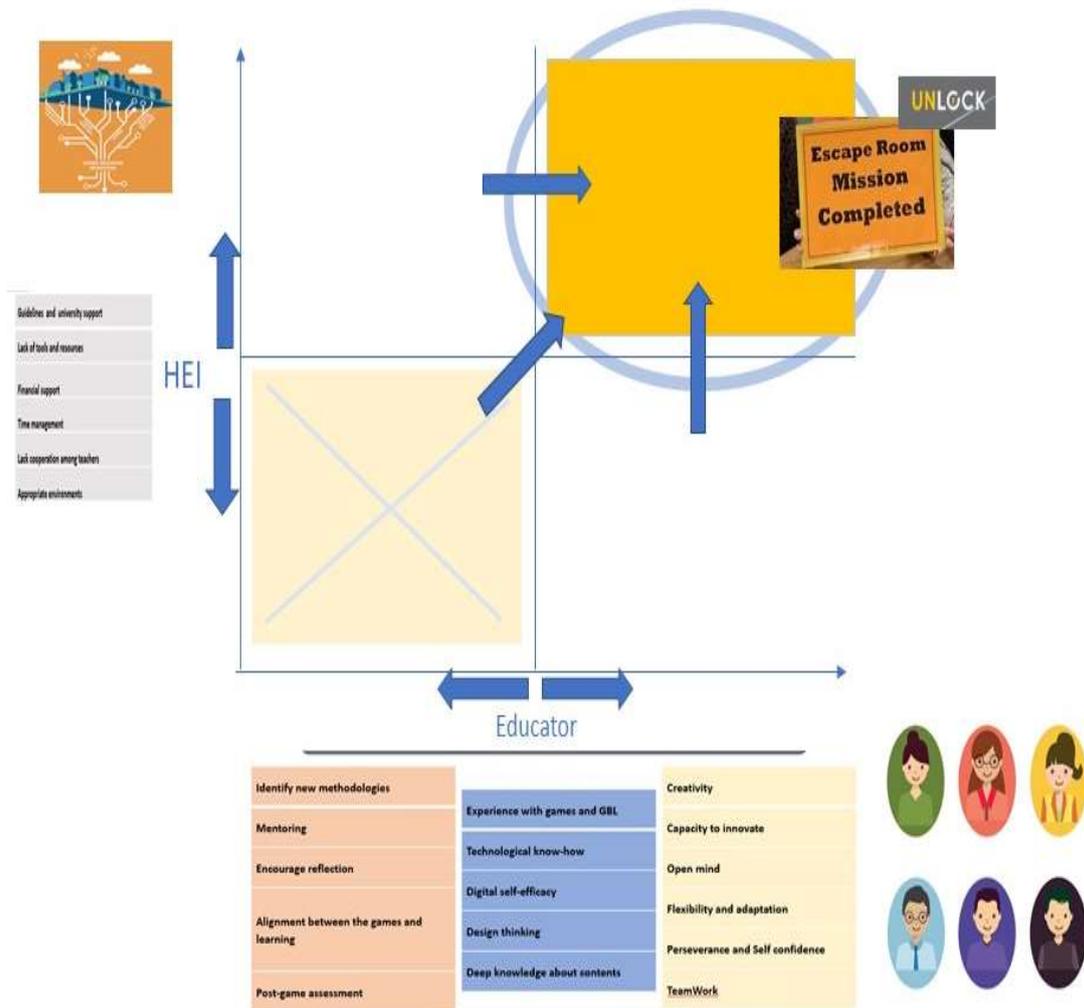


Figure 8. Conceptual proposal of educators' profiles

The development of this conceptual and review work will be put into practice with the creation of the manual and MOOC for EER.

Before creating the MOOC fieldwork it was necessary a literature review on the topic, interviews, case studies, questionnaires, and practical activities. With these activities, we sought to delve deeper into the topic of GBL activities and in particular EER activities in the European context.

With a clearer panorama of the challenges, motivations, and opinions of educators who conduct and develop EER, we may establish guidelines for the creation of a manual and a specific MOOC to help educators to develop and implement these activities in higher education institutions and to propagate these activities and contribute to their sustainability.

CHARLOTTE



**MOTIVATED/EXPERIENCED
EDUCATOR IN A FAVORABLE
ENVIRONMENT**

**EXPERIMENTATION WITH NEW
TECHNOLOGIES**

DESIGN THINKING

FLEXIBILITY AND ADAPTATION SKILLS

COOPERATION AMONG TEACHERS

GUIDELINES AND UNIVERSITY SUPPORT

DESCRIPTION

Charlotte is a management higher education professor who has a vibrant international experience, collaborating with several universities and co-authors in several countries.

RESOURCES

She is very open to experimentation with new technologies and media, making use of online tools to engage her students and she is very involved in the development of non-formal learning activities for students and colleague researchers.

MOTIVATION

She has always been enthusiastic about the use of new teaching methodologies, namely design thinking, as well as mentoring, which reflects her flexibility and adaptation skills.

EXPECTATIONS

Loves to travel and to read and is easily caught daydreaming about new projects, ideas and destinations. Charlotte is very involved in the university activities and is very happy with the university environment that promotes innovation by conducting events about innovative pedagogy and offers opportunities and rewards for professors that experiment with new methodologies.

Figure 9. Persona 1/Type 1 – Motivated/experienced educator in a favorable environment

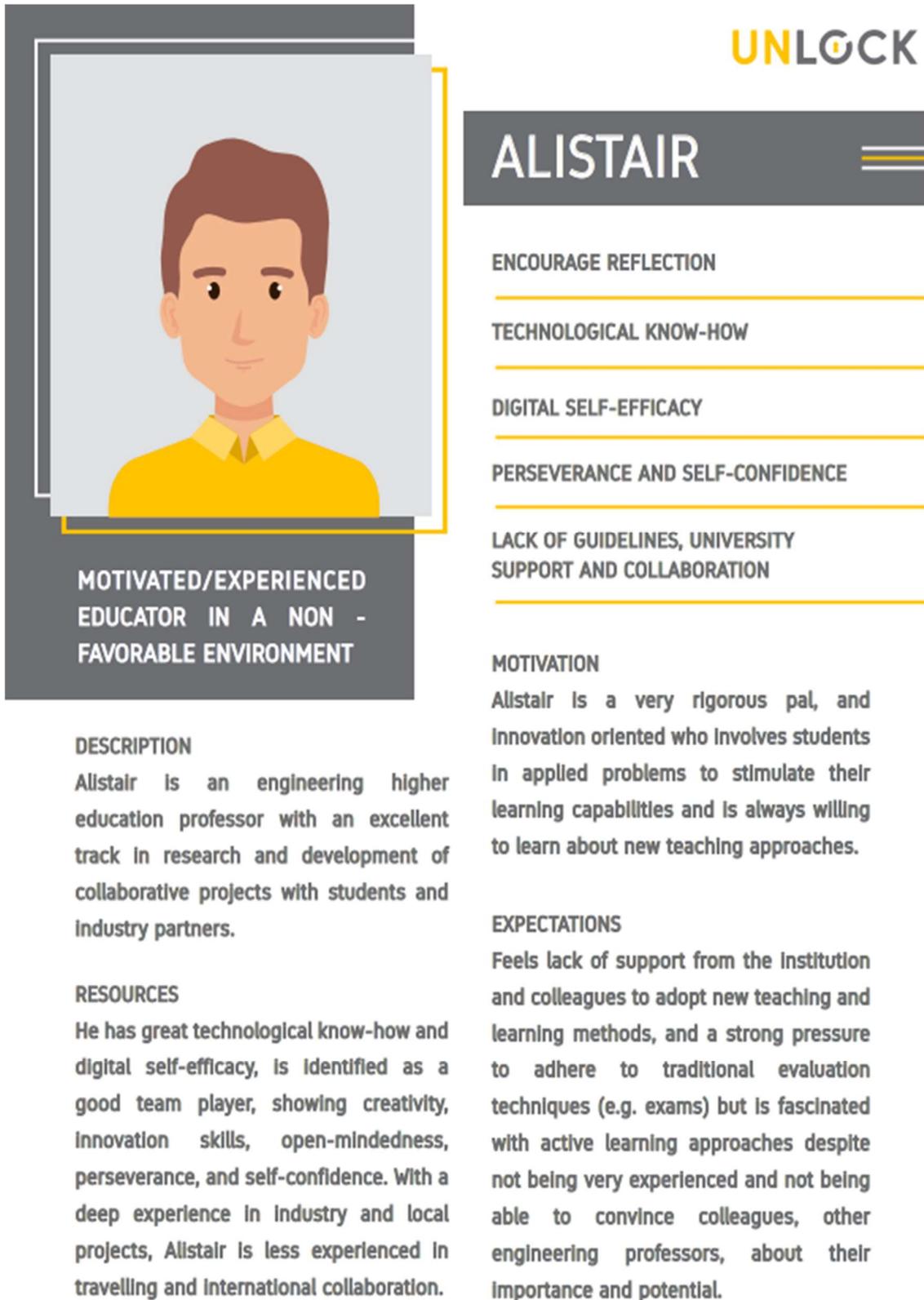


Figure 10. Persona 2/Type 2 – Motivated/experienced educator in a non-favorable environment

JULIA



**NON MOTIVATED/ NON
EXPERIENCED EDUCATOR IN
A FAVORABLE ENVIRONMENT**

GUIDELINES AND UNIVERSITY SUPPORT

APPROPRIATE ENVIRONMENTS

TOOLS AND RESOURCES

TEAMWORK

DEEP KNOWLEDGE ABOUT CONTENTS

DESCRIPTION

Julia is a very competent Economics higher education professor who, despite being open to new ideas to improve her teaching abilities and being an excellent teacher, is afraid of not being able to fully comprehend and utilize new technologies.

RESOURCES

Besides being afraid of not being perfectly able of utilizing new teaching methods, Julia may benefit from a well-rounded community of educators who are comfortable with helping her understand the benefits and how to better apply these practices.

MOTIVATION

As she already is an outstanding teacher with proven results, sometimes Julia doesn't fully have the motivation to introduce new teaching methods.

EXPECTATIONS

Julia is already a well-established and recognized teacher in the university. So, her usual expectations are to keep teaching the way she always did. She expects each year to be about the same as the last year, however, if she can recognize that an activity has a proven benefit to the students and she can be taught how to maximize its utility, she will surely make an effort to integrate these methods.

Figure 11. Persona 3/Type 3 – Non-Motivated/ Non experienced educator in a favorable environment

8. CONCLUSIONS

This study sought to contextualize and understand the new role of educators in facilitating GBL, specifically, in EER activities. Based on this contextualization and additional research the elaboration of a Pedagogical framework was proposed, identifying the specific knowledge, skills, and attitudes that educators in HEIs need to develop to be able to design, frame, apply and evaluate escape rooms for educational purposes and foster students' creativity.

All these competences have been summarised in the creation of educator profiles for conducting EER activities. These profiles aim to gather the attention of educators from HEIs as well as other levels of education, training providers, and companies to become aware of the significance of facilitating a game-based activity.

This study is part of the UNLOCK project. It will support along with results from the project's research activity the development of an innovative and gamified Massive Open Online Course (MOOC) for HEI educators, on the design and application of escape room games for pedagogical purposes, and the development of creativity as an entrepreneurial skill in students.

To access an abridged version of this work, go to <https://www.unlock.eu/publications.html>. On the website, the abridged version is available in seven languages namely English, Danish, Dutch, German, Lithuanian, Portuguese, and Spanish.

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Appendix 1. Questionnaire 1 applied to educators in general (GBL)

- 1. Gender:**
- 2. Age:**
- 3. Where is the educational institution in which you teach?**
- 4. The institution where you teach is:**
- 5. What level of education do you teach?**
- 6. What is your main domain of teaching**
- 7. For how long have you been teaching (in years)?**
- 8. What is the highest level of education you completed?**
- 9. Are you familiar with the concept of Game-based learning (GBL)?**
- 10. Have you already use GBL methodologies in your teaching activities?**
- 11. Which kind of GBL have you already applied?**

Puzzles; Escape Room; Digital games; board games. Other. Please specify

- 12. In which domain have you (mostly) applied GBL?**
- 13. How many times have you used GBL in a year?**
- 14. What is your experience in developing GBL?**

On the next questions, considering the following scale, please use a range from 1 to 5 to rate your preferences: 1 – Strongly disagree; 2– Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly agree

- 15. Why haven't you used this methodology yet?** If you have applied this methodology. Please skip to the next question

Lack of framework/adequacy with programmatic contents
Scarcity of time to develop and implement the methodology
Lack of resources (e.g. rooms, equipment, utensils, materials, etc.)
Excessive class burden
Programme/time charge does not allow activities of this nature
Does not perceive effective pedagogical benefits in this methodology
Lack of specific training in GBL
Do not see any advantages on applying it
Other. Please specify

- 16. What are the main obstacles you identify in implementing this methodology?**

Lack of framework/adequacy with programmatic contents
Scarcity of time
Lack of resources (e.g. rooms, equipment, utensils, materials, etc.)
Excessive class size
Programme/time charge does not allow activities of this nature to be combined
Does not perceive/vision effective pedagogical benefits in methodology
Lack of specific training in GBL
Other. Please specify

17. Which advantages do you associate with the implementation of this methodology?

Increased student motivation
Better understanding of content
Active participation of students in the teaching-learning process
Possibility of developing transversal competences
Development of team work competences
Implementation of innovative methods
Better understanding of content
Other. Please specify

18. Which kind of transversal competences do you associate with GBL activities in students?

Autonomy	Perform under pressure
Ability to negotiate	Engagement
Communication	Responsibility
Creativity	Critical Thinking
Adaptability	Self-employed learning
Collaboration	Increased confidence
Anticipate situations	Take risks
Decision making	Problem solving
Argumentation	Leadership
	Time optimization

19. If you could have access to training and development opportunities in applying GBL you would... on a scale of 1 to 5, inform us of your interest:

start introducing this methodology in my classes
be hesitant to apply the methodology
be very motivated to develop the methodology
I am not interested in the methodology even with training courses

Appendix 2. Questionnaire 2 spread to experts and beginners EER

1. Gender

2. Age

3. What is your highest level of education?

4. How many years of total length of professional experience do you have?

5. If you are an educator/teacher in which level do you teach

6. For how long have you been using GBL in teaching (professional activity)?

7. Respond according to a 5-point scale, strongly agree and strongly disagree

How would you rate your experience in developing GBL?

How would you rate your experience in applying GBL?

How would you rate your experience in developing EER?

How would you rate your experience in applying EER?

8. Please, indicate which of the following scientific fields of application do you apply the games such as EER?

9. Did you start using games in a digital environment during the corona virus pandemic?

10. Please, consider a scale from 1 to 5, where 1- never, 2- rarely, 3- sometimes, 4- often, 5-always. For each sentence, please rate according to your opinion.

How often do you use games in educational environment context?

How often do you use digital EER in educational environment context?

How often do you use digital EER in in classroom face to face context?

I adapt my teaching style to different learners in an EER classroom.

I select effective teaching approaches to guide student thinking and learning

I use strategies that combine content, games and teaching approaches

I use EER to support student reflection and guide students to better understand a topic concepts learned during curricular activities

I use EER in student assessment assignment about their acquired knowledge

I feel have the technical competences I need to use games.

I choose to attend training on EER

I search and analyse different types of games for educational usage

I am able to digitally assist students when they needed it during the EER

I am part of EER networks, and I keep in touch with specialists

I search for innovations to add to my educational games

I feel competent with using EER

I feel competent with developing EER

I feel motivated using EER

I feel motivated developing EER

I adapt the games I use to different learning objectives

I have lack knowledge about where to find games

I have lack knowledge about how to use games

I have limited time to prepare my teaching activities

I am able to find colleagues that are willing to collaborate with me in EER

I feel that my students have low motivation for EER

My institution provides me with adequate technological, technical, and pedagogical resources to support EER

11. Please, considering a scale from 1 to 5, indicate your preferences: 1 – Strongly disagree; 2–Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly agree

I prefer using EER in the virtual environment.

I prefer using EER in face-to-face context

Educators who use EER in teaching must understand the concept behind using.

Educators who use EER in teaching need to be trained to use.

Educators who use EER in teaching need are open-minded to the latest ICT (information and communication technologies).

Educators who use EER in teaching are more willing to listen to students' suggestion in classrooms.

Educators who use EER in teaching cannot use EER effectively unless they get involved in game production.

Educators who use EER in teaching need to have a lot of free time to set up all the tasks and challenges in game production.

12.Name the 5 competences needed while applying EER.

13. Name the 5 competences needed while developing EER.

14. Name the 3 obstacles you needed to overcome to develop/apply EER.

Appendix 3. Challenges to the partners: do you dare...

Information on the process of constructing and using an Escape Room in Spain.

13 de Nov de 2020 3:58pm

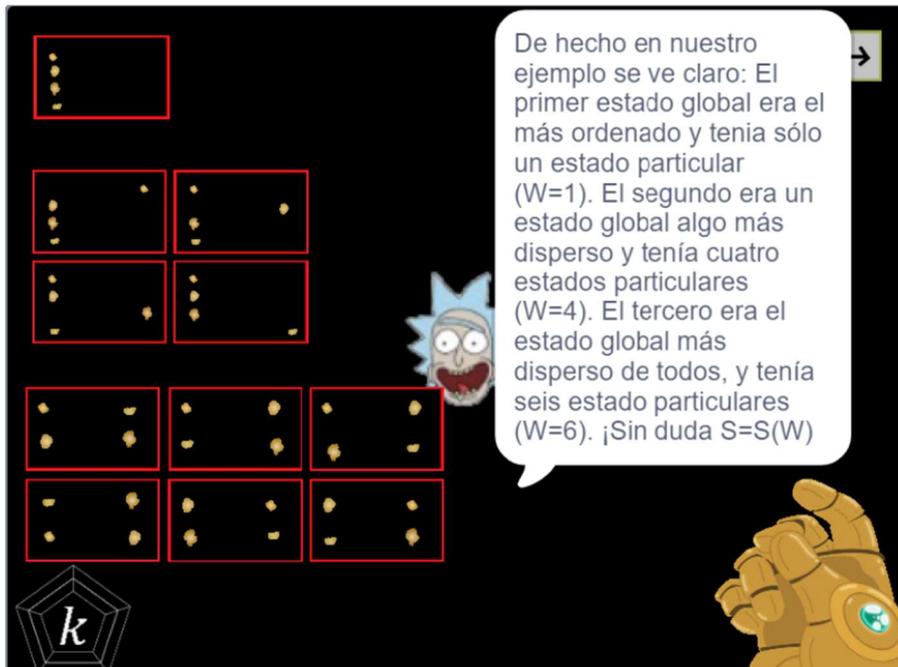
Diego Ruiz

In Granada is practically imposible to implement a physical escape room because of the current situation, so we have decided to implement it virtually.

Scratch is a plataform very interesting to do so. You can use it online for free, and save and play your project in the cloud. The programming language is easy and intuitive, and using some tricks, it is possible to collect/export data for analysis, i.e. how many right and wrong answers the players get (using "cloud variables", see

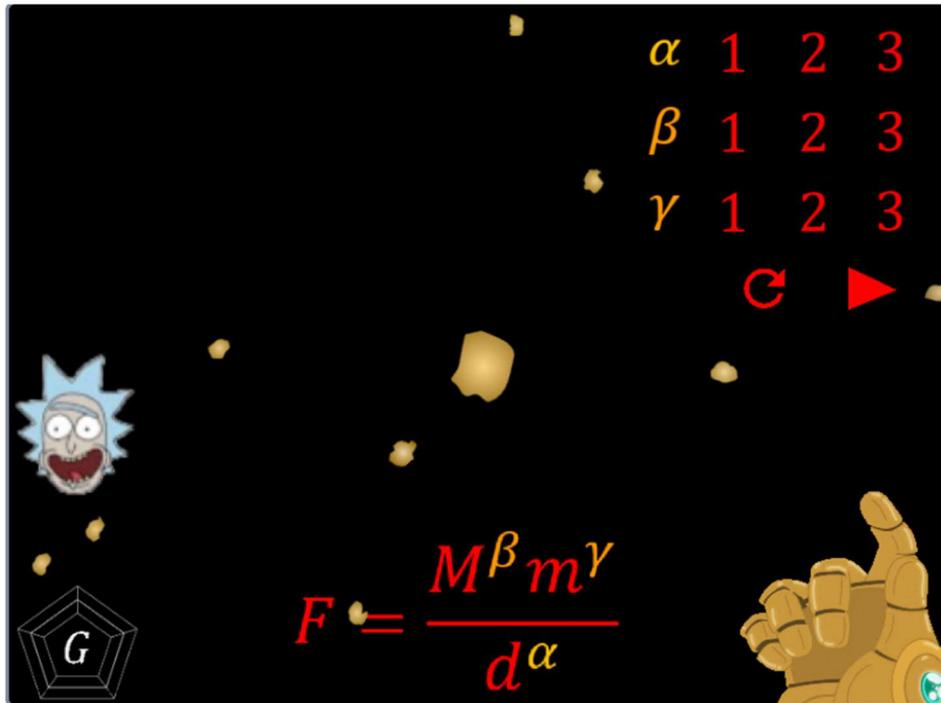
<https://scratch.mit.edu/discuss/topic/348711/?page=1#post-3521010>).

2 de Dez de 2020 8:24am



Our escape room

We have created a virtual escape room about physics with 5 rooms, each of which is related to a fundamental area of physics (e.g. Thermodynamics and statistical physics). The players have to create the universe right from the start, deducing the fundamental laws of nature. For each law constructed, a Planck constant is obtained, which serves as a key to the next room. Here are some images attached:



Developing the escape room narrative

Our theme is based on creating the universe right from the start. The difficulty that we have encountered when designing the narrative in a consistent manner has been to find purely theoretical and mathematical justifications for constructing the laws of physics. From my point of view, it is the most important part. Let us remember that methodologies based on gamification are not always better alternatives to the classic method. The big question is: when are they useful? This question comes up again and again when you are developing the narrative, especially when the plot becomes complex and you wonder whether it's worth gamifying.

The following criteria has been useful in our game: If the classic method doesn't cover some interesting point, and there is a gamified method able to do that in a consistent, fun manner, then it is a good alternative.

Generally, it is easy to identify the points where the classic method fails. The hard part is finding a gamified method that achieves both consistency and fun. Our case can serve as an example:

The second room of the game is about gravitation. In the classic method, this topic is relatively simple to teach: You show the students the Newton's law of universal gravitation, you explain how well it fits the experimental data (which is consistent), and then you are able to calculate the solar mass, the gravity of a hollow planet, or you can put into orbit the Elon Musk's Tesla Roadster (which is fun). The classic method is really good. But it has a weak point: Why that gravitation law and no other? Not even Newton was able to answer

this question. So it is an interesting question that we can approach with a gamified method.

Let's focus on consistency: In our game, in principle, the player can create her own law of gravitation however she wants. We can't tell her she has to make a law that fits experimental data because there is no experimental data in her universe. So we had to search in our classical mechanics books a theoretical reason to build the gravitation law as Newton did, and we found the Bertrand's Theorem, which states that, in celestial mechanics, the only force that result in closed orbits is the Newton's law of gravitation. Now let's focus on fun. We have a consistent plot. But we have not built a game to end up proving a boring theorem (that would be easier with a chalk and a blackboard), so we decided to make a real simulation of interacting particles, and let the students try different gravitational forces, until they found one that would give rise to stable orbits. Therefore, once the player comes up with Newton's law of gravitation, she will understand that it is the only logical alternative if she wants to create a universe with solar systems and galaxies.

We hope this reflection is useful for you!

24 de Dez de 2020 11:11am

SINALEAN

Evaluation

During the research phase of the project, we have realized that in most articles, the evaluation of escape rooms was carried out only trough questionnaires. In that sense, we have missed more objetive evaluation tools.

As we commented in a previous post, we decided to take advantage of the fact that our game is virtual to collect anonymous statistical data such as:

- Number of people playing the game
- Number of mistakes made in each puzzle
- Time spent in each enigma, in each room and throughout the whole game.

This data serve as an objective complement to weight the answers of a questionnaire at the end of the game. To link the statistical data with the questionnarie without compromising privacy, each player was given a random identification number.

We have focused the evaluation on the following points:

- Objectives achievement
- Game quality
- Interesting questions regarding gamification in the classroom

The evaluation process has been divided in two phases:

First, a dissemination of the game among a group of experts in the field of gamification, graphic design and in the evaluation of escape rooms. These testers have been sent an extensive questionnaire with technical questions.

After improving the game based on the opinion of the experts, the game will be disseminated among Physics students (first and second year) and among students of the master's degree on "Teacher Training for Compulsory and Upper Secondary Education, Vocational Education and Training (VET) and Language Teaching". This testers will be given a different and shorter questionnaire.