



IDEAL-GAME

*Improving didactics, education and learning
in higher education with the Online Serious Game Creator*

O1-A3-Summary Research Report

University of Paderborn

Project Title: Improving didactics, education and learning
in higher education with the Online Serious Game Creator

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Project partners:

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P2	Ingenious Knowledge GmbH (IK), DE
P3	Universitatea din Pitesti (UPIT), RO
P4	Wyższa Szkoła Ekonomii i Innowacji w Lublinie (WSEI), PL
P5	University of Dundee (UoD), UK
P6	Universidad a Distancia de Madrid SA (UDIMA), ES

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1 Executive Summary

This Summary Pedagogic Research Report focuses on the research results concerning the desk-based research and field-based research relating to the Intellectual Output 1. Moreover, this report presents findings acquired in a research process carried out between December 2020 to May 2021 by six project partners in five European countries (Germany, Romania, Poland Scotland/UK and Spain) in the framework of the IDEAL-GAME project (Improving didactics, education and learning in higher education with the Online Serious Game Creator), financed by the Erasmus+ Programme of the European Commission.

IDEAL-GAME focuses on the design of an Online Serious Game Creator and addresses the creation, testing and evaluation of Mini OER Serious Games within learning scenarios. Generally speaking, the approach aims to enhance didactics and learning in higher education with the help of an Online Serious Game Creator. This IDEAL-GAME tool will offer the chance to create different types of small Serious Games which can be integrated into modules and lectures: e.g. (a) Serious Games for learning professional and subject-related vocabulary, (b) Serious Games for assessment of corresponding facts and terms, (c) Serious Games which focus on process flows, (d) competitive serious games to enhance learning as well as (e) Puzzle Games to become acquainted with models and theories etc. Moreover, the partners will also collate best practice learning and teaching resources.

The proposed research to be conducted in each partner country will:

- gather information on the use of Serious Games in higher education and its pedagogical approaches to date;
- collect information on the present status of currently used ways for actively engaging learners in lectures and motivating students;
- highlight information on didactic approaches and current use of IT and digital environments in higher education;
- identify data on the use of flipped classrooms and the opportunities and challenges concerning the use of mini Serious Games in lectures and study modules as well as on current experiences and future perspectives in higher education;
- collect and present examples of best practice learning and teaching resources.

Responses to all of the above aspects will inform the creation, testing and evaluation of Mini OER Serious Games within learning scenarios that will be used to guide all further development actions. The research results will be the basis for the tool design and the selection of the necessary mini Serious Games, including additional OER worksheets and topics, as well as ensuring the fit to the target groups. Using this learning outcomes approach as a key element of the pedagogic strategy enables individual learning content to be localised to take account of the different cultural patterns in partner countries without compromising the value of the learning resource.

Based on these main objectives the research was conducted in two ways. On the one hand, desk-based research undertaken through literature review. On the other hand, field-based data acquired through an online survey questionnaire.

On the one hand, the following results based on the literature research which focuses on using and learning with Serious Games in higher education.



- Part 1 will be an introduction to the report.
- Part 2 will be a section focusing on the existing experiences with the use of IT, digital environments and the flipped classroom concept and the didactic approaches adopted.
- Part 3 will be a section focussing on the current status of approaches used to actively engage learners in lectures and motivate students.
- Part 4 will be a section focussing on existing experiences with the use of Serious Games in higher education and the corresponding associated pedagogical approaches.
- Part 5 will be a section focussing on opportunities and challenges concerning the use of mini Serious Games in lectures and study modules in higher education as well as on current experiences and future perspectives.
- Part 6 will be a section focussing on best practice learning and teaching resources in each partner's institution. Here learning and teaching materials will be addressed.
- Part 7 will be a short conclusion.

On the other hand, findings from the field-based research are shown. The research was achieved through a use of quantitative data. This questionnaire consists of open and closed parts and addresses four thematic sections:

- General information
- Environment resources and appropriate media in higher education
- Estimations about digitisation / e-learning/ flipped classrooms/ (Mini) Serious Games in higher education
- Opportunities and Challenges

Each partner committed to providing answers from at least 100 participants to ensure that each answer stands at least for just 1 per cent and no less.

The last part presents the results of collecting and presenting best practice learning and teaching resources from every partner.

2 Introduction

Digitisation – With more than 32,800,000 (December 2020) entries on Google, the megatrend of digitisation, caused by global change, illustrates the importance of digitisation in every organisational context. In the field of education, the importance and relevance of digital change are increasing. Nevertheless, digitisation also provides challenges in the (higher) education sector. Consequently, it is necessary to support the education system with innovative knowledge and ways of learning and teaching to meet the challenges of digitisation.

Therefore, the Erasmus+-project IDEAL-GAME (“Improving didactics, education and learning in higher education with the Online Serious Game Creator”) aims to enhance teaching and learning in higher education institutions by creating an Online Game Creator for Serious Games.

This IDEAL-GAME tool will support teachers in creating different types of small Serious Games which can be integrated into modules and lectures: e.g. (a) Serious Games for learning professional and subject-related vocabulary, (b) Serious Games for assessment of corresponding facts and terms, (c) Serious Games which focus on process, (d) competitive Serious Games to enhance learning and (e) Puzzle Games to engage with models and theories etc.

The **main objective of the IDEAL-GAME** project is to create an online Serious Game creator tool for higher education. Teachers should be able to create tailor-made Serious Games for their lectures and seminars with the help of the created creator tool. Nevertheless, the project provides the user with already existing Serious Games, which in combination with supplementary learning materials- serve as the first inspiration for the creation of further games. In due course, a handbook will be produced to provide guidance for the creation of Serious Games as well as implementation strategies for lectures and seminars. Especially in the IDEAL-GAME project, Serious Games are tested in connection with the Flipped Classroom concept. In the Flipped Classroom, learners prepare new content, concepts and theories in self-directed learning (online) and use the lecture for discussions and comprehension questions.

3 Part A: Results of the literature review in partner countries

Part A presents the findings of the desk-based research of all partners. Firstly, the existing experiences with the use of IT, digital environments and flipped classroom concept and its didactic approaches will be shown. Thereby, the status quo about currently used ways for activating the learners in lectures will also be described. Finally, this is followed by the presentation of existing experiences with the use of Serious Games in higher education and its pedagogical approaches as well as opportunities and challenges concerning the use of mini Serious Games in lectures.

3.1 Existing experiences with the use of IT, digital environments and the flipped classroom concept and its didactic approaches

The national research reports show that the project partners already had experience with the use of IT, digital environments and the flipped classroom concept and its didactic approaches.

Germany

The *University of Paderborn (UPB)* from Germany has many years of experience with the use of new media, digital environments and flipped classroom concepts as Professor Marc Beutner has carried out many research activities in this field. His research fields are active citizenship and fostering youth in Europe, the development of new e-learning methods, innovative learning approaches, career orientation, vocational education and training (VET), didactics and evaluation. Moreover, he and his team have created several e-learning tools for the didactical use of e-learning in the field of higher education. Examples of completed Erasmus+ projects in this field are MATH, GET-UP, Shadows, SMART, Learning Map, YES etc. The research fields are active citizenship and fostering higher education in Europe, the development of new e-learning methods, Serious Game design with the PVEC - the Paderborn Concept for Serious Game Design -, innovative learning approaches, career orientation, vocational education and training, didactics and evaluation. Moreover, UPB created several e-learning tools for didactical use of e-learning in the field of higher education. Therefore, the flipped-classroom approach is essential for pedagogy in higher education and activating students is a core issue within lectures.

One example is the project PINGO. In PINGO UPB created a classroom-response system for higher education, which can be used by lecturers in their courses with their students to engage them in the discussion and provide live feedback immediately (cf. PINGO 2021). This tool is already used in more than 40 universities all over Europe. The scope of the work is both local work at our university and also with regard to a European level and with the strong wish to create common solutions for young learners in Europe.

Romania

Also, the *Universitatea din Pitesti (UPIT)* has many experiences in using ICT (Information and Communications Technology) and the design of learning environments. Among many other focuses, the university has specialised departments of “Development of Systems and Software Applications” and “Centre of Higher Educational Quality Assurance”. Especially Professor Georgeta Chirleşan carried out many research activities in this field and is distinguished by her high level of expertise.

Starting in 2015 until 2020 the “NATIONAL STRATEGY FOR TERTIARY EDUCATION” in Romania carried out modernisation measures of the infrastructure in higher education (<https://edu.ro/>; 22.06.2021). UPIT was

also affected by the modernisation measures and enjoys a completely digital environment. Objectives like a unique registration register, a higher education statistical data collection platform for funding, a pre-university education system database and much more were achieved and implemented.

Nevertheless, *UPIT* has a high level of expertise on OER (Open Educational Resource) and OEP (Open Educational Practices). OER refers to any learning, teaching and research materials that are available in any format and support, in the public domain or under open licences and which allow free access, reuse, adaptation and redistribution. Moreover, OERs are freely and openly available to teachers, educators, students and pupils for use, sharing, adaptation or expansion, without bachelor's fees or author's rights. So OER is a content-centred approach, where the focus is on the creation and (re)use of educational resources.

Examples for OER in Higher Education were developed from the "STRATEGY FOR THE DIGITALISATION OF THE EDUCATION" in Romania as well as the "MINISTRY OF EDUCATION AND RESEARCH IN ROMANIA". These are online educational platforms established by national and European programmes. Such are the platforms dedicated to higher education:

- AeL Educational / AeL Academic (<http://www.siveco.ro>), which provides support for teaching and learning, testing and evaluation, digital content management, management and monitoring of the entire educational process;
- Digital EDUCRED (<http://digital.educred.ro>), a portal dedicated to all teachers interested in harnessing new technologies in student learning activities, leveraging the experience and the results achieved in both the CRED (Relevant Curriculum and Open Education for All) educational project and resources outside the project;
- The Online Learning Centre (<http://training.ise.ro>), through which the National Centre for Policy and Evaluation in Education conducts a series of online courses of best practices in the field of education, aimed at students, teachers, school principals, experts, school counsellors, and all those interested in specific educational issues;
- Study in Romania (<http://www.studyinromania.gov.ro>), which provides detailed information on the study programmes offered by higher education institutions in Romania;
- EERIS (<http://www.erris.gov.ro>), which provides information on the research infrastructures available in higher education institutions and national development research institutes.

In addition to experience in the field of OER, as already mentioned, *UPIT* also has experience in the field of Open Educational Practices (OEP). OEP is the range of practices around the creation, use and management of OER to improve quality and innovating education. So OEP is a practice-centred approach, where the focus is on the interactions between teachers and students, using OER for education.

The flipped classroom concept and its didactic approach in higher education is an example of OEP. In Romania, during the COVID-19 pandemic, higher education activities were carried out online, which led to the use of the flipped classroom concepts on an unprecedented scale. Teachers and students used rich OER archives and also provided OER themselves.

Poland

The *University of Economics and Innovation in Lublin / Wyższa Szkoła Ekonomii i Innowacji w Lublinie* in short *WSEI* is a non-state higher education institution funded in 2001. *WSEI* in Lublin has extensive experience in the field of development of different types of tools and materials aimed at shaping soft competencies of different types of target groups. The IDEAL-Game Team at *WSEI* has a great wealth of experience in preparing applications, implementing and coordinating projects, which have been selected for funding under the range of EU initiatives. They focus on building bridges between business and the academic sector, creating links between work and education through new innovative methods and tools to academic curricula. IDEAL-Game Project Manager Magda Janiak is an expert in dealing with social exclusion, vocational skills in the labour market, entrepreneurship, social economy, new competencies and counselling for apprentices.

As *UPIT*, *WSEI* describes similar experiences concerning COVID-19 in the context of existing experiences with the use of IT, digital environments and flipped classroom concept and its didactic approaches. The pandemic greatly supported the development of distance learning and the use of modern technology in teaching. AT *WSEI*, the vast majority of teachers tried to keep the quality of teaching high despite the pandemic. For this, they used videoconferencing platforms like Zoom, Google Meet or Microsoft Teams.

Statistics on the use of videoconferencing platforms clearly show that in Poland, as well as worldwide, Zoom, Google Meet or Microsoft Teams have seen an unprecedented jump in the number of downloads. *WSEI* takes a positive view of the development of the use of IT. They describe that the ability to use these platforms for lessons cannot be unlearned – and the great value for teachers is that many of them are now able to use digital environments, and are using this and similar tools on daily basis. This improves the didactic, education as well as learning in higher education (cf. JEMIELNIAK 2020).

Thus, many educators have already implemented learning and teaching according to the flipped classroom model. Teachers can record and narrate screencasts of work they do on their computer desktops, creating videos of themselves teaching.



UK

The University of Dundee (UoD) in Scotland is an expert in dealing with IT and digital environments for many years. They have extremely strong STEM connections and their research focuses on how best to educate students across all levels of formal education, how to develop strong communities, and how to support our most vulnerable. Professor Divya Jindal-Snape is an educator with experience working across several disciplines. She is the personal chair of Education, Inclusion and Life Transitions with these being of particular relevance to the proposed study and demonstrating her international standing in this area.

With technological advancements and an understanding of the importance of learner-centred teaching along with the creation of personalised learning environments and active learning, higher education staff are increasingly using digital technologies (cf. MERCADER & GAIRIN 2020). *UoD* knows the benefits of digital technologies and identifies ten advantages for itself:

1. applicability to real-world situations
2. immediate feedback
3. interactivity
4. collaborative learning
5. engagement
6. self-paced learning
7. development of problem-solving and critical thinking skills
8. creativity
9. emotional intelligence
10. transferable competencies

(cf. ALMEIDA & SIMOES 2019)

In connection with the flipped classroom concept, *UoD*'s experience shows that blended learning was more effective than online learning (cf. TOPPING et al. 2021). One such blended learning environment is created through the flipped classroom approach.

Just like the other project partners, the *University of Dundee* has increasingly used and created digital environments during the pandemic. However, MERCADER and GAIRIN (2020) highlight that previous studies found that not even 50% of lectures use digital technologies, and even when they use them, they use the same technologies repeatedly, and that also support their teaching rather than being used for active learning. Reasons for not using digital technology in universities can be divided into four categories: personal barriers (e.g., lack of confidence, negative attitudes), professional barriers (e.g., lack of training, lack of experience of using technologies in class), institutional barriers (e.g., lack of infrastructure as well as poor quality of infrastructure), and contextual barriers (e.g., perceptions of their usability in different academic disciplines). It is an imperative then that these barriers are removed.

One helpful step has already been taken by the Scottish Government to establish a National Framework for Digital Literacies in Initial Teacher Education across all universities to ensure the development of digital skills, positive attitudes and behaviours of student teachers (cf. ROBERTSON et al. 2020). Along with this, there was an acknowledgement of the need for undertaking more research to understand the effective use of digital technologies. The IDEAL-Game project fosters the deepening of research.

Spain

The *Universidad a Distancia de Madrid SA (UDIMA)* in Spain is the first private distance university in Spain. Its methodology is based on distance training, making use of the latest information and communication technologies. In this way, it contributes to the fact that, despite the distance, the student feels accompanied by the teacher at all times. *UDIMA* has extensive experience in national and European research projects, mainly within the Erasmus+ Program, many of them related to education and new technologies. Ana Landeta will be active in the project IDEAL-Game. She is an expert in distance learning, education and eLearning as well as game-based approaches. Her experiences fit excellently to the needs of the project.

In relation to the flipped classroom, *UDIMA* clarifies that current higher education students focus their learning on spontaneously incorporating information from digital resources: videos and images. In that sense, the flipped classroom methodology encourages group, collaborative and cooperative work, being another of the motivations that students require when debating and reflecting on their ideas. Regarding the teacher's point of view, communication with students acquires a new meaning, since time in the classroom is used to resolve doubts and doubts (cf. TOURÓN & SANTIAGO 2015; cf. MATTIS 2014), thus inviting the teacher to work in small groups and individually.

UDIMA's experience of the flipped classroom show discrepancies in the scientific results. Although they agree that improvements are observed in students' grades, behaviours and attitudes when working with a flipped classroom, everyone agrees that masterclasses should not disappear, especially in degrees that require it, but they should be complemented with active teaching strategies that favour the meaningful learning of knowledge. For this reason, the development of tools that facilitate the creation of this type of active teaching strategies through the use of technologies is of great importance. And in this context, the Online Serious Games Creator can be of great help to the educational community, teachers and lecturers in the planning sequences of the module or course, so that it generates an impact on the didactic and pedagogical environment.

There are even methodological proposals on this from the NATIONAL INSTITUTE OF EDUCATIONAL TECHNOLOGIES AND TEACHER TRAINING (INTEF) in Spain. The INTEF web platform offers courses and technological resources for the different educational levels. Some of these valid resources for higher education are:

- Educa IGN: online, open and free educational resources of the National Geographic Institute and National Geographic Information Center aimed at different educational stages
- Fundación Telefónica: has various initiatives on education such as ScholarTIC (Hispanic digital community aimed at teachers and future teachers); STEMBYME (training platform to promote the development of STEAM vocations among young people between 14 and 20 years old) or code.org (programming courses for young people)
- Lego Education Robotix: online initiatives for teachers, families and students, so that the latter can continue learning robotics, programming and STEAM from home
- Educaplay: a tool that allows the creation of playful activities, while offering the possibility of finding tasks for different themes and levels
- Labsland: a tool that offers access to remote laboratories, allowing teachers and students to experiment in real-time and on real equipment without the need for any software or hardware

In addition to the existing experiences that everyone has had with IT, digital environments and the flipped classroom, the project consortium of IDEAL-GAME are interested in the current methods universities are using to activate their students.

3.2 Status quo about currently strategies for activating learners in lectures

One of the main goals of the IDEAL-GAME project is to activate learners in lectures and seminars. Therefore, we first collected the current activation methods and incorporate them into the development of the Creator Tool. In this way, the need for Serious Games for student activation can be determined and existing ideas can be further developed.

The following are the presentations and experiences of the project partners to currently handle an Activation from learners in lectures:

Germany

UPB uses new media and online elements in higher education to motivate learners and stimulate learning. Furthermore, the use of online learning methods offers an innovative way to make the learning content attractive. An example of activating the learners in lectures is the use of the H5P tool. This tool makes it very easy to create tasks for learners. The advantage of this program is that you can integrate the tasks into many other programs or systems. H5P has over 40 different task types. This makes it attractive for learners and also fosters their motivation. Moreover, this program is accessible to everyone and can be used free of charge (cf. H5P 2020). Ultimately, it allows users to “create, share and reuse interactive HTML5 content in your browser” (H5P 2020).

Romania

UPIT also tries to activate learners in lectures through new media and innovative methods. Two approaches have currently gained acceptance. One is the use of Web-Based Learning (WBL) and the other is the use of Massive Open Online Courses (MOOCs).

WBL refers to the training process that is carried out using a computer connected to the Internet network, and educational content can be realized in the form of a traditional lesson or a working session in collaboration with teachers and colleagues using communication technologies. An example of a suitable approach to WBL is THE LEARNING CENTRE OF THE UNIVERSITY OF BUCHAREST (<http://fpse.unibuc.ro>) in Romania. It is a flexible online learning space adapted to the needs of students and the specifics of their learning activities. The approach allows for easy and flexible repositioning of learners and supports collaborative learning through WBL and Flipped-Learning (flipped classroom concept). It aims to ensure the development of a set of skills specific to first-year students, enabling them to successfully integrate into academic life and to increase performance and learning outcomes in terms of cross-cutting skills.

MOOCs, on the other hand, are very large OER that offer teachers, researchers and practitioners the opportunity to experiment and research different possibilities of integrating new concepts into formal, academic courses for any course of study. For example, one notable advantage of the use of MOOC is learning and interacting with the material at their own pace, outside the attendance course time, by watching videos and automatic evaluation, easily accessible in the virtual space of MOOC. A suitable approach of MOOC is to incorporate them into classical academic courses, which will determine a more efficient transformation, democratisation and improvement of the students' education. In Romania, several universities include MOOCs in their academic courses as an effective method if using OER.

Poland

WSEI's ways to activate the learners in lectures are “traditional”. The most typical way of activating learners in lectures are questions provoking discussions and systems of grades. Students are also encouraged to use technology like digital presentations in their work. Generally, the use of digital media or new methods at *WSEI* is rare.

Reasons for a traditional activation of students is on the one hand the class size and on the other hand the tuition fees. In Poland, seminars held in public and private schools, there are over 20 and 30 students restively. For *WSEI*, it is difficult to have a reliable study and a proper lecturer-student relationship in such large groups. Furthermore, the difference in the level of education in public and private centres is also reflected in the cost of education of one student – PLN 21,000 in a state university and PLN 8,000 in a non-public one. In such conditions, it is difficult to use effectively ICT techniques and modern educational technologies, such as flipped classrooms, on a large scale (cf. SYSTEM OCENY JAKOSCI KSZTALCENIA W SZKOTACH WYSZYCH 2018).

UK

Staff at the *UoD* have been using a range of approaches and methodologies to actively engage and motivate students. Some of these approaches and methodologies are in concert with the thinking that can inform and underpin the design and use of Serious Games. One example is the concept of playful learning along with maker-culture to engage the students in learning about the teaching of Design and Technology in an interdisciplinary context. To do this, a peripheral device called the Makey Makey™ is used. In this example, ROBERTSON embraces the alter-ego of DJ Jelly as he demonstrates how circuits, conducting wires, sound files, dessert jelly and imagination can create an engaging digital artefact. Full details of this example can be viewed from this online report (cf. ROBERTSON 2019).

An approach to actively engage learners in lectures and motivate was started from JINDAL-SNAPE using the Flipped classroom concept in combination with using digital technologies. The attempt showed that it was difficult to motivate the students. Rather, students' participant was patchy and students were found to be expecting teacher-led “knowledge transmission”, with differences in self-determined learning varying based on students' cultural background, prior educational experiences and preferred learning style.

Another possibility to engage learners is the “Whodunnit” scenario at the *University of Dundee* by TONNER-SAUNDERS and JINDAL-SNAPE. They created a scenario in which by using the QR codes, students accessed clues to find the mystery person. Throughout this activity, the students moved around the key *University of Dundee* spaces and met with key personnel. The competition aspect led to students co-operating and getting to know at least five other people from their degree programme.

Spain

The *Universidad a Distancia de Madrid SA* is oriented towards the students and the respective professional degrees to motivate them. They always try to link actions with situations. This allows for more immersive learning and motivates students to participate (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021; cf. FERNÁNDEZ-SÁNCHEZ et al. 2020; cf. HERNÁNDEZ 2020).

Some of the active methodologies that favour the design of this type of situation are “design thinking” to solve problems, “flipped learning” for accompaniment and autonomy, “gamification” to learn through games and, “social media” for network learning, which are becoming increasingly common in pedagogical practices (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021). At *UDIMA*, the design thinking, the flipped classroom and the gamification pedagogical strategies especially stand out today and are gaining more and more presence.

Design thinking generates new learning scenarios to practice creativity and critical thinking and the analysis and construction skills achieved allow students to solve problems considering the available resources (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021; cf. LATORRE-COSCULLUELA et al. 2020). The results after the design thinking experience carried out by LATORRE-COSCULLUELA et al. (2020) indicate that the work teams were able to design innovative approaches to real problems in their environment and engaged students in the shared process of seeking solutions.

Flipped learning reverses the traditional approach, from learning in the classroom to the students’ habitual environments of human interaction, allowing them to learn at their own place and based on their needs and interests. Sharing the knowledge acquired and working on it with their peers and teachers (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021; cf. PARRA-GONZÁLEZ et al., 2020).

Games enable problem-solving while receiving satisfaction and rewards as feedback, so it seems logical to use these motivating elements of the game to promote the participation and involvement of the student in their teaching-learning process (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021; cf. PARRA-GONZÁLEZ et al., 2020). Gamification promotes the objective of learning through games which must be considered attractive and motivating, establishing a balance between challenge and skill level, as well as ensuring clear objectives and feedback to maintain concentration and feeling rewarding (cf. APARICIO-GÓMEZ & OSTOS-ORTIZ 2021).

PARRA-GONZÁLEZ, et al. (2020), developed a study to analyse the effects of the implementation of “flipped learning” and “gamification” models. After this experience, they compared variables such as learning achievement, learning anxiety, motivation and autonomy, attaining really good results, showing the benefits as teaching models in both cases. The study concludes that the implementation of these two methodologies in the classroom results in the improvement in the students’ learning processes, achievements and raising their enthusiasm as well.

In conclusion, each project partner has its methods and experiences to activate the students in their lectures. Nevertheless, one also notices that the current methods are still expandable. Some use traditional activation strategies like provocative discussions, some use IT elements and others try to involve students through the flipped classroom approach or creating action that ties in with professional or student life. Nevertheless, the project consortium tries to inspire each other about what Serious Games they know and what they think of them for a common exchange of experience.

3.3 Existing experiences with the use of Serious Games in higher education and its pedagogical approaches

The following results show that especially the blended learning approach was often used as a didactic basis concerning the creation of Serious Games and developing digital environments in the education sector.

Germany

The *University of Paderborn* has many years of experiences with the use of Serious Games. For instance, the Erasmus+- project MATH developed an app. “The MATH - App is a Serious Game which supports ICT-based teaching and learning as well as E-game based approaches in the school education sector. Furthermore, it intends to create an innovative concept for training math skills in a more fun - oriented setting” (BEUTNER 2019, p. 6). According to the MATH App, you also find the blended learning approach. Here the App can be played in a face-to-face scenario or by using the MATH App via mobile phone.

Moreover, the running Erasmus+-project EDU-VET aims to create new teaching and learning environments for VET. The project focuses on the development of eLearning courses. In this context, the blended learning approach will also be addressed.

Romania

In Romania, at the *University of Pitesti*, in the Department of Environmental Engineering and Applied Engineering Sciences, students study physical phenomena in applied physics courses through verifiable practical experiments with the Pintar InterACTIVE VirtuaLab computer application. This application is a virtual interactive laboratory with specialized software for every fundamental domain of applied physics, designed to easily integrate into the practical laboratory work.

UPIT has also gained experience with military Serious Games. Serious Military Games train players in an explicit and flexible way by presenting a specific scenario adapted to each type of mission. A Serious Game of this type includes an armed forces engagement, the typical model being the exchange of weapons and power between the shooter and the target.

For example, the NATIONAL DEFENCE UNIVERSITY “CAROL I” in Bucharest, through the Department for Distance Advanced Distributed Education, offers the students the Serious Game VBS2 NATO developed by Bohemia Interactive, considered one of the most powerful instruments of individual or collective military training. This Serious Game supports and develops training by providing a virtual sandbox where participants can perform tasks based on reality and learn from their mistakes.

NATO VBS2 includes a series of training scenarios for avoiding improvised explosive devices (CIED), that allow participants to operate from an insurgent’s’ point of view. The Serious Games offers the opportunity to act by following a plan and react to events affecting the plan. It is well suited for developing coordination and communication skills, including a scenario for collective training based on the defence of a convoy, in which lessons learned must be applied to counter the actions of insurgents. This Serious Game can also be used individually, including single-player scenarios, a content viewer (library) and a 2D mission editor. It can also connect online to a NATO VBS2 server, which allows access to a range of additional features, such as a 3D mission editor (units, vehicles and terrain), a real-time editor, and an analysis at the end of the game.

Poland

The *University of Economics and Innovation in Lublin* already tries to introduce Serious Games. An example of an interesting Serious Game at the *WSEI* is the Coffee Game. The Coffee Game is an Internet application simulating the reality of the contemporary market within the business realm. The games take place in the virtual world and reflect the basic rules and dependencies existing in the business world. The world in which the game takes place has its own properties. At the start of the game, all the business entities are automatically located on the map. These are the players' companies, clients, suppliers, warehouses and transport companies. It means that each company receives an investment plot on some country's territory and therefore the access to trade partners existing in a particular country. To enter into a partnership with foreign companies, a player's company will have to establish a branch in a neighbouring country. The players play the role of owners of companies producing mobile phones. Their task is to start and develop their companies in the reality of competition with other enterprises of similar profile and run by other players. Competing in this difficult market requires skilful management of the company's potential and resorting to cooperation with trade partners.

The Coffee Game is used at *WSEI* for teaching students of economics, administration, and IT. The introductory version of the Coffee Game was also used for teaching students of Organizational and Industrial Psychology. The Coffee Game was funded with support from the European Commission (agreement no 2013-1-PL1-LEO05-37816)

UK

The *University of Dundee* experiences' makes clear, that the gameplay of Serious Games can be teacher-led depending on the difficulty level of the game but ideally it should be immersive and learner-led (cf. LAMERAS et al., 2017). Nevertheless, the majority of university students were found to be positive about the use of Serious Games.

Besides the already mentioned game "Whodunnit", the *University of Dundee* has been able to gain further experience with Serious Games, such as "The Law of Murder", "Second Life" or "Phone Story".

BOUKI and ECONOMOU (2015) designed the Serious Game, "The Law of Murder". Students were presented with a scenario and had to use their knowledge, skills and processes to decide if a murder had taken place or not. The students were presented with information in a variety of ways and using a range of gaming techniques the students had to make decisions in a timed framework. The timed framework was to ensure students stayed focused on their learning.

The Serious Game "Second Life" has been used in several universities. For example, the University of Nottingham has developed a maternity ward for simulated learning. The University of Derby and the Institute of Quarrying partnered to create a quarry that allows students to participate in structured exercises such as quarry blasts.

Phone Story (MOLLENDUSTRIA 2010) has been used in an interdisciplinary context with 1st-year Teacher Education, Social Work and Community Education students concerning the critical exploration of the ways in social justice, in a local and global context, is impacted by the digital world. Although no research has yet been undertaken into the use of this game, it does seem to have elicited very good responses from students who until then had no real idea about where their phones came from.



Spain

UDIMA focuses on the benefits of Serious Games and concludes that Serious Games can enhance knowledge and deepen competencies.

In the process, the *Universidad a Distancia de Madrid SA* presents the Serious Game “The Republic Times”. The Republic Times serves as a baseline study to analyse “The Republic Times Gamedesign” based on a closer look to journalistic reality, working with routines, informational values, and professional practices (cf. MARTINEZ et al. 2020). The accompanying study shows that the Serious Game in question effectively transmits journalistic values related to the selection and ranking of the news, the effects of the manipulation of public opinion, the responsibility of the journalist as a watchdog of power, or the moral dilemma posed on the value of loyalty to a totalitarian government.

In addition, GONZÁLEZ (2021) shows in his study that the technological revolution in the university leads us to have to train students to practice professions that have not yet existed, in which they will use tools that have not yet been invented and in which that will solve problems that are still unknown to us.

Following, the opportunities and challenges should be collected and compared before creating a Serious Game Creator Tool, which will improve future didactic, education and learning in higher education.

3.4 Opportunities and challenges concerning the use of mini Serious Games in lectures

In this section, the opportunities and challenges concerning the use of mini Serious Games in lectures are discussed.

Germany

First the opportunities that Serious Games present will be discussed. They have acknowledged potential for instruction because they can strongly motivate learners. They can also provide immersive environments where advanced users can practice knowledge and skills, also exploiting multimodal interaction. They can combine the effectiveness of computer processing and data storage, with high levels of attractiveness. Our work has investigated the state of the art research on Serious Games, starting from the cognitive aspects that are necessary to root technological development and applications in sound theoretical foundations. The paper discusses some key aspects about Serious Game design and exploitation: choice of components-off-the-shelf or from-scratch design, tools and methodologies for development or adaptation, intelligent tutoring, virtual coaches and affective learning, living worlds, game mechanics, Human-Computer Interaction” (BELLOTTI / BERTA / DE GLORIA 2010, p. 22).

In summary, eight key opportunities can be listed:

- 1) Stimulation of the mind
- 2) Strengthening self-confidence
- 3) Applicable in real life
- 4) Continuous personal development
- 5) Immediate feedback
- 6) Interactivity
- 7) Fostering collaborative learning
- 8) Fostering of diverse competencies (knowledge, social competencies, soft skills etc.)

(cf. GAMELEARN 2021).

Against this, there are also challenges of Serious Games. Like all media, there is a habituation effect after a certain time. On the one hand, computer games have a certain attractiveness per se due to their multimedia nature, however, due to their current presence in children's rooms, one should not conclude that this fascination will also work in schools. It should also not be forgotten that multimedia always contains the risk of being overtaxed, because the human sensory channels will probably not change so quickly in evolutionary terms, as can be seen from the increasing incompetence of children, but also adults, to concentrate on a task for a longer period. Multimedia ultimately produces even more amounts of information that must be selectively reduced to be absorbed. Of course, there is also a certain risk of addiction, especially since some children and young people with a tendency to excessive consumption may be reinforced by the additional use in lessons. Of course, there can also be a dulling effect, although the addictive potential of educational games is probably limited anyway. One should also not underestimate the effort that will be necessary to convince the school system and not least the teachers that computer games make sense in the classroom. Expecting teachers to be relieved is an illusion, especially since this medium will require additional effort, and not only technical effort,

at least at the beginning. The effort to develop high-quality computer games that are suitable for teaching will also soon reach budget limits (cf. STANGL 2021).

Romania

First, the opportunities are presented before the challenges are outlined. Serious games can be used to transfer knowledge innovatively and sustainably. Often interdisciplinary work can also be done, as can be seen in the example of the SUSTAIN project. In the SUSTAIN project, a new sustainable city is being built. Specialists from academia, as well as in fields such as culture, architecture, engineering, environmental management, entrepreneurship, public services and civil society can cooperate. The Sustain Project aims to promote among students the importance of the sustainability of cities and the protection of the environment using clean technologies. In this context, the Serious Game can be integrated very well into university seminars.

In Romania, Serious Games can improve learning outcomes, but they also create certain challenges in terms of their implementation in higher education.

From an institutional point of view, it may be difficult for some faculties to adapt their teaching methods so that the inclusion of Serious Games in lectures corresponds to the interest shown by students in an interactive form of teaching. Thus, in a report on the quality of higher education in Romania, the opinions of the students questioned about their preferences regarding the method of teaching courses are summarised. Student responses varied according to:

- Faculty specialisation: students from the faculties of Agronomy and Economics are more attracted to courses taught by classical lecture, while students from the faculties of Medicine and Pharmacy prefer interactive courses, which can also include Serious Games;
- Year of study: Students in earlier years of study are more receptive to courses taught by classical lecture, while students in the later years of study are interested in dialogue-focused courses, which may also include Serious Games;
- University location: in Bucharest and in smaller university locations more students prefer courses taught by classical lecture than in larger university campuses outside the capital; students from private universities also have this preference over students from state universities;
- Form of schooling: the preference for courses taught by classical lecture is more pronounced among students who pay for their studies than in students with subsidized studies.

With regards to teachers, some of them are afraid of losing control of the teaching process when they invite their students to make their contributions to the course activities and to actively participate in their development by using interactive teaching methods, including Serious Games. On the other hand, some teachers, especially the older ones, do not have the digital skills to incorporate Serious Games in their courses. For these teachers, digital skills training are organized along with training courses in the use of OER and OEP, including the use of Serious Games in lectures.

As for the students, some of them are more familiar with traditional approaches to teaching and learning, and therefore it is difficult for them to adapt to a modern interactive course, which also includes Serious Games, as this would force them to make an extra effort to become more active, participatory, communicative, innovative and autonomous. These students should be advised by teachers and educators to make this initial effort to discover the advantages of interactive methods of education to evolve towards higher learning performance.



Poland

The *University of Economics and Innovation in Lublin* identified the following opportunities for Serious Games. Serious Games have chances to provide students with the opportunity to actively learn, solve problems and gain experience in a risk-free environment. The motivational properties of games can be used for educational purposes. Also, Serious Games or gamification can be used at a time and place that suits the learner. The reusable nature of Serious Games can allow for more frequent or longer interactions, free lecturer time and save money. Students may have the opportunity to develop analytical skills, strategic thinking, knowledge, multitasking, decision making, communication and psychomotor skills, and the multiplayer features provide the opportunity for collaborative learning. However, this can lead to reduced opportunities to ask questions, engage in discussions, and spend time in real-world activities. The efficiency of Serious Games in education can be improved by applying the method in small groups, with the support of the lecturer stimulating discussion and interaction. In addition, it is possible to effectively implement the curriculum, e.g. in the field of biology, and probably also in other disciplines and experimental specialities.

Challenges arise at *WSEI* in the case of practical classes, especially laboratory exercises. Of course, it is possible to conduct theoretical classes such as seminars and discuss with students the issues related to the topic of the exercises, but the problem of conducting experiments remains unsolved. The key to teaching experimental techniques or methods is the independent performance of experiments by students. This is the chance, and the challenge as well. The implementation of Serious Games is also associated with costs, whereby, as already mentioned, the universities in Poland do not have much money to spare.

UK

UoD also distinguished between opportunities and challenges from Serious Games. First, the opportunities are presented. Serious games can provide lecturers opportunities to create authentic learning situations for their students that can develop students' problem solving and thinking skills. Further, the dynamic nature of Serious Games and the opportunity for active learning can enhance learners' motivation (cf. WESTERA 2019), and they can be applied to a range of different subjects (cf. LAMERAS et al. 2017). A meta-analysis of Serious Games found that there was evidence of Serious Games having a positive impact on immersive learning, facilitating understanding of concepts (especially in science), enhancement of cognitive and affective functioning, provided flexibility in time and place of learning, improved cross-cultural understanding and collaboration (cf. ZHONGGEN 2019).

For Serious Games to engage learners, it is important therefore that the learner finds the play to be fun, with higher levels of enjoyment increasing the level and length of engagement (YOUNIS & LOH 2010). Therefore, Serious Games need to have a good balance of fun and learning, which has led to the use of commercial off-the-shelf (COTS) games instead (cf. JINDAL-SNAPE, BAIRD & MILLER 2011; cf. MILLER & ROBERTSON 2010, 2012). LOH (2009) has suggested 10 steps for the creation of Serious Games (see Figure 1).

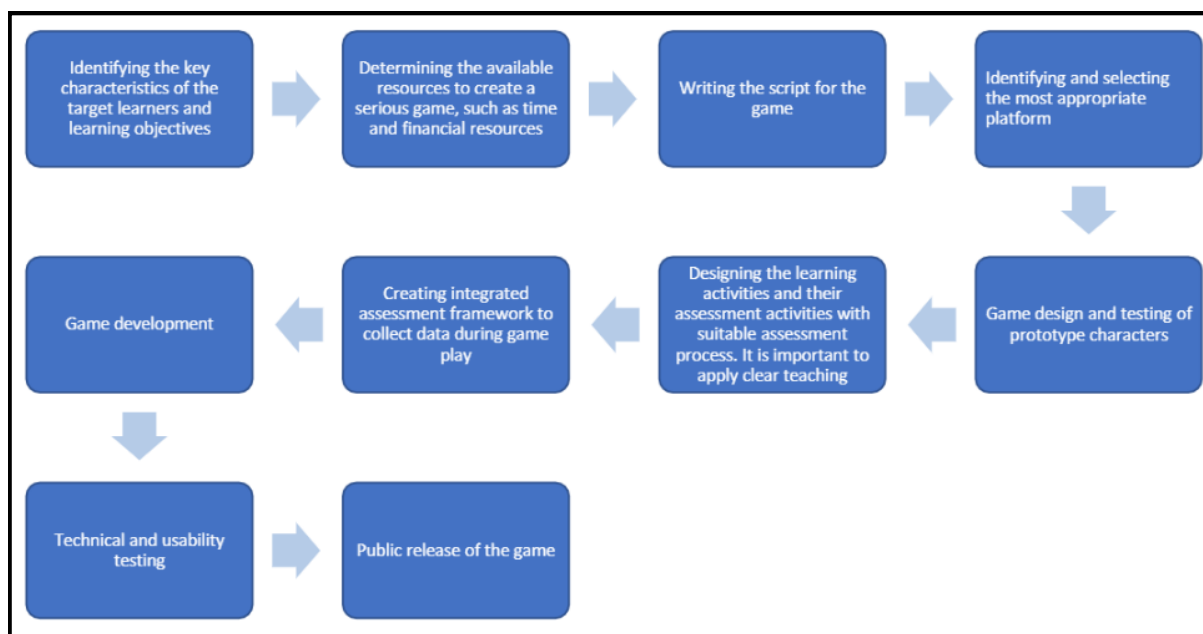


Figure 1: 10 steps for creation of Serious Games (based on Loh 2009)

As can be seen from these steps, the creation of Serious Games is time-consuming and requires appropriate funding. Therefore, for lecturers to be able to create Serious Games in higher education teaching can be problematic. Further, the Serious Games have to be designed to be accessible to everyone as well as meeting the pedagogical principles. DE GLORIA et al. (2014) have highlighted some other challenges, such as tensions between game features and learning objectives, the suspension of disbelief that is crucial for gameplay might have a negative impact on learning, and the extrinsic motivation obtained from rewards during gameplay might stop the learner from developing intrinsic motivation to learn. Further, very few Serious Games studies have so far robustly evaluated their impact on learning outcomes (cf. WESTERA 2019).

Spain

UDIMA confirms the previously mentioned opportunities and takes a closer look at the chances of mini Serious Games. Especially, our project aim is to create mini Serious Games as well as the mini Serious Game Creator Tool. Thus, it is necessary to collect chances and challenges as well for mini Serious Games.

Serious mini-games are increasing their popularity due to their flexibility and lower development costs -compared to full-fledged Serious Games- (cf. JUUL 2012; cf. MARFISI-SCHOTTMANN 2010), and also for the basic game mechanics, quick-to-learn game rules and limited learning objectives (cf. ILLANAS et al. 2011). Mini Serious Games also add value to learning, because learning by re-constructing knowledge or re-framing is a process that is triggered through action in response to a concrete problem (cf. ARGYRIS 1977; cf. PAPERT 1980).

In this sense, PAPERT (1980) proposes to use games to support this process of, so-called, problem-based-learning, contributing to collective and organizational learning (cf. LOZANO 2014), but also experiential learning, because they follow Kolb's cycle of four stages (experiencing, reflecting, thinking and acting) and, therefore, the model proposed by BROWN and LAMBERT (2013), who extends this cycle from individual to collective learning, establishing, like Kolb, four different stages to learn: ideals, facts, ideas and actions.

However, despite the many advantages and opportunities that games offer for learning, BELLOTI et al. (2010) believe that "while serious games are frequently seen as "de facto" instructional, the combination of entertainment and knowledge acquisition is far from being immediate. [...] the next step towards instructional effectiveness is more difficult to accomplish" (pp. 24-25). In this sense, mini Serious Games must have adaptability, which is key to personalize the learning process, to release its intrinsic motivation and flow, and to avoid stereotyped training scenarios and a predictable game-play that does not contribute to learning (cf. BELLOTI et al., 2010).

Another challenge mini Serious Games must face is not to be too short or too shallow to offer a real sense of immersion to the student (FRAZER et al., 2007). According to these authors, "mini-games are so short that there is often little incentive for learners to contextualise any new knowledge they acquire. But if that knowledge were required in a later 'episode' in the series, players would have to reconsider the old knowledge within the newly presented context, reinforcing the integrity of their mental models" (p. 5).

In summary, Serious Games offer a very interesting research project. Of course, the challenges associated with Serious Games should not be ignored, but more chances in this interesting subject area can be seen in all project partners. Particularly in the context of an ever-developing university, further examination and creation of Serious Games is desirable.

4 Part B: Results of the online questionnaire survey applied in partner countries

The field-based research of each partner University consists of a questionnaire survey. Each partner should provide answers from at least 100 participants to ensure each answer stands at least for just 1 per cent and not more. The target groups of the questionnaire should be students/ learners, teachers/ lecturers and professors of higher education.

The questionnaire was conducted online. Therefore, it was necessary to translate the questionnaire into the national language of the partner. Afterwards, the translated questionnaires were inserted into the online tool. Lastly, each partner got the link to the online questionnaire as well as access codes for the users.

The following part presents the key results from questionnaires applied in partner countries to a total of 573 respondents. The questionnaire study was conducted online.

General information

The applied questionnaire contained 15 multiple-choice/ matrix items and 6 open-ended items. For the multiple-choice/ matrix items the options to answer were provided on a 4-level Likert scale and 6-level Likert scale (*i.e. 1 = Very important, 2 = Important, 3 = Less important, 4 = Unimportant*). The interpretation of the results was based on the number of answers per category.

The profile of the target groups encompasses students/ learners at University, lecturers/ teachers at University, professors at University as well as higher education experts. Their age ranges from below 20 to over 60 years. Both men and women have participated in our survey.

Estimations about the definitions of digitisation and Serious Games

Concerning the estimations about the definitions of digitisation and Serious Games, the results show that the respondents have adequate knowledge of digitation. There is also a basic understanding of Serious Game approaches in general. However, it is evident that Serious Games and especially flipped classroom approaches have not yet been strongly focused on higher education and there is a need for development in this area. The answers show that about one-third of the respondents do not know what a flipped classroom even is. More than half of the answers present that serious games are known but have not yet been used regularly in the education sector.

However, the use or implementation of these approaches as well as digitisation in general also entails challenges for the users, especially in the context of higher education. More than 80 per cent of the respondents also agree with this statement.

Furthermore, the respondents agree that the use of Serious Games will lead to challenges for the lecturers, but also for the learners because the knowledge is not yet sufficiently available. Nevertheless, the majority agrees that the combination of fun and seriousness of Serious Games not only enhances the creativity of the users but is equally a motivating element for the learners in their learning process.



Environment resources and appropriate media in higher education

The second question section refers to the environment, resources and appropriate media in higher education. In the following section, a summary of the responses of all participants will be shown.

The results demonstrate that the respondents have adequate digital competencies. There is also a basic understanding of e-learning. Against this background, more than half say that they use Serious Games in teaching. On the other hand, flipped classrooms, are very rarely used. One reason may be the digital infrastructure of the institutions, which may require development. For example, more than half of the learners have no PCs or other technical devices available at the institutions as well as no facilities to use learning platforms.

Additionally, the respondents recommend the following teaching materials and resources that are important and motivate learners in higher education (in decreasing order):

- Learning programmes/software
- OER (Open educational resources)
- Single choice or multiple choices questions
- Blended learning scenarios
- Interactive tasks
- MOOCs (Massive open online courses)
- Online courses
- (Mini) Serious Games
- Videos
- Best practice examples
- Graphics and illustrations
- Quizzes
- Worksheets as WORD documents or PDF
- Audios

Regarding learning platforms that are appropriate for higher education, the answers suggested (in decreasing order) the following:

- Moodle
- ILIAS
- Canvas
- Accord LMS
- Blackboard
- Schoology
- Learning Space

Estimation of the importance of digitisation/e-learning/ flipped classrooms/ (Mini) Serious Games in higher education

Another question part refers to the estimations about digitisation, e-learning, flipped classrooms and (Mini) Serious Games. In the following section, a summary of the responses of all participants will be presented.

Concerning the estimation about digitisation, it is agreed that digitisation is very important, interesting, motivating, innovative, helpful, useful and necessary. However, some respondents stated that it is sometimes not so easy to implement digitisation in the learning and teaching process.

With regard to the estimation of e-learning in higher education, the results are quite similar to the items before. However, at this point, the majority expresses reservations about using e-learning in the teaching and learning process. However, the majority of the respondents think that e-learning is also very important, interesting, motivating, innovative, helpful, useful and necessary.

Concerning the estimation about flipped classrooms and (Mini) Serious Games, you can see that there is a very similar picture of the results as in the previous question. There are also concerns in this context in using flipped classroom approaches as well as Serious Games in the teaching and learning process. However, the majority of the respondents express that these innovative approaches are also very important, interesting, motivating, innovative, helpful, useful and necessary.

Opportunities and Challenges

The last part of the questionnaire addresses opportunities and challenges of digitisation and Serious Games. At this point, it is an open response format. Following, we address the summarised results.

Opportunities of digitisation and Serious Games in higher education:

- Online teaching and learning is possible
- A combination of fun and seriousness is very motivating for learners
- An easy and attractive way to learn and teach
- Flexibility
- Immediate communication
- Independence of place and time
- Sustainable learning and teaching
- Consolidation of teaching and learning materials
- An innovative and modern way for learning and teaching
- Structured teaching and learning
- Immediate communication between learners, but also between learners and lecturers
- Additional applications such as chat, forums etc.
- The attractiveness of learning content
- Increase of teaching and learning motivation
- Control of own learning pace
- Individualization of the learning process



Challenges of digitisation and Serious Games in higher education:

- Cost/benefit
- Financial resources are often not already available
- Observance of data protection
- Continuous training/ further education necessary
- Lack of digital skills among learners and lecturers
- High training costs
- Often no technical end devices or equipment for learners
- Intensive support and supervision of learners

5 Part C: Specific research results conducted by IK

Concerning the field-based research, IK has produced and provided each partner with an online questionnaire and online survey tool. With regard to activity 3 of IO1 (Collecting and presenting best practice learning and teaching resources), IK and UPB will work on criteria for a database to enable searching through these best practice learning and teaching resources which then will be made available on the internet. Together with UPB, IK will focus on the structure and the way to present the information to make it easy for teachers to search for such resources.

Moreover, IK will provide a platform for this database that can be opened in a web browser. In summary, IK has to create an approach to structure the resources online. In the following, initial ideas and considerations will be addressed against the background of the research results above.

Based on the reports, the previous experiences of the project partners and our technical project partner IK, the Moodle platform seems to be most suitable for delivering best practice learning and teaching resources. The design will be based on the following literature aspects.

Best practices in the design and production of (Mini) Serious Games format teaching resources

Concerning the effectiveness of the design of online courses the following points should be considered:

- They are grounded in an understanding of the learning process.
- They are based on the needs of adult learners.
- They link theory and practice.
- They accommodate a range of learning styles.
- They are accessible.
- They are “flexibly” designed.
- They offer flexible delivery.
- They provide flexible assessment.
- They use a variety of media.
- They are interactive. (cf. BURNS 2016, n. p.)

In this context, there are six principles of good graphic design – contrast, similarity, proximity, alignment, symmetry and repetition – that should be applied when building a course (cf. IBID.).

When designing e-learning, repeating key points helps the learner to remember and associate these points and the new information presented together. This principle is called ‘scaffolding.’ This is also an important element of graphic design within e-learning because it allows the learner to anchor key information together (cf. COLMAN 2020, n. p.).

Concerning mini- or micro-learning format many variants will be used, e.g. short learning videos, playful elements such as a quiz (keyword: gamification), clear infographics, digital flashcards or interactive elements. These various forms are also appropriate for IDEAL-GAME and will be also included on the learning platform. Moreover IDEAL-GAME intends to combine the elements above.

Best practices in the design of e-learning environments

Another research part is the research of best practices in the design of e-learning environments. Based on the literature (cf. SCHEIN 2004) and the technical know-how of IK proposes the following basic framework for developing an e-learning environment according to IDEAL-GAME. The table below focuses on these research results:

Instructions for Use	<ul style="list-style-type: none"> -Write a brief description of the topic at the beginning of a learning session -Clarify the learning goals/ learning outcomes -Mention the approximate total time required to complete the whole session (including reading tasks, videos, quizzes, participation, etc.) -Provide the students with a To-Do-List. This guides them to accomplish the session step by step -Consider Checklists at the end of each session. Checklists help students with self-evaluation and self-improvement -Set other rules clearly -Always, write instructions in an easy language
Content Presentation	<ul style="list-style-type: none"> -Identify clear learning objectives -Prepare consistent and structured content -Simplify what you explain or show -Use various types of learning activities and digital materials (e.g. audio, short video, slide-show, PDF, text, link to a website, etc.) -Employ the right material for the right context (e.g. sometimes reading a file is better than listening to audio) -Make the materials accessible for online and offline uses
Knowledge Testing	<ul style="list-style-type: none"> -Create tasks for the students to assess their learning -Make sure that the tasks are relevant to the content and the learning objectives -Provide feedback (e.g. immediate automatic feedback)
Engagement	<ul style="list-style-type: none"> -Communicate with learners more often than you do in seminars (e.g. regular emails and reminders, information in a forum) -Foster teacher-student and student-student interactions (asynchronous and synchronous communication) -Personalise your profile (on Moodle). Upload a profile picture and write something about yourself. Advise your students to do the same! This creates a friendly online environment. -Encourage students to build up virtual study groups to support each other -Consider feedback exchange

Table 1: Best practices in the design of e-learning environments Source: Own representation.

6 Conclusion and recommendations

E-Learning and digitisation in higher education become more and more important. In particular, the Corona crisis has brought this issue to the forefront. As the results of the research activities show, the IDEAL-GAME project has high practical relevance. Consequently, it is necessary to support the education system with innovative knowledge and ways of learning and teaching to meet the challenges of digitisation.

Additionally, the conducted research suggests a high interest in the development of new and innovative teaching and learning environments for higher education. The support for lecturers and learners is still to be improved. Therefore, the IDEAL-GAME tool will support lecturers in creating different types of small Serious Games which can be integrated into modules and lectures: e.g. (a) Serious Games for learning professional and subject-related vocabulary, (b) Serious Games for assessment of corresponding facts and terms, (c) Serious Games which focus on process, (d) competitive Serious Games to enhance learning and (e) Puzzle Games to engage with models and theories etc. Following, this supports teachers with appropriate innovative learning resources as well as learners with innovative modern ways to deal with topics and learning activities. Because of this, the flipped classroom concept, as well as the development of Serious Games in higher education offered by IDEAL GAME, is welcome.

To ensure that the IDEAL-GAME flipped classroom concept and the Online IDEAL-GAME Serious Game Creator tool are relevant and useful to lecturers and learners in higher education, the following recommendations can be made:

- There is a need for an emphasis on the development of topics and learning activities in e-learning settings in higher education.
- The contents of the IDEAL-GAME flipped classroom concept and the Online IDEAL-GAME Serious Game Creator tool should be specific to lecturers and learners with information and guidance to dealing with innovative learning resources in higher education.
- Concerning the creation of the (Mini) Serious Games interactive elements should be integrated.
- Concerning, the flipped classroom concept and the Online IDEAL-GAME Serious Game Creator tool interactive tasks (e.g. H5P tasks), the collection of best practice of teaching resources should be addressed.
- The legislative and didactical framework concerning the European higher education sector should be also considered in the IDEAL-GAME concepts.

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