GAME IT

Erasmus+

A comprehensive model of a cooperative role-playing game

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TABLE OF CONTENTS

TERMINOLOGY

Gamma Testing – is the final phase of testing and is performed when the product is ready for release with specific requirements.[1]

Learning goals – state a target for a course / program, state the general outcome of a course / program, describe a more general learning outcome, may have several learning objectives.[2]

Learning objectives – state what the student will learn and be able to accomplish by the end of instruction. It describes a specific behaviour which will lead to the desired goal. It is specific and measurable. It has three major components: *What* the student will be able to do; *Conditions* needed for the student to accomplish the task; *Norm* for evaluating the student performance.

Learning outcomes – statements of what a student will be able to do as a result of a learning activity. They are specific, measurable, clear, and assessable statements that define what a student is able to do at the end of a course or completion of a program. These outcomes may involve: knowledge (cognitive), skills (behavioural), attitudes (affective behaviour).

Non-player character (NPC), also known as a non-playable character – is any character in a game which is not controlled by a player. In video games, this usually means a character controlled by the computer via predetermined or responsive behaviour, but not necessarily true artificial intelligence. In traditional tabletop role-playing games the term applies to characters controlled by the gamemaster or referee, rather than another player.

Round-robin story – a type of collaborative fiction (or storytelling) where a number of authors each write chapters of a novel (or pieces of a story) in rounds.

Flow: that 'in the zone' feeling. Flow is the feeling of intense concentration and efficiency. Practiced athletes, tenured musicians and software engineers are familiar with the feeling of flow. It is said to take ten years or 50,000 hours to achieve the skills, muscle memory, and understanding needed to find flow within an activity. Key aspects of flow include a challenge with clear goals, well established rules for action, and increased difficulty over time. All these things lend themselves nicely to gaming. The very nature of video games allow players to achieve the feeling of flow much faster. When a gamer is experiencing this emotional high, quitting or winning would be equally dissatisfying outcomes. They want to keep playing and stay 'in the zone' for as long as possible.

Fiero: the Italian word for "Pride" and a term often used by game designers to describe that feeling of emotional elation after a huge discovery or victory within a game. What's the best about this emotion is that we all express it the exact same way, which is why fiero is considered to be one of our most primal emotions. Maybe you know the feeling or have seen it before- it's usually expressed when a player throws their arms over their head and yells! Scientists will tell you fiero is one of the most powerful neurochemical highs that we can experience.

[1] More on: https://www.softwaretestinghelp.com/gamma-testing-2/

[2] More on: olms.cte.jhu.edu/olms2/data/ck/sites/329/files/Writing%20Goals.doc

Augmented reality (AR) adds digital elements to a live view often by using the camera on a smartphone. Examples of augmented reality experiences include Snapchat lenses and the game Pokemon Go.

Virtual reality (VR) implies a complete immersion experience that shuts out the physical world. Using VR devices such as HTC Vive, Oculus Rift or Google Cardboard, users can be transported into a number of real-world and imagined environments.

In a **mixed reality** (MR) experience, which combines elements of both AR and VR, real-world and digital objects interact.

INTRODUCTION

A shift from traditional didactic transmission model of teaching to student-oriented forms of active learning, where the teacher's role radically changes, is needed in modern education. Instead of transmitting knowledge, a teacher prepares a suitable environment and tasks as well as other challenges for independent student learning, directs them, and gives them appropriate feedback.

Learning objectives should move from lower taxonomic levels, dominated by retrieving various information and facts, to higher taxonomic levels, where there is an emphasis on the search for, evaluation and application of knowledge. Information and communication technologies (ICTs), which have a very limited role in traditional forms of teaching, can very effectively improve the efficiency and quality of learning when these changes happen.

ICTs' potential in finding, processing, transmitting, storing and displaying data in various forms (i.e. multimedia) is well-known, but in the traditional forms of teaching and learning their usefulness is limited. This is also valid for communication support, support for collaboration, as well as for the opportunities for easy distribution of learning materials and results of the work of all those who are involved in the educational process.

Only in the last decade experts discovered new opportunities that can contribute for the learner's cognitive processes by interactivity and by the meaningful and purposeful use of multimedia.

THEORETICAL BACKGROUND

1. THE CHARACTERISTICS OF GAMES

Games accompany humans at all stages of their development, but they are used most intensively in the early stages when the intensity of learning is maximal. Games have their own specific characteristics that affect their popularity, and have largely positive impact on their usefulness in learning. Prensky has identified seven key elements of the game:

1. The game is usually based on the story, which provides a framework and connects the parts of the game into a recognizable whole.
2. Players in the game try to meet the objectives related to the story and challenges (**goals of the game!**),
3. While observing the rules that give the game a structure, and add the game some additional challenges.
4. The player participates in the game through **active interaction with** other **characters** that appear in the game or **with** the **game environment**.
5. They are usually in a **conflict** relationship, or **compete** with them.
6. The interaction in the game gives the player a sense of control over events and over opportunities to influence the course of the game.
7. The environment of a game usually responds the player with the outcome or another type of feedback that at any time permits him to verify the appropriateness of his actions and effectiveness of his progression towards the goals in the game.

An important aspect of playing games is the intensity of player's involvement in the game. Good game may cause the state of ecstasy that was called »flow« by American psychologist Csikszentmihalyi. Such state of ecstasy is well known from sporting activities, while some others experience it when reading a good book. It causes loss of sense of place and time and complete devotion to the current activity. The author has found that the state »flow« in general represents:

- Optimal level of capacity to act;
- A feeling of pleasure and control;
- Matched player's skills with the challenges of the current activities;
- Clear objectives;
- Feedback (response);
- Ecstasy with a loss of sense of time.

To achieve such state of ecstasy, certain conditions must be fulfilled. Malone defined 5 conditions for achieving »flow«:

1. The activity must be designed so that the player can continuously adjust the level of challenge to his abilities
2. The activity must be organized in such a way that it can be »isolated« from other stimuli that could affect the player during the game.
3. There should be clear criteria for success.
4. The activity should provide feedback to the player, which tells him how successful he is in the game.
5. The activity must have a wide variety of challenges, so that the player can obtain information about various aspects of his performance.

1.1 CLASIFICATION OF GAMES

There are different classifications of games available in the literature. We will present here the classification based on the list of genres, where the activity involved in the game is considered. A particular game often cuts across our categorization. There are role-playing games that involve aspects related to action adventure and strategy. It is important to have an idea of the different genres of game according to the activity involved in order to have an overall view of the range of possibilities. It should however be viewed as orientative and any particular game may belong to more than one particular genre (summarized after the report of ENGAGE project <www.engagelearning.eu>).

1.1.1 THE GENRES OF GAMES

ACTION GAMES

Action games focus on physical coordination, successful use involves skilful use of the hardware such as joysticks and buttons and the mouse, and usually requires quick reflexes to avoid obstacles or react to different stimuli that appear. This is perhaps the most basic genre, since the activity involved is principally reactive, and their relative simplicity also means that this is perhaps the most broadly used type of game. This is the type of game most frequently provided with computer and phone hardware as part of the software package. These games include the classic arcade and home computer games that constituted the first computer games, maze games, platform jumping games, race games and combat and shooting games. The games may be played against the computer or another player.

ADVENTURE GAMES

These games involve exploration of, and interaction with, the environment and elements and characters within it as the main activity. The player is usually required to solve puzzles in order to find different items, work out the next step involved, or understand the environment. The interaction tends mostly to be non-confrontational and fighting and combat play a minor role, and are usually more centered on the use of different tools rather than simple shooting. Time constraints may be involved, however not always. The richness and complexity of the environment that is being explored plays an important part in the success of these kinds of games.

ACTION ADVENTURE GAMES

Many action games are enhanced with other elements, such as strategy or problem solving. For example many shooting games involve elements of strategy related to the choice of weapon and other attributes and tactics such as the choice of environment. The action adventure genre combines elements of action games, particularly combat, with a focus on some kind of exploration or quest to find items, which often involves puzzle-solving or challenges related to the order in which different activities within the game are undertaken.

ROLE-PLAY GAMES

The activity involved in role playing games derives from the assumption by the player of a particular role that has a series of characteristics, skills and abilities, which the player may define at the start of the game. Activity within the game often involves a series of tasks to be performed often involving rescue and the objective tends to be to increase the power, skills and abilities and experience of the role character by successful performance, in this way developing the character. They derive from traditional role-playing games and the theme and characters are often loosely based on mythical subjects. There may be a strong emphasis on combat or alternatively strategy, in some games this may depend on the nature of the role chosen.

STRATEGY GAMES

In strategy games, which derive from board games such as *Monopoly*, the player has »godlike« view of the game world under his or her command, and stands outside managing and directing what happens within the world by his or her choices, making it evolve in a particular direction. The aim is to control the environment and the way it develops. This may be done alone or with other players. These games require careful and skilful thinking and planning and may be turn based or work in real-time. The focus may often be on military, economic or social scenarios or a combination of these.

SIMULATIONS

Simulation games aim to realistically mimic the conditions of a particular environment or activity. There are various types of simulation and in some senses they repeat the patterns involved in the other games genres with the difference that the aim is a focus on the imitation or reproduction of real conditions, while games tend to involve invented or fantasy worlds.

Construction and management simulations have much in common with strategy games. In this type of simulation players must build, expand or manage fictional communities or projects with limited resources. In these games the player is the overall planner and leader, and must meet the needs and claims of game characters with regards to food, shelter, health, economy, ...

Other games attempt to simulate a business activity where the player controls the economy of the game, and often the development of a company. Life simulation games or Artificial Life Games involve the control by the player of one or more artificial lives, by manipulating different parameters of the organisms and the environment over time. These may be invented organisms, pets or human characters.

There are different sport related games that focus on the strategy behind the sport, for example, acting as a football manager, and are therefore closer to strategy games.

PUZZLE GAMES

These games involve the solving of a puzzle of some kind, some times against the clock. These sometimes require physical skills, which take them close to the action genre. They are usually very simple graphically.

1.1.2 MASSIVELY MULTIPLAYER ONLINE GAMES

Massively Multiplayer Online Games (MMOGS) are multi-player games that enable thousands of players to play online against each other simultaneously, usually in a virtual world created for the purpose. The activity involved in these games may be similar to the activity involved in any of the other genres and indeed many games now involve the possibility of playing online with others. The key difference is that the other game players are often not known to the player at first, which often changes the dynamics and behaviour of the game play, making it more complex and unpredictable, and hence for many, more absorbing.

The definitions of these genres are **based on a context** in which the game is played on a device, such as a PC or a console and in which the player is either alone or playing with others who are present, or connected remotely.

2. GAME-BASED LEARNING

Games have always represented an important form of learning, but very rarely were they used in formal education. If they are somehow tolerated in the earliest development stages, they cannot be found in the selection of appropriate methods in the more »mature« periods of life, as many teachers believe

that teaching and learning is too serious matter to allow the presence of play in these processes. Therefore, games were marginalized for a long time.
Significant changes brought more massive introduction of information and communication technologies into education. ICTs do not change teaching methods, but they often encourage teachers and other professionals in the field of education to start thinking about new approaches. Thus, with the advent of ICT, teachers have often started thinking about collaborative forms of learning, even though this could be implemented in the classroom where students sit next to each other also without technology.
Even the emergence of computer games teaching has led experts to think more about games at school, and they found that high quality games always include construction, synthesis and application of knowledge. This means that by playing games, the player actually performs activities that are essential in constructivist theories of learning.

2.1 GAMES AND LEARNING

In a game, a player can create an environment within the zone of proximal development (ZPD) in cognitive and socio-emotional sense by selecting the complexity. This concept was defined by Vygotsky and represents the difference between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with peers that are more capable. Learning is most effective when it takes place within the ZPD.
Serious computer games are an example of the use of technology to effectively achieve the learning objectives taking into account these requirements. Of course, not every game is didactic and meets the above-mentioned conditions. The game is educational only when it »hides« some learning objectives. It is important, however, that despite the learning objectives the game remains funny and keeps all the other attractive features of the game.

2.1.1 GAMES ON THE BASIS OF BEHAVIOURAL THEORIES OF LEARNING

In the beginning, the majority of computer games was based on the behavioural learning theory. In fact, this was the teaching material with some »playful« accessories. Thus, the stimulus, which is the basic element of the learning process in this context, is the question the game addresses the player. His response to this stimulus is the answer, which may be right or wrong. Whenever there is a correct answer, a positive response should be given, which acts as an amplifier of the connection between the question and the correct answer. In a game, it can be »happy tune« or the emergence of figures, which stimulates positive emotions. In the case of a wrong response, the reaction must be negative. It can be »a sad melody« and/or graphic element, which has a similar effect and weakens the connection. Typically, a series of correct answers followed by any additional »reward« for the player's achievements in the form of mini game or animation. These games are based on the »drill and practice« principle and use game techniques such as quizzes, point and click, or practicing basic arithmetic operations. Such games are suitable for implementation with the use of ICT and are relatively simple to develop.

2.1.2 GAMES ON THE BASIS OF CONSTRUCTIVIST THEORIES OF LEARNING

Nowadays, we are increasingly interested in a constructivist approach to learning, because it is based on the learner's active role and allows the achievement of higher taxonomic levels of knowledge. Learning should be to the maximum possible extent problem-based and should take place in an authentic environment. Therefore, computer games are designed as stories in a real or fairy world and represent an adapted model of reality in which the learner plays a role, identifies with what is happening in that

world, and actively solves its problems. The teacher's main task is the selection (or in certain cases production) of suitable games and provision of proper guidance and responses before or during game play. In any case, after the game play, the teacher has to lead a reflection on playing and accompanying events related to learning, and make a summary of the learning results. This helps the learner in constructing appropriate mental models.

2.2 SERIOUS GAMES IN PEDAGOGICAL PRACTICE

Serious games can be used almost everywhere where people learn: in all levels of education – from kindergarten to higher education, in different subject fields, in formal and informal education. Such forms of education are very popular in the army, in the field of safety, security and rescue and, more recently, in healthcare. These are the areas where it is very difficult to train people in real situations; therefore, games offer an opportunity to establish them in the desired environment, and the player can identify with it. More and more often, serious games appear in education in the field of public administration, governance, and management as well as in other areas where there is a need for specific forms of communication, negotiation, and teamwork, especially in practical training.

Production of high-quality serious games is a very complex process, involving experts in selected subject areas, didactics and cognitive psychologists, graphic designers, videographers, programmers, and experts in advertising and marketing. On average, ten to fifteen people working on the project are involved in the development of good commercial games, for one to two years, and half a million euros are spent.

All these properties of serious games and the popularity of new technologies among the younger generations have been stimulus that we have started using games at the Department of Computer Science and didactics of computer science at the Faculty of Education, University of Ljubljana.

Motivational benefits are often mentioned as a reason for using computer games in education. But the experts are convinced that the motivational aspects of games are often **overestimated** and are actually secondary to **pedagogical advantages** associated with the design of computer games. This is especially **true** for **students in higher education** where the motivational aspects of games are certainly not the main reason for their use. The rationale for using games to teach is that they **embody sound educational principles**. If a game is recognized as being the most effective way to learn in a particular context, then students will be motivated to use it to learn (Whitton, 2009).

The **constructivist paradigm** has become the most widely used theory of learning in higher education. Bruner proposed in 1966 the idea that learning is an active process and that people construct their own insights about a subject by building on past knowledge and experience. He stated that teaching should **stimulate an inclination to learn**, specify ways in which to **structure knowledge** so that learning is most effective, and identify the most **effective sequences** in which to present the materials to be learned.

Savery and Duffy in 1995 provided a summary of three fundamental principles of constructivism:

- the notion of **situated cognition** where individuals' understandings are developed by interactions with their environment in an authentic context;
- **cognitive puzzlement** that provides the stimulus for learning;
- **social collaboration** where knowledge evolves through discussion with others and is a primary mechanism for testing understandings and providing sources of alternative views to challenge the ways in which people think.

Certain types of computer games, such as **role-playing games**, with their rich interactive context, increasingly difficult challenges, and forum for social interaction and collaboration, **provide** powerful **constructivist learning environments**.

Constructivist learning environments should

- allow students to take **responsibility** for their own learning, including what and how they learn;
- provide exposure to **multiple views**;
- encourage **awareness** of the learning process;
- make learning **relevant**, based on real-life activities;
- make learning a **social, collaborative** and **interactive**;
- use **multiple modes** of representation and rich media.

We will present a **set of guidelines** that can be used to support the creation of educational computer games for use in higher education. They are based on existing design guidelines in three areas related to effective educational online game design:

- constructivist learning environments,
- educational multimedia,
- engaging computer-based activities and games.

Three aspects of games have been identified that lead to increased engagement:

- appropriate challenge,
- compelling fantasy,
- creating curiosity in the environment,
- control over the environment,
- a feeling of power in the game.

Whitton (2009) created two sets of recommendations for effective educational computer game design for adult learners. The first set of guidelines highlights six characteristics that should be taken into account in the educational design of a learning game:

1. the ability of the game to **support active learning**,
2. the degree to which it is designed to **stimulate engagement**,
3. the **appropriateness** of the game **for** the desired **learning outcomes**,
4. the degree to which it **supports the reflective process**,
5. the extent to which it provides an **equitable experience for all learners**, and
6. the **availability of** ongoing **support** throughout the game.

These criteria are explained with examples in the following table:

Criteria	**Examples of ways to meet criteria**
Supports active learning	Encourage exploration, problem-solving, enquiry.
	Provide opportunities for collaboration.
	Provide opportunities to test ideas and gain feedback.
	Provide opportunities for practice and consolidation.
	Ensure game goals align with learning goals.
Engenders engagement	Give clear and achievable goals.
	Create a large world to be explored.
	Support a high level of interactivity.

	Supply multiple possible ways to complete the game.
	Stimulate curiosity and puzzlement.
	Set challenges at an appropriate level, for example by making them gradually more difficult or customisable.
	Provide sufficient control over the learning environment.
Appropriateness	Ensure game goals align with curriculum, learning outcomes and assessment.
	Ensure a game-based approach is appropriate for subject matter and acceptable to students.
	Match game playing time to time available (including set-up, briefing, de-briefing).
	Make the game personally relevant to students.
Supports reflection	Provide opportunities for structured reflection.
	Ensure that there is debriefing on learning and consideration of application to the real world.
	Highlight the process of learning.
Provides equitable experience	Account for differing prior knowledge of the game type.
	Allow for customisation of the game.
	Provide equal opportunities to participate.
Provides ongoing support	Provide an orientation and overview.
	Allow students to achieve quick initial success with the gradual introduction of complexity.
	Provide ongoing hints and clues.

The second set is focused on the **interface design** of a game and there are six characteristics that are important for learning support:

1. provision of flexible ways for users to interact with the environment,
2. support for the development of a player community,
3. transparent navigation functions,
4. features that support user control of the environment,
5. robustness of design, and
6. appropriate visual design.

These criteria are explained with examples in the following table, where the criteria for the effective interface design of game-based learning applications, and elements that support fulfilment of each criterion are listed:

Criteria	**Examples of ways to meet criteria**
Flexible interaction	Make sure that all interaction is purposeful.
	Ensure that feedback is timely and meaningful.
	Controls must be logical and consistent.
	Build in performance indicators.
	Make a range of interaction methods available.
Support for player community	Provide a facility for players to communicate.
	Provide community self-regulation functionality.
	Use avatars or other individual representations.
Transparent navigation	Make navigation tools clear and consistent.
	Provide alternative methods of navigation.
	Ensure that help functionality is obvious.
	Provide an overview of player position in environment.
User control	Make game pace and level adjustable.
	Provide multiple customisation options.
	Enable tasks to be undertaken in any sequence.
	Make instructions obvious and clear.
	Ensure that all functionality is appropriate and obvious.
Robustness	Make it easy to recover from errors.
	Ensure the interface is responsive to input.
	Provide context-sensitive help and hints.
	Provide the functionality to save and return at a later time.
Appropriate visual design	Make interface simple, uncluttered and aesthetically pleasing.
	Provide information in accessible chunks.
	Ensure consistent of components.
	Ensure that graphics and rich media is purposeful.
	Make sure that text legible.

SERIOUS GAMES DESIGN AND DEVELOPMENT

3. INTRODUCTION

We know what content is and we know that certain **types of game suit** particular **content types**. Prensky argues that there is **no one way** for developing applications and that **serious games must be created on a case by case basis**.

In his description of game-based learning, he calls out principles of instructional design, domain or subject knowledge and game design.
Appelman & Goldsworthy argue that to create the most effective learning environment, the designer must **balance the content density** against the **level of understanding** of the content by the user, and **continuously adapt this balance** throughout the game experience. For example, as the learner's familiarity with the content increases, the presentation can become more abstract and the level of fun or 'affective experiences' required can be reduced. This **inverse relationship** highlights the reason why **simply integrating content into games technology will not work**: too much instruction will 'suck the fun' out of the game, but **too much fun**, particularly in an abstract or context-less game environment, can **make the learning harder** to contextualize without extensive reflection or a skilled facilitator.

There are typically three key types of participants involved in a successful learning game design process:

- **Subject matter expert** are responsible for defining the desired learning outcomes and the necessary subject content required to deliver these outcomes, often in the form of traditional text-based content or character dialogue, depending on the game genre.
- **Instructional designers** are responsible for validating whether the learning outcomes will be achieved by the proposed game design during all stages of development, typically including evaluation studies with target end users. They often work in collaboration with the game designer on the pedagogical aspects of the design, as well as ensuring that good learning practices are taken into account.
- **Game designers** are responsible for recommending the most appropriate game genre and game mechanics for achieving the desired learning outcomes, creating any scenario and defining any characters required.

Teachers at all levels of education system typically perform the roles of subject matter expert and instructional designer, but are much less familiar with the role of game designer.
In the framework of the GameIT project, the partners have to combine the knowledge of the subject matter expert, instructional designer, and the game designer in content creation process to design and produce a learning game. As the partners mainly have background in pedagogy and are experts in educational content in different domains, they need at least some basic skills in several areas in addition to expertise in the subject, such as some level of programming, instructional and graphics design.
Development tools and editors used for designing the game environment need to be simple enough that the domain expert will be able use them. In some more complex cases participation of game designers

might be required. The development of a game may be made in cycles, where the domain expert writes down a specification of the content that the game designer integrates in a game map. After that, the domain experts inspect the result and give some feedback in order to get the virtual environment and planned activities consistent with the learning goals.
There are some other important recommendations for the design of learning goals. An important issue that is often difficult to counter is ensuring alignment between the outcomes of the game and the intended learning outcomes from the game. The next important feature is the amount of time available, both to design and develop the game and associated activities and the time available to use in a teaching setting. Authors have to take into account also limited physical or virtual space available and the resources available (e.g. availability of hardware). These circumstances need to be considered as they can influence how and when games can be integrated into learning process.

4. GAME DEVELOPMENT METHODOLOGY

Serious games design and development process can be based on the SADDIE method, which we have developed for this purpose and is an extension of the ADDIE method, which was in the seventies of the last century developed in Florida State University for the preparation of educational materials in the American army. This model is the basis for most models that are used today in the development of educational content. It was named after the initials of the names of development phases: Analyse, Design, Develop, Implement, and Evaluate.
We added another phase, called Specification, as a first phase of the process, in which authors identify didactic problem in the learning process which cannot be effectively solved by traditional teaching/learning methods, define specific learning objectives, and propose an innovative educational method or technique of the game, by means of which the problem could be effectively solved.
Authors document all project work phases and at the end of the project submit the project documentation together with an elaborate game for assessment.
In the following paragraphs, we will present the individual phases of the project.

4.1 SPECIFICATION

It is quite a didactic task. At this stage, authors on the basis of their experience identify »weak points« in the traditional teaching and learning of selected topics, where they and their pupils need help. Taking into account the curriculum, they determine learning outcomes and the didactic method or game technique, which will serve in the later stages of the project to design and develop game elements. It is very helpful if the authors formulate at least a rough idea of the story that will later be the basis for writing a scenario. The story defines time and place of the events, characters, and various artefacts that appear in the story, and the links between them, along with the plot and challenge that are at the core of the story. This specification can then be transmitted to a team that will develop the game.

4.2 ANALYSIS

In the analysis phase, authors collect and analyse all relevant information for game design and implementation. In addition to data from the specification phase, there is information about available resources, users, and the environment where games will be used. Resources that are needed for the production of games include software tools for the preparation of the story and script. When analysing the learning objectives we are mainly interested in the expected taxonomic level of knowledge,

appropriate instructional methods, and appropriate game techniques. Based on the results of the analysis, Authors prepare work plan and timing for the remaining phases of the project.

4.3 DESIGN

In learning games, **real-time virtual environments** are utilized to **present** educational **content**. Virtual environment is implemented as **multimedia content** of a game, which consists of scenes, objects and characters, textures to dress the models, animations, music and sound effects. **Gameplay** is another part of a game and defines »what the player does«. Game designers build the dynamics of the game world by providing a detailed description of what the player can do and what the game has to do in response. There are many different approaches to integrate the content into learning game (Gómez-Martín M., Gómez-Martín P. & González-Calero, 2009).

- The easiest one is **extrinsic integration** that does not allow the user to go on playing the game until he has not successfully answered a question.
- More complex scenarios try to **smoothly integrate educational content** into game: explanations, exercises and feedback are part of the game design.
- In a **learning-by-doing approach,** virtual environment is utilized to present a simulation or metaphorical representation of a real environment where the student practices the concepts he is supposed to learn. The key part of the educational content is not the explanation associated with the concepts but the exercise itself. The user plays in a virtual environment in order to resolve certain task. The environment reacts to the user actions and provides explanations and feedback.

4.3.1 CHARACTERISTICS OF ROLE-PLAYING GAMES

In a role–play, the participants play a »role« in a specific situation or scenario. They can play their own part or someone else's in a safe environment where they can act, experiment, learn and teach with no risks of irreversible consequences. Since people won't fear the personal consequences of their behaviour, they are less cautious, inhibited and risk averse. Such emotional states might encourage them to learn (Greco, 2009).

Role–play had already existed a long time ago, in the genuine form of children's games, where most of the times everyone plays a role (e.g. say a girl playing with a doll, pretending to be her mother).

Role Playing Game (RPG) was defined by Tychsen as follows:

1. *The core of the game is role playing guided by rules. Each player typically takes control of one character. A character is a fictional figure that the player tries to act as role play.*
2. *The player will usually have full control of decision making at the character level. There is no author-audience relationship: each player has a hand in developing a personal, perceived story.*
3. *The game is usually set in a fictional reality, which is communicated via the fictional contract. The contract is the shared understanding among the game participants of the game setting/world.*

Greenberg & Folger proposed an interesting taxonomy that suits role-playing games very well. It has five key dimensions:

1. The **level of involvement** the participants encounter while playing a game can be described as an ordinal variable which is qualitatively rated from »low« to »very high«. In the first case, there are »non-active« role-plays, in which the players are asked to pretend they are in a certain situation.

When the *involvement* is very *high* there are highly active role-playing games (e.g. the simulations), where *each relevant variable is very close to reality*.

2. The second dimension of the taxonomy is the **role being played**. Greenberg & Eskew suggest envisioning it as differing along two independent dimensions: **person** and **familiarity**. In some RPGs the players can »play themselves«: they have to act, think and choose spontaneously, just the way they are, without pretending to be someone else. On the other hand, in the vast majority of RPGs, characters are quite different from players: they have their own personality, skills and experiences.
3. The third element of Greenberg's taxonomy is the **degree of response specificity**. It describes »*the degree to which subjects are free to improvise their reaction to game events, by acting in a free and spontaneous manner as opposed to a highly restricted, specified manner*«
4. The **competitiveness of a game** is very important since making a game more competitive can increase the engagement of the players, while stressing the importance of cooperation can support team-building and team-playing.
5. Serious Games can be, from the **didactical** point of view, developed in order to accomplish one or more of the following goals:
   - improving interpersonal skills (e.g. communication, leadership);
   - improving specific skills (e.g. negotiation, hotel's management);
   - gaining knowledge about something (e.g. internet security, university settings).

		Familiarity with Role	
		Familiar	**Unfamiliar**
Person played	**Self**	*Play oneself in a familiar role* Example: a businessman playing the role of a Chief Executive Officer in a business game *Global Management Challenge (http://www.worldgmc.com/)*	*Play oneself in an unfamiliar role* Example: a student playing the role of a Chief Executive Officer in a business game.
	Other	*Play someone else different from you in a familiar role* Example: an MBA student playing the role of a Chief Executive Officer in a business game	*Play oneself in an unfamiliar role* Example: a college student asked to play the role of a negotiator in a Union – Management negotiation simulation (Raiffa, 1982).

4.3.2 LEARNING GOALS AND GAME TECHNIQUES

Learning goals may be associated with different types of skills. In our work, we have relied on the taxonomy developed by Kapp, which includes the following categories: declarative knowledge, conceptual knowledge, knowledge-based rules, procedural knowledge, and so-called soft skills. For each type of knowledge, experts identified appropriate teaching approaches and game techniques.

DECLARATIVE KNOWLEDGE

Students acquire *declarative knowledge* mainly with memorization. Examples of such knowledge are different facts, data, and terminology. It represents the basis for the acquisition of knowledge on higher

taxonomic levels and students must learn it first. Learning declarative knowledge is largely based on the behavioural theory of learning.
Methods for learning the facts are the integration of new information with the existing one and showing the relationship of new facts with the existing ones in a given context. We may also use techniques of sorting and organization with which students allocate facts or objects into logical groups, or chunking, where large amounts of data or facts is organized in smaller units. One of the known methods is linking with which students associate names with images or concepts with their definitions. A very traditional method is also repetition. These teaching methods can be more or less indirectly »mapped« in the relevant game techniques. In the case of declarative knowledge, such techniques use stories, sorting and coordination as well as repeating gameplay.
Since prehistory, stories have been used to transfer knowledge between generations, even by at that time still illiterate people. Today we can also theoretically explain why such a form was suitable. Cognitive psychologists have found that the brain has affinity for the construction of stories. We remember facts better if they are told as a story than if they are communicated in any other form, for example, in the form of a list. Thus, even legal arguments are more convincing in a story than in a formal form.

CONCEPTUAL KNOWLEDGE

is based on understanding concepts, which are a form of association of similar or related ideas, events, or objects that have common attributes. Examples of such concepts are free market in economics, mathematical proofs and virus, worm, and Trojan horses in computing. Traditional teaching strategies include the use of metaphors, examples, and counter examples, and classification of attributes. If this strategy is transferred into a game, we get proper game techniques that enable us to achieve similar learning goals. Such techniques are sorting or organizing elements and content according to their attributes, »experiencing« the concepts about which players learn, and »experiencing« examples of these concepts. Sorting and editing in this context is not based on memorization, but on the understanding of concepts. From these facts it is evident, therefore, that the learning objectives are on higher taxonomic levels. Even when experiencing the concepts, players must understand abstract concepts and then use this understanding in a variety of concrete situations in practice.
The challenge of the game is to complete planned activities for which it is necessary to understand the abovementioned concepts. To make the game more challenging, the time that players spend on problem solving can be measured. This represents an additional performance measure.

KNOWLEDGE BASED ON RULES

is the next taxonomic level that is known in Kapp's categorization. By definition, the rule is a statement that expresses the relationship between the concepts. The rules define the parameters that dictate the desired behaviour with predictable results. An example of such rules is etiquette. Learning strategies that are most commonly used in this type of knowledge is illustration with examples and role-playing. If we use games, the most appropriate techniques for such knowledge type are simulation of tasks, experiencing consequences of non-compliance with the rules, and sorting and classification according to certain rules.
Simulation of tasks is a very common form of serious games. There are no strict boundaries between conventional simulations and games based on simulations. Typically, the latter contains an additional motivation in the form of a story added to it, which can further increase the interest and challenges. Simulation allows the player to encounter a customized virtual reality, which allows adjustment of the complexity of the situation and control, while allowing the implementation of activities that would be is

too dangerous (or too expensive) in the world. Otherwise, the various forms of simulations of driving, shipping, or flying are known for a long time in the education of drivers, sailors, and pilots. Even the operation of nuclear power plants or dangerous chemical process in practice cannot be done just for practice. Today's performance of multimedia technology increases the realism of the action and lowers the price and availability of such systems. Therefore, they are often also used in the activities in the field of protection and rescue, in the health sector, in public administration and even in business studies. Experiencing the consequences of compliance with the rules is just an extension of these simulation processes. Sorting and organizing, which we already encountered in both types of skills previously discussed, are here associated with the application of the rules.

PROCEDURAL KNOWLEDGE
is the sequence of steps that need to be done in the right order to reach a selected goal. Learning strategies for acquiring such knowledge is beginning with »big picture« and learning »how« and »why». In serious games, these strategies are translated into techniques such as carrying out exercises by following the procedure in difficult conditions, presentation of the challenge, which is achieved through instructions, and experience with the procedure in various forms of performance, which includes playing the demo, training, and various game modes (e.g. test mode, free mode).
Based on the results of specification and analysis phase, and taking into account the recommendations about the selection of game techniques, Authors can enter into writing stories that will allow the inclusion of specified learning objectives and will represent the basis for a game scenario. This is certainly one of the most creative phases of the project. In a scenario, all the details of the game have to be described, from the scenography through a description of all characters who appear in the game, to dialogues and, if necessary, any other individual details of the story. Typically, the script also includes drawings of all key elements of the game, which need to be developed in the next phase.

SOFT SKILLS consist of:
• Leadership skills: e.g. decision making, team communications, strategy development and tactics,
• Management skills: e.g. time prioritisation, interpersonal skills, communications, financial management and written skills.
According to at least one study, games are regarded as a perfect environment for teaching soft skills that support self-efficacy, self-directed learning and reflection upon performance, in addition to interpersonal skills that allow players to collaborate, communicate, cooperate and negotiate important skills for problem-solving and leadership.

4.3.3. RPG DESIGN PROCESS

We don’t have a fixed design process since having the same starting point and steps in design will usually lead to the same end product. Being innovative means finding new ways of work. Nevertheless, we can divide the design process in some basic ingredients. These can be a good basis for creating RPG.

In this document, we name the main ingredients which should be taken into consideration when creating RPG:
1. Choosing the topic, game universe and defining the game plot
2. Defining the game system, game rules and choosing the game mechanics
3. Developing character profiles and defining non-playable characters
4. Defining the levels of difficulty

5. Defining the time frame for a single game
6. Defining the number of players
7. Thinking about accessories and multimedia aids for the game
8. After creating the game we should think about the game manual

Each of the ingredients stated above is described in more detail below.

TOPIC MATTER, GAME UNIVERSE AND GAME PLOT

We can describe role-playing games as interactive storytelling. Storytelling is (1) incorporated in the actual game and also (2) shows in the form of pseudo-personal narratives of players when the game is over. Bowman (2010) observes that »RPGs allow individuals to participate in the construction of their own narratives in a group practice of co-creation. [...] the story develops through a continual process of involved interaction and creativity on the part of the participants. Thus, the 'audience' of a role-playing game invents the narrative as well as experiences it.«. Role-playing can simply be described as a group of players who create a story together by alternately telling it. This represents a form of round-robin storytelling, where the structure of well-defined individual roles within the narrative is missing. Players will experience the story on a personal level if we allow them to impersonate characters within the narrative. This allows them to better connect with the characters and the imaginary world, enhance the gaming experience and allows them to embed the acquired information deeper into their memory since they see it as a personal experience.

The Game Master or the Storyteller is responsible for story coherence and fluency. Their role is to describe the game world to the players and the results of the actions players make. Players are in this case characters in the story. The focus of role-playing games is not competition and winning, but challenging the players in the roles of characters to accomplish certain goals. In the end, everyone wins. The Game Master is the one who creates the game, and also assures that the players follow the rules and enjoy and learn from the gaming experience. It is helpful if the Game Master knows the players as people and as characters, since the game experience is better if it is more personalized. Role-playing encourages improvisation and creative thinking of everyone involved within the game so that makes players feel in control of their character's destiny and the ending of the story. This form of storytelling is called interactive because the Game Master and the players complete and expand each other's ideas in the spirit of »yes, and …«. The Game Masters need to be acceptable for new ideas from the players and need to come up with alternative solutions to keep the game on without forcing their own decisions and ideas, while constantly giving feedback to the players, rewarding creative solutions in various forms (extra points and dice, critical successes and lasting effects within the game world). According to McGonigal (2011) continuous feedback is one of the factors that motivate players to keep playing and make games enjoyable and challenging. The outcome of the game to come to a natural conclusion and set the balance of the game world. The educational and emotional value are also of great significance, since they provide a useful and memorable experience.

Story Choice

According to Zalka (2012) we need to consider the following points when choosing a story.

- Team effort: Since role-playing games are social games, participants work towards a common goal and usually do not compete against each other. That is why narratives should present a group of characters with their own distinct personalities and skills or have to present obstacles and problems complex enough to require a team effort and a set of diverse skills possessed by several players. If not, some players passive observers and others have to do everything on their own. This can lead into boredom during playing the game. All players have to be challenged to participate in the creative thinking and planning phase and actively support the plans the group has made.

- A new tale in a familiar setting: the players will feel comfortable with the game world and come up with suitable characters, actions and solutions if they are familiar with the cultural background of the game. The game should require minimal previous knowledge about the background of the game, and trigger interest and further research of it. The story should not be something too familiar to the players because this might lead to limited creativity regarding character creation and coming up with alternative solutions. Also, a too familiar setting can lead to the feeling of anticipation and can diminish the wish for exploration.

- Episodic narrative or easily dividable story into individual sessions: Time can be problem in implementing any kind of game into education. Stories chosen for gaming should have short episodes or clear pauses between scenes so they can be divided, and the individual scenes or sessions can be rearranged or left out – but they still have to lead up to a satisfactory ending.

- Connection with different characters and narratives: With the purpose of further learning and problem solving in the game, the chosen narrative has to be connected to other narratives of importance through characters, settings, or events. Through these connections players gain contextualized understanding and knowledge transmission, which are one of the main educational goals of games and storytelling.

- Multiple possible solutions: Games have to be constructed in a way which allows multiple solutions and enables players to create new ones because this encourages their creativity and improves the gaming experience.

- Age appropriate story: The story of the game should be appropriate for the age group of the players. We can either choose a story that has been previously used in the classroom or adapt one into an appropriate version.

Once an appropriate story is chosen, we need to research it with the purpose of character creation and defining the setting and the game world. If we want to add diversity to the game, we need to use multiple variations of the same story.

Also, as already mentioned, as educators we must create a list of learning goals before the creation of the game. These goals are an important factor when choosing the story of the game since it must be useful for achieving the selected goals.

The Mission Statements

With a single sentence, called the mission statement, we can reflect what our game is about. It should emphasize the specific kind of experience that our game offers. The mission statement can be more philosophical or personal, in any case it needs to be something that we are focusing around in our game design.
Some examples of mission statements are:

- Ghost stories on space stations.
- Build worlds and challenge your beliefs within them.
- Fight for what you believe.
- Powerful ambition and poor impulse control.
- There are no status quos, so play to see what happens.

Setting Context

With setting a context for playing in our game we create specific situations in some kind of fiction for player characters. In some cases the context is focused around one world, and in other cases games take place in multiple distinct contexts, compatible with each other.
When we think about context we should try to answer the following questions:

- Does our context encourage players to behave appropriately and leave room for conflicts? How? What are the major internal and external threats, along with scarcities, that fuel the most conflicts in your setting?
- How is life organized in terms of politics and other organizations in our context? Do you have multiple governing bodies, one nation or fractious anarchy? What types of government do you have (for example: monarchy, tyranny, plutocracy, theocracy or direct democracy)?
- On what kind of economy is our context based (for example: salt, gold, silks or shells)? Who trades with whom, and with which means of transportation?
- Do you have a religion? Is it a monotheism, polytheism or more diverse set of spiritual practices? What is the greatest spiritual problem in our context?
- What is the climate like, and how does that affect the local flora and fauna? Are there any plants with special medicinal, industrial, agricultural, spiritual and/or addictive properties? Are there any animals of particular value for labour, companionship, military, food, hides, or spiritual reasons?

Setting

Game settings are a part of every game and can be adapted according to the way the players prefer to play the game. Games are created on the basis of different aspects, such as:

- physical settings: where the game will be placed and how the players will interact and adapt to that setting,
- temporal settings: the time period of the game should be chronologically accurate; this will add to game realism and depth,
- environmental setting: conditions like weather, temperature, lighting, surface, etc. should affect characters' actions while playing the game,

- emotional settings: understanding the character's emotions and backstory helps us feel their motivations and can affect their decisions made by players during the game; this makes the player more immersed and emotionally attached in the game,
- ethical settings: defines the appropriate age group of players according to the contents of the story.

Setting is essential for making the game world come alive and it needs to include details from both the historical and the cultural background of the original story (maps, weapons used, languages spoken, clothes worn, etc.). Some of this elements could be set by the game creators (character creation, languages, social status) and some of them can be adapted by payers during the play.

Some details of the setting used in the games are:

- **Architecture**: Architecture defines a significant part of the physical setting of the game. The group of players need to be able to navigate in a building when they enter it (if the building plays a key role in the game, a floor plan is needed, otherwise a description is enough) or when they imagine it (in that case additional descriptions of the place are needed).

- **Weaponry**: Usually games require from the players to defeat monsters or other opponents. Sometimes this can be done in a peaceful way, but often that is not possible, so for these situations characters carry different kinds of weapons, according to their attributes. Players need to know what are available weapons so they can prepare for fight situations. Weapons are also an option for negotiating.

- **Languages**[3]: The playing group usually speaks the same language, but their characters may come across beings who do not speak their language. These encounters are usually a challenge of alternative communication that needs to be solved through creative thinking and visual aid. We need to provide the players with the list of most commonly spoken languages in the game and make those languages useful during the game. Our characters' languages skills define the number of spoken languages in the game.

- **Transportation**: During the game creation and playing itself, some ways of transportation (which are not obvious) should be defined and negotiated (for example between the players and the Game Master).

During game creation we need to make sure that the Game Master and the players are aware of what is available in game and what is not to avoid later confusion.

[3] Example in Dungeon Master's Guide:
https://rpg.rem.uz/Dungeons%20%26%20Dragons/D%26D%204th%20Edition/Core/Dungeon%20Master%27s%20Guide.pdf
Player's Handbook:
http://cadwe.free.fr/cadr/DD4/Player's%20Handbook.pdf

Game Module

As it has been mentioned before in relation to story choice, having clearly separated episodes and scenes in the game is important, especially in a classroom setting. That allows educators to stop the game at different points, without breaking the connection between stories which have to form a clear story arc. There are some key scenes that need to be included in the story so that the game is fluent:

- **Introduction**: Games usually start by capturing the player's attention and curiosity with a short introduction by the Game Master, setting the scene and the mood, describing the game world, telling the players where their characters are at the beginning of the game, and building up to the point where they can start acting within the scene.

- **Call to Adventure**: In the beginning, the players expect to find out what their quest, mission or adventure will be. It can be given to them directly by a NPC or the Game Master lets them figure out what they need to do by themselves.

- **Episodes and scenes**: The main part of the game is divided into smaller sections called episodes and scenes. An episode can consist of just one scene or several scenes. They usually consist of one task that the group has to resolve before they move on. An episode is a longer, coherent story unit that can include one or more of these scenes.

- **Conclusion**: In role-playing the game is officially over when the group manages to achieve their goal. Although the highest point of excitement and achievement, the fiero (McGonigal, 2011), occurs right after the group has defeated the final opponent or obstacle, there still needs to be a conclusion, just as in traditional storytelling. There are many different ways of concluding a story, either simply by returning home, stating how life is different after the quest, or with a promise of more adventures. Usually, when games continue on for new adventures, characters can receive experience points for improving their skills or acquiring new ones.

Creativity

Creativity is the most important part of role-playing games. Interesting ideas, character histories and plot twists are the elements that make the game special. When designing a game, you have to give the players the means to be creative.

- *Pillars* are bits of information without context, with rich descriptions that express the themes, moods and motifs of the setting, which can be used during play to build some kind of cohesive context.
- *Walls* are restrictions for the game that tell us which ideas are appropriate in the game, limiting our creativity to be within a certain fictional space. Characters may like staying within these walls or may want to break them down. In any case, walls give participants something to build off.
- *Webs* are combinations of various elements of fiction and their interaction. If we have something to build off, we can quickly build connections.

But you can get creatively exhausted if you do too much work. The Game Master must spread the creativity among the entire group and not be the only creative person in the game.

GAME MECHANICS

Game System

The Game Master is responsible for selecting the system for the game. The easiest way to create a game is to build it around a role-playing system that the majority of players is already familiar with (for example Dungeons and Dragons). Even if some players do not know the system, the group can teach them the basics.

Some of the mechanics to use in a game are:

- **Dice:** They are often used for determining success and making decisions, but they are not necessary. These elements can also be solved on the basis of trust and cooperation of the players. But playing without dice can lead to misunderstandings or even arguments. The dice represent the element of chance in the game and increase the excitement and entertainment of the game.

- **Cards**: Instead of dice, cards can also be used to add the element of chance to the game. They offer 52 possibilities if you do not use the jokers. You can also divide them into various groups: 4 suits, 2 colors, 12 face cards (not counting aces, 16 if you do), evens and odds. Jokers can have really powerful effects since they will not come up often.

- **Coins**: Coins are easily accessible, light and small and can be, in addition to RPG resolution, used as tokens or currency markers. Coin flipping provides binary results (heads or tails) but this can be expanded in an RPG, where players can flip multiple coins and check their results against another player's flip, a table or difficulty rating.

- **Dominos**: There are many different kinds of domino sets and a number of already established games that use them. You can apply some rules of those games to your RPG. Or you can invent your own uses of dominos. You can use them for comparison of the totals on the dominos between players, use them as currency, or even build a train of dominos and if a players wants their character to do something, they must play a tile to do it.

- **Tokens**: Almost anything can be used as tokens. Since they are physical objects, everyone knows how many tokens players around them have. They represent a resource of some kind. They can be used in bidding wars, comparisons, gambling, and spending. In a bidding war[4], players would go back and forth bidding tokens until one person gives up or they both run out. The emphasis in comparisons is put on accumulating large numbers of tokens with the purpose of defeating opponents. Gambling is like a bidding war, but instead the winner would receive some amount of tokens back, while the loser loses all of theirs. The emphasis here is put on resource management and risk-taking. And the easiest ways of using tokens is spending.

- **Point Pools**: Point pools are similar to tokens, but since they are not physical objects for other players to see, it is easier to keep them secret. Often, there is a space on a character sheet to track them. Since they are physical objects, trading points is quite easy, just with an eraser and a pencil.

[4] Bidding war: https://en.wikipedia.org/wiki/Bidding_war

- **Talk**: This is probably the most basic resolution mechanic. It can be used for adding information or solving conflicts. But be careful with using talk in resolution making. There has to be a limit to what people can do and objects like dice, cards, etc. can offer limits and unpredictability to your game.

Character creation and combat are the main two topics when creating a basic game system. Character creation forms the system of skills, abilities, and attributes[5] that describe a character and what it is capable of. Characters use these stats in the game to perform tasks that require skill or talent in some field. Having stats and dice rolls associated with using them allows any task in the game to become a challenge. There is a level of unpredictability and a dice roll may result in a fail or in a success. This adds to the number of possible outcomes the storyline can develop.
Combat is an important part of most games and can be divided in multiple rounds. Some games focus more on the storytelling aspect and narration takes over the role of dice rolls to determine, for example, where a hit has landed. Combats that include an extensive amount of rolling, especially if the results are not interpreted in narrative form by the Game Master, can drag out and become boring very quickly. Using more narration instead of dice rolling can make the system a lot simpler and easier to learn, which saves a significant amount of time for other elements of the game.
The game system has to be determined before creating characters, so that we can can include aspects (special abilities, extra skills, etc.) that are tied to the mechanics of the game.

Meaningful Choices

Meaningful choices are the main feature of roleplaying games. They allow the players to feel like their ideas and creativity are appreciated. When these choices are personally relevant to the player and are crafted to suit the individual character, you encourage identification with the character and a deeper level of roleplaying. This is why you always need to consider where meaningful choices are presented.
Vincent Baker proposes the Fruitful Void as another piece of RPG design theory about choices. Games are designed with specific problems or decisions that the rules cannot be applied to solve. Those »Fruitful Voids« are where player choices, situations and creativity will form the game. Dungeons and Dragons has no rules that explain why heroes seek adventure or why they seek to risk their lives for advancement and treasure. The deepest experience in play is how the player chooses to answer those questions for themselves.
Psychology research has found that the human mind can only easily keep track of about 5-7 entities at time. If you have a choice with multiple answers in your design, try to limit yourself to under seven different options. Lists of 3-4 strong items tend to be the best to choose from.

Resolution Systems

At their core, roleplaying games are collaborative storytelling that have a set of rules that govern the outcome of various conflict situations. Those rules consist of the resolution system and are often the core game mechanic for play. There are three common approaches to determining who gets their way, originally proposed by Johnathan Tweet in his seminal game Everway. All of these have their positive and negative sides, and often several of them are featured in any given game.

[5] Attributes = »stats«

- *Chance*: Success is determined by a random factor, for example dice (for example in Dungeons and Dragons), playing cards and tarot cards. In game design theory, this is often referred to as »Fortune«.
- *Choice*: This system allows players to choose the outcome of a certain conflict on the basis of some procedure or limitation, for example spending resources, saying ritual phrases, or whatever is dramatically appropriate. This is often referred to as »Drama« in game design theory.
- *Certainty*: This resolution system offers some fixed and absolute values for the participants. If you have a superior value in a situation, you get your way. This is often called »Karma« in game design theory.

Currencies

Most games include some kind of Currency. Players can get Currencies for certain actions and it can be spent for certain gains. But some games use Currencies in radically different ways.
For reference, traditional Dungeons and Dragons had three currencies:

- Hit Points can be gained by rest or magical healing, and this allows you to survive an injury.
- Gold can be gained by performing quests or eliminating threats, allowing you to acquire
- equipment and services.
- Experience can be acquired by violence, theft or performing quests allowing you to gain competence and 'level-up'.
- Here's a few things you should consider:
- How do people gain and lose Currency?
- What behaviours are incentivized by each Currency?
- Is the Currency positive, negative or mixed in effect?
- How much will be people willing to spend their limited Currency, and what will be the effect of people hoarding it?
- Who can exchange Currency and what happens after it's spent?

CHARACTER PROFILES

Character Options

After deciding the story and the game system, the following thing to do is to put together a list of playable characters. If we once again take Dungeons and Dragons as an example, characters are created based on Class (e.g. Fighter, Bard, Sorcerer) and Race (e.g. Human, Elf, Dwarf) that define their basic stats and are then individualized. Games that are based on traditional narratives feature characters are also used in the original source.

All characters must have a unique trait and skills or powers. These tell us what the character will be able to do in the game and what it can add to the team as a whole. A well-balanced team consists of a range of character types.

When designing character options for a game, the Game Master has to make sure to leave enough freedom for the players' own creativity and imagination. If the characters are too well detailed, the

players will not see them as their own creations, and that takes away from their connection to the game. The Game Master only gives profiles, suggestions, or unique traits, and helps with the creation process, but the players have to have the possibility fill in the blanks and create characters they truly enjoy playing. Gamers are proud of a well-designed original character. The Game Master decides if they allow changes made to the characters by players, but has to at least consider them.

Nonplayer Characters and Mobs[6]

Not all characters from the original story have to be playable in the game. There are certain roles these characters have to play, such as enemies that pose a challenge or NPCs that give quests or provide advice. NPCs can be divided in two categories, major NPCs and minor NPCs. They can be friendly or hostile to the group. Major NPCs have a full character sheet and play a significant role in the game story, they can be a recurring character or the solution of a challenge depends on them. Minor NPCs that only play insignificant roles and are ordinary people without any special skill or ability do not usually need stats. If a minor NPC, by some turn of events becomes a major one, their character sheet can be worked out later on.
All NPCs are played by the Game Master, so it is best not to have more than one major NPC per scene. It can divide the Game Master's attention and draws the focus of the story away from the group. The players need to be the heroes of the game; everyone else is just a supporting actor.

Bartle (2004) provided a typology of NPC functional roles in *Designing Virtual Worlds*. Bartle's work represents the most well-developed work on how NPCs can provide supporting functions in a game. The typology contains the following types:

- *Buy, sell and make stuff.*
- *Provide services.*
- *Guard places.*
- *Get killed for loot.*
- *Dispense quests (or clues of other NPCs' quests).*
- *Supply background information (history, lore, cultural attitudes).*
- *Do stuff for players.*
- *Make the place look busy.*

Monsters and fighting opponents need a profile, but not necessarily a full character sheet. For them, only stats related to fighting are needed. The Game Master can always modify the stats of monsters to the playing character's needs; sometimes it is initially too easy or too difficult to defeat them, so the Game Master has the right to adjust the numbers.
NPCs and monsters, just as playable characters, provide a chance for further learning. Choosing monsters and opponents from the original story enhances the game experience and adds details that motivate players to learn more about the game world and the tradition behind it.

[6] Mobs = Monsters

Dividing Responsibilities

Many games have a central figure that holds most of the responsibilities. Others have more distributed authorities, where each person has equal control over the game. And then, there are some games that mix the two styles, and have player-controlled factions or multiple GMs.
Below are some questions to consider for your game regarding responsibilities.

- Who is responsible for controlling the spotlight and attention of the group?
- Who is responsible for explaining, arbitrating and/or altering the rules?
- Who is responsible for creating NPCs (non-playing characters)?
- Who controls and portrays friendly NPCs?
- Who controls and portrays hostile NPCs and monsters?
- Who determines how the scenes are established?
- Who determines when the scene is finished?
- Who controls natural phenomena?
- Who can establish facts about the past, during play?
- Who can establish facts about the future, during play?
- Who controls the PC's actions and decisions?
- Who controls the PC's thoughts and emotions?
- Who narrates the outcome of a conflict?
- Who keeps track of time in the fiction?
- Who manages the logistics of actually getting together to play the game?
- Who needs to prepare for game sessions?

LEVEL OF DIFFICULTY

Difficulty levels / modes in games are rarely discussed as an important factor. Difficulty levels offer various choices to a player. They select a level according to their level of skill or according to their playing style. They determine the amount of challenge a player experiences while playing the game. Games do not have the same changes when different difficulty levels are selected. There are some mutual characteristics, though:

- The amount of opponents/problems encountered
- The amount of problems opponents cause
- The amount of strength/power of the opponents
- The amount of problems the player can cause to the opponents
- The amount of strength / power of the player
- The amount of strength / power "drops" in a game
- Time limit
- Reduced safe places / situations for the player
- Resource/power/strength stinginess.

Games usually use simple, self-descriptive difficulty settings: Easy, Normal, and Hard.

TIMEFRAME FOR A SINGLE GAME

Timeframe for a single game depends on the goals which we are trying to achieve through the game.

Long games (for example, more than 1,5 hour):
Games can be long (a few hours) – in this case we need to consider creating a game in modules. In that way we can stop the game after some amount of time (for example 15 - 30 minutes, one hour etc.) and continue next time. In this case learning goals should be hidden in every module of our game and need to complement each other.

Short games (for example, less than or equal to 1,5 hour):
In higher education we cannot afford to play more than 1,5 hour a single game. The game can, besides the time consumption, have demotivational effects on students if it takes too much time to play. Short games can in that terms have bigger effect and are more appropriate for educational use.

NUMBER OF PLAYERS IN A TEAM

The ideal number of players in a role-playing game usually ranges from three to eight, but there are usually considerably more students in an average classroom, so the games designed for education have to be adjusted accordingly. Simulation games have to deal with the same problem and authors have proposed various solutions to it. Adams (1973) suggests that »the teacher explain the game to five to six children and then, if others are to participate, have each of these play the game with a group of five or six classmates«. This could also work with role-playing games. However, it would require a great deal more preparation on the part of students who are assuming the role of Game Masters. It is of great benefit if there are students in the class who have experience in role-playing games and have been Game Masters before.

There are some alternative ways of playing when you have a larger group of players. One way is to have only some students playing, while others are observers. But there is a danger of the game becoming boring for students who are only observers. To avoid this when choosing this alternative, it is good if the audience has a task to fulfil, not just being listeners.

Another way of dealing with a large group is to have multiple people play one character. This method can be especially useful if some of the players are experienced with role-playing while others are not, and having pairs of experienced gamers and beginners allows the students to learn from each other through the process of the game instead of learning from a lecture. When beginners gain experience and become better, they could be allowed to take over the characters and try playing by themselves.

It is possible to play a role-playing game with a whole class, even though it is not ideal. It requires mutual respect between players and the Game Master in order to give everyone a turn to speak and act and for everyone to hear each other’s ideas. One solution for this is a system of turn-based acting, determining an order in which everyone can declare what they would like to do. This system allows the Game Master to pay attention to everyone and make sure all voices are heard.

ACCESSORIES AND MULTIMEDIA AIDS

Accessories and multimedia aids provide a level of comfort or convenience that makes gaming easier, smoother, and more appealing. Below is a list of some of the more popular accessories for tabletop games together with a short description.

Accessories

Playmats

Playmats are similar to boards for tabletop games, but usually made of a soft material which offers protection for our cards, makes it easier to pick them up and stops them from sliding on smooth surfaces. Another thing that playmats offer is a defined area for playing, especially useful if the game involves lots of cards and the playmat is marked with specific areas to put cards down.

Card Sleeves

Card sleeves are great for keeping your cards in a perfect condition. Cards that are regularly played with get scuffed, dented, scratched and torn, due to constant shuffling and dealing. If not protected, they can eventually become too damaged for normal play. Even slight damage can help you identify them from the others when they're face down in the deck.

Deck Boxes

Deck boxes are used for storing and transporting cards. There are many different colours and materials to choose from.

Card Folders

Card folders are another means of keeping your cards safe, flat and easy to look through. But putting cards in and taking them out regularly is not good for both cards and card folders. If you have a lot of cards you don't play very often and you want them in an easy to browse storage solution, a card folder is a good solution.

Board Game Box Inserts

These are box inserts that fit into the original game box, but keep all the cards, tokens, counters, markers, and other items for the game secure and separate.

Carry Cases

Carry cases are specifically designed to keep your safe in transit. They offer protection for game pieces and prevent them from mixing and getting broken.

Dice

Most games use regular dice and come supplied with dice. But unless they have custom dice designed just for the game, they often do not provide enough of dice and you have to roll them in two or three parts. So one solution for this is buying additional dice.

Dice Vault

Dice vaults are a great way of keeping your dice safe and sound.

Gaming Counters
Gaming counters are a cheap and handy solution when you need tokens. Or something that would represent different items on a map.

Spare templates
If templates are a part of the game, spare templates that are designed specifically for the game are a useful purchase.

Component upgrades
You can play your games as they come, but you can also upgrade them with new component upgrades and make them more exciting.

Multimedia Aids

Multimedia represents a wide field, which can be included in the board game design in many ways. Some of the basic examples are:

QR codes
Nowadays, when almost every student uses a smartphone in education, we have a nice opportunity to connect physical elements with some multimedia content. A QR code (quick response code) is a type of 2D bar code that is used to provide easy access to information through a smartphone. In this process, known as mobile tagging, the smartphone owner points the phone at a QR code and opens a barcode reader app which works in conjunction with the phone's camera.

Augmented reality (AR) / Virtual reality (VR) / Mixed reality (MR) applications
One of the ways how to add multimedia content to our physical setting in the board game is through Augmented / Virtual / Mixed reality and applications connected to them. Since devices that support AR/VR/MR can be expensive (for example, different VR glasses), we need to think about simpler solutions. One of them is using applications that support different realities.
For example, HP Reveal (formerly Aurasma) changes the way we interact with the physical world. HP Reveal is an Augmented Reality Studio. So simple (but powerful) that anyone can create (without any coding) an augmented reality experience. HP Reveal makes it easy for anyone to create and use AR, from educators teaching the next generation to the world's leading brands.

Video content/Graphics/Pictures/Music
With the help of different applications or QR codes we can easily add different multimedia content to the board game (for example video, graphics, pictures, music, etc.). We should take into consideration that using too much of external multimedia aids can be disturbing and lead students away from the learning goals and goals of the game. Also, if we consider using the strategy “bring your own device” (where students use their smartphones during the play), we need to be aware of all the distractions that these devices bring with them. Our game needs to be interactive and engaging so students won’t be distracted by their phones.

NINETEEN POINT CORE DESIGN DOCUMENT

Now that you have considered the fundamentals of your game, you are ready to write a Core Design Document. This will be a few pages of text that you will be able to refer to during the game design process to inform all of your decisions as well as your play testing efforts. Write your working title for the game, followed by your mission statement.
Try to answer each of next questions in turn and write your answers onto your core design document. This is a great document to share with other designers when you are soliciting feedback.

1.) What is your game about?
2.) What are your goals for game?
3.) Who is your target audience?
4.) What do the characters do?
5.) What do the players (including the GM if there is one) do?
6.) How does your setting (or lack thereof) reinforce what your game is about?
7.) How does the Character Creation of your game reinforce what your game is about?
8.) What types of behaviours/styles of play does your game reward (and punish if necessary)?
9.) How are behaviours and styles of play rewarded or punished in your game?
10.) How are the responsibilities of narration and credibility divided in your game?
11.) What does your game do to command the players' attention, engagement, and participation? (i.e. What does the game do to make them care?)
12.) What are the resolution mechanics of your game like?
13.) How do the resolution mechanics reinforce what your game is about?
14.) Do characters in your game advance? If so, how?
15.) How does the character advancement (or lack thereof) reinforce what your game is about?
16.) What sort of product or effect do you want your game to produce in or for the players?
17.) What areas of your game receive extra attention and color? Why?
18.) Which part of your game are you most excited about or interested in? Why?
19.) Where does your game take the players that other games can't, don't, or won't?

4.4 DEVELOPMENT

In this phase, authors produce the game. It means that they have to create scene artefacts and all occurring characters with the use of various graphical tools. Authors tackle these time consuming tasks in different ways. Some of them create all of these graphic elements using the selected software tools. It requires a lot of skills and knowledge of the technology of work, but then further processing of graphical elements is much easier. Others draw key elements on paper and then digitize images. Especially for characters that are animated in a game, this work is time-consuming because it is necessary to draw each character in different positions and from different angles. Designed graphic elements must then be uploaded into a game machine. This is a program that supports animation, dialogues, and player's interaction with the game environment. The technology is progressing rapidly and we try to follow it and select the solutions that enable authors to give the maximal attention to the didactic aspects, while the computer takes care of the technical aspects of the realization of games.

4.4.1 GAME MANUAL

When you create a new game, you must also form a set of instructions to help others learn how to play. It can be fairly difficult sometimes to teach a completely new game to the public. You must have in mind that everything about your game is completely new to your public. It can take some time to put together a set of game rules. But it is important to have them as detailed as possible.

PART 1: Formatting Your Instructions

1. You can take the basis for your rules from some of your favourite games. They can serve as inspiration and examples in terms of format and style. Notice the hierarchy of the information explained. Follow the format of other instruction books that move from specific points to the big picture.

2. Write your instructions to be suitable for loud reading, because these rules are usually read to the group by one person. This means writing in present tense, in active voice and being short and to the point.
The key is making the text quick and easy to understand, getting a good amount of information to the players and explaining their objectives and ways of winning the game.
For example, if you have a board game about two countries at war, you might explain the objective like: »You are a member of one of the two countries at war. You are assigned a role to aid your country. The goal of the game is to work together to defeat the enemy country in one of three ways: You can win by destroying the country through war, assassinating the country's leader, or being the first country to go into space.«.

3. Using the second person helps you to convey the rules of your game. Instead of saying »When a player…« or »The player…« Try saying »When you…« as much as possible. Using active voice also gives the players clear directions of what to do. There are times when using the second person sounds awkward, so use the third person when it makes more sense.

4. Make game terms easy to find and understand, and include references right away. If the explanation needs more depth, add a notation, then include a separate section explaining it further.
For example, if you mention that one way to win is to kill the enemy's leader, state where you can find the instructions on how to do this and add a separate section that explains this in more detail.
Always show players where to find more information on the term.

PART 2: Creating your instructions

1. Explain the concept or goal of the game. It is also a good idea to give a brief summary of the game or the game world's history. It should be short and help players understand the objective that follows. If there is a war in the game for example, explain why countries are at war.

2. Write your instructions in a logical path of explaining the mechanics of the game.
You can start a game with a brief summary and continue with included pieces, objectives, the setup, how the play operates, what each piece / character does and finally explain how you win.
Design your instructions like a book, with table of contents. Include a brief section on the details how many players can play and the age range. Describe your game and explain the rules.

Explain the setup so players can set up the board. Then continue with how to start playing and later with a style of play. If you have a turned based game, explain how the turns work.

3. Group similar information together. Game instructions should be written in sections which are easy to understand and follow. Write them in the easiest way possible. Put all the ways to score points together. Explain the turns in one section.

4. Make a list and explain all objects in the game individually. Use this section as an encyclopedia, go further in depth and explain all objects, although you have already mentioned them before.
It's very important that the player understands what cards, pieces, units etc. represents. Draw or sketch your pieces as a visual aid.

PART 3: Finalizing Game Instructions

1. Read over your game instructions. Put yourself in the role of someone who doesn't know anything about the game. How would you understand these instructions? Are the objectives explained well? What about the setup, turns and winning work? If there are trouble spots, revise them. Instructions should be easy to understand.

2. Show some examples. If there are any turning points in the game, show an example of how turn should go. Examples should cover most of the scenarios and interactions between the game elements. If there are multiple turns in the game, use notation to explain this part.

3. Think about including strategy tips. The descriptions of the rules or how the board is setup are sometimes hard to understand. Help the players by including some tips on strategy. List all special scenarios that might otherwise confuse the player and include strategic methods for winning the scenario. The winning method can be quick and easy or maybe more complicated, depending of the game. However, it is a really important step.

4. Extras or possible game variants can be included at the end. List the alternative ways here, if they exist.
The main instructions explain the operation of the game. Explain all elements that aren't used specifically for the main game.

5. The instructions should be easy to read. Ask someone to read your game instructions and check for any errors. He can tell you if the instructions make sense and where / how to better explain things.

4.5 IMPLEMENTATION

Implementation in the context of our project is the application of serious games in a learning process. Using games for teaching and learning does not mean that students are left with their ICT devices to spend their time on their own.
Games rely heavily on free exploration that is a move away from traditional teaching methodologies. Through the changing landscape of education, the teacher's role in the classroom has changed.
Teachers often say that if the game teaches certain topic, students can learn by themselves. In fact the opposite is true. Teachers are integral to the learning process. Utilizing constructivist techniques such as

experimentation, games allow students to discuss and demonstrate actions and reactions; this is part of inductive discovery, learning through practice and learning though experience.
Very often playing games is a time consuming process, but teachers have limited time for use of alternative learning resources in formal education. There are several approaches that can be used to overcome this problem. Each of the presented approaches has some positive effects on learning and GBL can only be justified when it increases efficiency of learning!
We can integrate games into the learning process in the following four ways:

- Game played by students in a classroom as a motivation before the other learning activity;
- Teacher playing game or just showing individual scenes during the lecture to display certain concept or to illustrate selected topic;
- Gameplay as a group activity in the classroom;
- Game as a homework as independent learning.

The game environment can be used to focus the student's attention on what needs to be learned, to motivate student for other learning activity, to illustrate selected contexts, or to help player to identify with the character in a game.
Game as a group activity in the classroom is used to stimulate cooperation and collaboration with peers in the classroom as well as collaboration with students from other locations. Students are responsible for the outcomes in a game and for the learning outcomes of the group and the others.
Games are not just as a vehicle for delivering learning, but serve also as a means

- to initiate discussion,
- to motivate students for different activities,
- for design, where learning happens through the game design process.

Games can allow the teacher very high level of interaction. When the game is complete, a further window of interaction occurs; students will want to talk about their achievements and activities.

To use games in the classroom the teacher must be familiar with the game at the very least. At the very most they should be an expert on all the rules, levels, characters etc., in order to guide students through the experience (Routledge, 2009). Some believe it is too much to ask to be an expert in game as well as their subject area, but it's similar to knowing the location of information in a textbook for example and it comes with practice.
Becoming familiar with the game should not be too much of a burden for the teacher. Some games come combined with lesson plans to aid the smooth transition into the classroom. Any developer of games-based learning should provide guidance on how to use their games and as a teacher you should expect this to be packaged with the game.
Teacher training is vital, as they must feel confident that they know what to do and say if asked a question.
Using games in the classroom change the way teacher works. Games are not a replacement for teachers but they should enhance the teaching experience. Students require the skills of the teacher to guide and draw out the learning. The game is a tool, and must come supplied with a learning framework. Teachers have to be able to devise strategies and plans that they can use to assess their students, and by pulling this information together it will help them to create lesson plans. They should also think about what other teaching techniques, such as class discussion or creative writing, can be applied and which ones will complement the game play (Routledge, 2009).

Gameplay, presented above, is just one of the activities in ***learning package*** that should be designed in

order to integrate game into the learning process. In the design process, authors have to take into account:

- students' background and previous knowledge,
- learning goals,
- curriculum,
- technical resources,
- their own competences.

Essential accompanying supporting activities in game based learning that ensure that students **understand** the **purpose** of the game and **relate** the **activities** during the gameplay to the intended **learning outcomes** are

- **briefing and**
- **debriefing,** which consists of **post-game discussion** and **reflection**

Briefing and debriefing are terms which have been traditionally used in a military context, but the same process is applied in educational settings (Mackenzie, 2002).

Briefing can be defined as orientating a person to an experience, which includes the instructions, goals and rules within which participants in the activity can achieve their goals. Briefing is important to set the right expectations about the experience, the format it will take, and the process teacher is planning to implement. The students need to understand it is a learning activity and they need to use the game for more than fun. The fun must be kept but students should be informed of what is expected of them and the types of activities that will follow. Students need not to be aware explicitly the game is for learning, but they should be prepared to be active!

Activity is the phase when students play the game. They have no fear and understand the need to experiment. They have no problems to play and then fail; than they ask to play again. Students playing games are motivated to improve their score, to work better as a team, to communicate more, and to plan. These can be rarely seen in traditional pedagogical methods.
They were learning about the game and learning outcomes through experimentation and peer interaction. A well-designed game inspires students to keep playing - to beat their score, or beat their friend.

Debriefing can be defined as a purposeful reflection which can be undertaken by an individual or group. It is a process where group members can discuss and work through ideas, issues, feelings or concerns which are generated by individuals within the group. In order to be an effective educational activity, debriefing needs to be based upon specific learning goals and be a regular activity that is closely linked to game-based learning. Debriefing is based on the premise that there is a positive connection between exposure to a practical experience and the process of learning from the experience after it has occurred.

Reflective learning is important a step in using games as teaching tools. Although games are important for the experience, learning will also happen away from ICT and it is essential to encourage students to think about the activity after the game has finished. Teacher can encourage reflective learning using techniques such as class discussion or written evaluation. It is very useful if it is possible to save the game so that it can be discussed later. Peer debriefing is also a great tool. Young people love to talk and share their experiences, their points, or whatever the game rewards them with.
The reflection and debrief often lead to the situation where students link their activities in the game back to the real world and transference is achieved. They can then go back into the game and apply their newly constructed knowledge, and the learning cycle begins again.

Briefing and debriefing are closely linked. The purpose of briefing is to optimise student learning by addressing student expectations and feelings about new and unfamiliar experiences they are about to undertake. The importance of peer group support and the acknowledgement of feelings amongst the group can also be emphasised (Horsfall, 1990).

Learning package ensure that the game based learning is **focused** and **appropriate**. **Supporting external activities** after gameplay that support discussion and reflection are (Whitton, 2010):

- reflective accounts or diaries that students keep of their progress,
- small group work with discussions about gameplay,
- replaying the game and talking through the thought processes involved and how performance has improved,
- production of artefacts that relate to the game (posters, presentations),
- creative activities around the characters or plot of the game,
- application of skills to the real world through activities that build on skills acquired during the game,
- critique of the game itself and its mechanics, considering how effective it was and how it could be improved.

Game-based learning is learning from experience or learning by doing. It first immerses learners in an experience and then encourages reflection about the experience to develop new skills, new attitudes, or new ways of thinking. It is built upon a foundation of interdisciplinary and constructivist learning. Outcomes of the learning process are varied and often unpredictable. How one student chooses to solve a problem will be different from another student, and what one student takes away from an experience will be different from the others. Students can process real-life scenarios, experiment with new behaviours, and receive feedback in a safe environment. Experiential learning assignments help students relate theory to practice and analyse real-life situations in light of course material« (Lewis & Williams, 1994).

According to Wurdinger (2005), there are some key things to keep in mind when implementing game-based learning activities:

1. *The importance of being able to make mistakes*
   Students are accustomed to being penalized for making mistakes. Instructors in GBL must work hard to overcome the stigma attached to mistakes by actively celebrating them as opportunities for learning. Allowing students to make mistakes may also lead to a situation where they retain more information because it is a more challenging learning process.
2. *The importance of personal relevance*
   It is important to discover what the students are interested in, and then select the appropriate topics. When interest is internal, as opposed to being forced, students become both emotionally and intellectually invested in the learning process.
3. *The importance of students understanding why they are doing something*
   If the student cannot see the reason behind their project, or do not see why they are involved, they may not learn anything at all.
4. *The importance of matching students with appropriate activities*
   In GBL, the means are as important as the ends, therefore it is of utmost importance that students stay engaged throughout the whole process. Not enough challenge may result in boredom, and too much challenge may result in frustration—in both cases, engagement will drop and learning will cease.
5. *The importance of students reflecting on their experience*

This step is tied to the previous one. Reflection, along with driving questions from the lecturer, will help students maintain interest, learn successfully, and complete activities.

6. *The importance of the instructor delegating authority to the students*
   In experiential learning, the lecturer serves as a guide and a resource to students, rather than as a leader. She needs to use the respect and position to promote student empowerment.

The role of the instructor in the experiential classroom is different than in the traditional classroom. In GBL, the instructor is a guide, a cheerleader, a resource, and a support. Because students must take control of their own learning, the instructor must work to both relinquish their authoritarian influence and become, instead, an integral member of the evolving group. After the students have attained self-determination, intervention by the teacher acting as a leader occurs only in situations when the group lacks the skills to deal with obstacles they encounter.
Since reflection is such a crucial component of a successful GBL process, it is imperative that students understand exactly what reflection is and how to use the process to deepen their learning.
Each implementation has to be evaluated by the teacher to determine to what extent learning goals have been achieved.

4.6 EVALUATION

We evaluate the whole process of game development together with authors, as it is one of the most important learning activities in two of the key courses of our study programme and it includes a large set of learning goals. We explain authors that the game they have developed in the course is actually just a side effect of their learning process.
Authors who design and develop a game must also evaluate the game itself as well as a learning process, in which the game is integrated during practical training at school. Authors first use peer evaluation in the so-called beta testing. The next step is gamma testing in a school. Authors interview pupils about their opinions regarding the comprehensibility of the game, and evaluate the effectiveness of learning by means of selected experimental methods. Authors monitor and observe all the activities in the classroom and discuss them with teachers. All collected data are then used for revisions and improvements, if needed. Summarized results are also used to evaluate to what extent the goals, set in the specification at the beginning of the project, were achieved.

4.6.1 TROUBLESHOOTING TIPS & TRICKS

A few design suggestions for introducing role playing in a game
The level of involvement in a computer game should be as the result of a symbiosis between content and graphics. The content of the game includes the story, the role of the player and the decisions he makes. The content has really important role. While the player can compensates cheap graphics by his imagination, a featureless content can't be compensated. Role-play in a game can significantly increase player's engagement and enhance learning. Players can empathise with others, understand their motivation and practice the concepts being taught.
Here are some situations when role-playing has proven to be effective (Greco, 2009). You want:

- The discipline you teach to be practice-based.
- To increase the engagement of players.
- To promote interaction among players.
- To modify attitudes.

- To improve interpersonal skills.
- To soften a positional negotiation approach.
- To increase the link between the learning situation and the real world.
- To forecast the decisions in conflicts and negotiations.
- To create an environment free of fear and distress.

Role-playing is not appropriate if the degree of response specificity is very low or the situation to be played is not convincing or relevant.
There are some other situations where role-play is useless or detrimental (Greco, 2009):

- You only want to see how people would act in a specific situation.
- The game or the experiment will not last long.
- Major status differences exist among players.
- The degree of response specificity is very low.
- The discipline being taught doesn't need any interpersonal interaction.

Developing a game with a complex didactic purpose requires a high level of al the taxonomy dimensions, competition and cooperation.

5. CONCLUSION

We don't have a fixed design process. We believe that starting from the same beginning will frequently lead to the same end. Finding new ways of working often leads to innovative designs. Of course, there are always the basic ingredients of game mechanics, game materials and the theme or the world. These are good anchor points and in a balanced design these dimensions will blend together nicely and support each other.

We have divided the design process into six steps: story choice, game system, character options, nonplayer characters, settings, and game module. The structure of the template is as follows:
1. *Story Choice*: The Game Master selects the narrative that will become the basis of the game. The GM conducts research on the origins and variants of the story.
2. *Game System*: The Game Master decides on the game system that fits the game story and the needs and experiences of the playing group and proceeds accordingly.
3. *Character Options*: The Game Master selects playable characters and creates short profiles that help the players choose and create their characters.
4. *Nonplayer Characters*: The Game Master selects the most important nonplayer characters and creates profiles for them. Shorter profiles are also created for monsters and potential combat opponents.
5. *Settings:* The Game Master conducts further research on the historical and cultural background of the story in order to add more detail to the game world.
6. *Game Module*: The Game Master creates a skeleton for the original story, divides it into shorter episodes and scenes, and plans the game module accordingly.

TWO EXAMPLES OF GAME DESIGN PROCESS

Examples are prepared through six steps of game design process with nineteen-point core design document. We prepared two examples:

- The reality show - The Restaurant, a didactic computer game made by Mateja Bevčič, Sanja Jedrinović, Dejan Krejić and Janja Pogačar with Jože Rugelj, Matej Zapušek and Alenka Žerovnik as mentors. This is not a typical role playing game because it is based on the SADDIE method.
- Dungeons and Dragons, the world's most famous roleplaying game for over forty years.

The 1st step: choose the narrative that will become the basis of the game

1. Short description of the game:

The reality show:

In the game the player gets to know the concept of the algorithm through the Reality show, where he faces various challenges - baking pancakes, cooking Cordon Bleu, serving guests. Challenges must be solved successfully if he wants to become the new owner of the Restaurant. The challenges are also time limited. The goal of the game is to complete one level and move to the next one. If the player does not complete the level, the game is over.

Dungeons and Dragons (D&D):

The Dungeons and Dragons is a roleplaying game, which is also a storytelling game. A roleplaying game like this provides form and structure, with robust gameplay and endless possibilities. It is a fantasy-adventure game, where at the beginning you create a character and team up with others, explore a world and battle with monsters. In the game you use dice and miniatures but whole action takes place in player's imagination. Every player has the freedom to create anything he imagines and anything can happen.

2. Learning goals:

The reality show:

Goal 1: The student can follow an algorithm prepared by someone else
Goal 2: The student understands the concept of an algorithm
Goal 3: The student can decompose the algorithm into building blocks (subprograms)
Goal 4: The student can connect multiple algorithms to a whole that solves a problem
Goal 5: The learner can describe everyday problem as a sequence of steps
Goal 6: The student can present a simple task with the algorithm
Goal 7: The learner presents algorithm with the help of instructions in a simple language

3. Target audience:

The reality show:

The game is intended for primary school pupils, especially students of the fourth, fifth and sixth grades. Pupils do not need any pre-knowledge. The game is designed for programming and can be used in a subject that is intended for computer literacy.

D&D:

There is no age limit for playing the game.

The 2nd step: decide on the game system that fits the game story and the needs and experiences of the playing group and proceed accordingly

4. What do the characters do?

The reality show:

Characters are in a reality show, where they face various challenges - baking pancakes, cooking Cordon Bleu, serving the guest. The main character competes with others and must successfully solve challenges if they want to become the new owner of the Restaurant.

The table shows how we connected learning goals with specific activities:

Learning Goals	**Activity**
A student can follow an algorithm prepared by someone else The student understands the concept of an algorithm	The player watches the boss in preparing the pancake and then imitates her
The student can decompose the algorithm into building blocks (subprograms) A learner presents algorithm with the help of instructions in a simple language	The player gets a recipe for the whole lunch, which is divided into three meaningful parts (for example meat, potato, sauce) The player can make the correct sequence of steps within subprograms (meat, potatoes, sauce)
A student can connect multiple algorithms to a whole that solves a problem	The machine brakes and the player has to determine which foods are correct
A learner can describe everyday problem as a sequence of steps	The player has to make a work plan for the third day (preparing the table, accepting guest orders, preparing food, serving)

The student can present a simple task with the algorithm.	The player prepares a table for the guest and serves the guest

5. What do the players (including the GM if there is one) do?

The reality show:

Students get to the introductory scene when the game starts, where the starting scene and the button "Play" are. If they want to continue they need to click the start button. The player first encounters with the boss Inga. Then they see all players in the game in the hall. This is followed by a character's choice scene. In this scene, the player must choose their character. They select a character by clicking on character's thumbnail. The player directs their selected character with the mouse. The player's character follows player's clicks with the mouse. If the player follows the instructions given by boss Inga, they can successfully finish the game.
The conversation between the player and different characters is done by right-clicking on a character and choosing one of the options that the object/character offers. The conversation is bound to clicks so that the player, when reading, clicks on the screen and the dialogue continues. If the animation is inserted into the game, this cannot be done.
When solving the problem, a student meets with easier and more difficult challenges, which they have to solve. In case of wrong decisions, they are warned and directed to right decisions. The player can also fail and then the game is over. If the player has done everything successfully, they become the owner of the restaurant.

D&D:

Player Characters
Every player creates a character, an adventurer. This character is a part of a team, which delves into dungeons, battle monsters and explores the world's dark wilderness. Player characters are at the center of the game's action. While playing your D&D character you put yourself into your character's shoes and act as if you were that character. You decide where to go, which door he opens, to attack a monster or not, to attempt a dangerous quest etc. These decisions are usually based on your character's personality, motivations, goals and you can speak or act like your character. The control over what you character can do and say in the game is almost limitless.

The Dungeon Master
The Dungeon Master (DM) is a special role for one person in a game. DM presents the adventure and the challenges that the players try to overcome.
DM has several functions in the game and every D&D game needs a Dungeon Master, you can't play without one. Those functions are:

- Adventure Builder: The DM creates adventures for all players to play through.
- Narrator: The DM sets the pace of the story, presents the various challenges.
- Monster Controller: The DM controls the monsters and villains the players battle against, chooses their actions and rolls dice for their attacks.
- Referee: The DM decides how to apply the rules when necessary.

The DM's job is to provide a framework for the whole group to enjoy an exciting adventure, this is e.g. challenging the player characters with interesting encounters, keeping the game moving, applying the rules etc.

6. How does your setting (or lack thereof) reinforce what your game is about?

The reality show:

The game is placed in a setting which represents the actual reality TV show. With architecture in the game we wanted to present a house with a kitchen, living room, bedroom and the restaurant as it is in a real reality show.

D&D:
D&D game presents a world of magic, monsters, brave warriors and spectacular adventures. It begins with medieval fantasy and adds creatures, places, powers to make the unique D&D world. This world is ancient, built upon and beneath the ruins of past empires, leaving the landscape dotted with places of adventure and mystery.

8. What types of behaviours/styles of play does your game reward (and punish if necessary)? 9. How are behaviours and styles of play rewarded or punished in your game?

The reality show:

The game begins when the boss Inga arrives and the competitors wait for her in front of the restaurant. The competition lasts for three days. The game continues in a room, inside the restaurant, where Inga and the competitors introduce themselves. The player can choose between four characters (Jessy, Bandele, Emma, Oscar). When a player chooses one of them, they continue with the first challenge. Inga makes a pancake through a specific procedure (animation) and the player has to do exactly the same. The player makes the pancake by clicking and dragging ingredients. During his work Inga pays attention to errors. The player has two minutes to prepare a pancake. If they are not successful, the game ends. If they need help, they can take a look in a recipe book. If the player completes the task, the day is over and they go to bed (animation). After each day one character gets out of the show. The next day the player has to prepare lunch (Cordon bleu with cream sauce and potatoes). Their first job is to separate the recipe into three logical units (meat, potatoes, sauce). Then they have to properly arrange each unit. they can make 10 mistakes in both activities together. If they make more than 10 mistakes, the game is over. They follow the preparation of lunch according to the previous recipe. This is done by a miraculous machine, which breaks down. The machine prepares more dishes and the player must choose the correct ones. The player has to be careful, if they make a mistake, the game is over. If all the tasks are done successfully, they go to bed and wake up on the third/last day. Two players remain in the final. The player gets a tablet and they have to make a plan for the day. They must be careful to choose the correct tasks. There is also a »smile figure« which gives player a hint. Their first task is to prepare a table for a guest. The player accepts the guest's order (animation) and prepares his meal. If they are not quick enough, the game is over. If they are successful, the results are announced and they become the next owner of the restaurant.

Game rewards players who follow the rules and punishes those who do not. Players who follow the rules are rewarded with progress to the next level and with magic ingredients during the play. Players, who do not follow the rules, lose the game.

D&D:

You advance a level in the game as you adventure and gain experience. Gaining a level is one of the biggest rewards you can recieve for your success in the game and with this your character inproves in several ways every time you go up a level. You reach a new level with earning enough experience points (XP), which you get each time you overcome a noncombat encounter, defeat monsters or complete a quest.

11. What does your game do to command the players' attention, engagement, and participation? (i.e. What does the game do to make them care?)

The reality show:

The game is made in such a way that no prior knowledge is needed. The game is simple and understandable for students. Our starting point was simply that most pupils know a reality show and knowing that there are some rules and observing some of the instructions. Students learn independently with the help of simulation of pancakes and Inga's instructions. Our primary goal was for students to understand the concept of an algorithm. Additional motivation is our final goal - the ownership of the restaurant.

Motivation elements

- Sound effects
- Graphic image
- Animations
- Learning with playing a game
- Become a boss of a restaurant with successful tasks
- Get magical cocoa
- Actual TV show

D&D:

Player Motivations
Most players enjoy many aspects of the game at different times. The primary player motivations are defined as type of the players:

- The **actor** likes to pretend to be her character. She emphasizes character development, trying to make her character seem to be a real person in the fantasy world. She enjoys interacting with the rest of the group, with characters and monsters in the game world.
- An **explorer** loves to see new places in the fantasy world, to meet the residents. He just needs the promise of an interesting locale or different culture and he goes to see that place.
- An **instigator** enjoys making things happen. She has no patience for careful planning, her moto is »just see what happens«. She opens dungeon doors to bring more monsters into an already difficult fight. She loves taking enormous risks and sometimes making bad choices.

- A **power gamer** thrives on gaining levels, defeats monsters, takes their stuff and uses that stuff against future enemies.
- The **slayer** is like the power gamer but even easier to please. She emphasizes kicking the tar out of monsters.
- The **storyteller** is a player who prefers the narrative of the game to individual character motivations and personality. This player sees the game as an ongoing chronicle of events in the fantasy world, and he wants to see where the tale goes.
- A **thinker** likes to make careful choices, reflecting on challenges and finding the best way to overcome them. She enjoys planning results in success with minimal risk and use of resources.
- A **watcher** is a casual player who wants to be part of the social event. He might be shy or just really laid back. He wants to participate but at the same time he doesn't want to be too involved in the details of the game, rules or story. He enjoys the game by being part of a social circle.

12. What are the resolution mechanics of your game like?
13. How do the resolution mechanics reinforce what your game is about?

The reality show:

Game mechanics:

- A **talk** with non-playable characters (Inga, Smiley, miraculous machine, the guest).
- **Choices**: The resolution system allows player to choose outcome based on some procedure or limitation. This involve spending certain resources (time, building blocks, …) in order to succeed.

Resolution mechanics (talk) represents what is really happening in reality shows like the one in game.

D&D:

Game mechanics:

Dice: The game uses polyhedral dice with different numbers of sides. When you need to roll dice, the rules tell you how many dice to roll, what size they are, and what modifiers to add. For example, »3d8 + 5« means you roll three eight-sided dice and add 5 to the total.

Languages: There are ten languages spoken throughout the D&D world, along with the six scripts used to write them.

Language	Spoken by …	Script
Common	Humans, halflings, tiefling	Common
Deep Speech	Mind flayers, githyanki, kuo-toas	Rellanic
Draconic	Dragons, dragonborn, kobolds	Iokharic
Dwarven	Dwarves, azer	Davek
Elven	Elves, eladrin, fomorians	Rellanic
Giant	Giants, orcs, ogres	Davek
Goblin	Goblins, hobgoblins, bugbears	Common
Primordial	Efreets, archons, elementals	Barazhad
Supernal	Angels, devils, gods	Supernal
Abyssal	Demons, gnolls, sahuagin	Barazhad

These languages are transcribed in different scripts, most of them are alphabets. At the beginning you start with knowing two or three languages and the associated script. Later you can learn additional language.
Characters and their opponents can use languages as a kind of code, speaking in languages their enemies can not understands.

14. Do characters in your game advance? If so, how?
15. How does the character advancement (or lack thereof) reinforce what your game is about?

The reality show:

Progress from day to day by completing the challenges. Progress like that is usual in reality TV shows about cooking.

D&D:

You reach a new level when you earn enough points.

16. What sort of product or effect do you want your game to produce in or for the players?

The reality show:

Students will evaluate their knowledge gained throughout the game, as they will be successful in following the instruction, and will continue to progress in stages of the game. If we look at the game in more detail, we will see that the first activity (baking pancakes), covers procedural knowledge and rule-based knowledge, as the player has to mimic some procedure being limited by the time (rule). Of course, the procedure must be exactly the same as Boss Inga's before him. In the second activity, the player must first separate a program into subprograms (meat, sauce, potatoes). This activity is covering conceptual knowledge, because the student must understand that some program (final dish) has to be subdivided into subprograms (meat, sauce, potatoes). Later in the machine, the player must also understand that with several subroutines he can make up the real dish no matter which subroutine he will first perform. In the last activity, however, he has to set his own daily plan and be aware of it. Again, it is about procedural knowledge and knowledge-based rules. To summarize, we noticed that the game is made mainly on building knowledge and collecting information. There is no classic behavioural approach in the game.

The 3rd step: select playable characters and create short profiles that help the players choose and create their characters

7. How does the Character Creation of your game reinforce what your game is about?
10. How are the responsibilities of narration and credibility divided in your game?

The reality show:

Main Characters – playing characters & the »rivals«. We imagined the game in such a way that we created four main characters and the player can choose between these four. The player can choose between two men figures and two women figures. The men are named Bandele and Oscar. The women

are named Jessy and Emma. The character chosen by the player communicates with the player and directs it through the game. The character is the one with which the learner recognizes the term algorithm. The character that the player chooses plays as the main hero, while the rest are in the game as his rivals. The characters are in three different clothes - depending on situation in which they are (nice clothes, sleepwear and cooking clothes).

D&D:

D&D is fundamentally a cooperative game and is no like most of others which have a winner and a loser. The DM plays a role of the antagonists in the adventure, but he isn't playing against the player characters (PC).

The DM represents all the PC's opponents (monsters, nonplayer characters (NPCs), traps) but he doesn't want the player characters to fail any more than other players do. The players cooperate to achieve success for their characters. The DM presents them challenges, just hard enough that other players have to work to overcome them.

Dungeon (Game) Master

The Dungeon Master makes the D&D game unique. The DM is a person who takes on the role of lead storyteller and game referee. He creates adventures for the characters and narrates the action for the players. The DM makes the game infinitely flexible; he can react to any situation, make an adventure vibrant, exciting and unexpected.

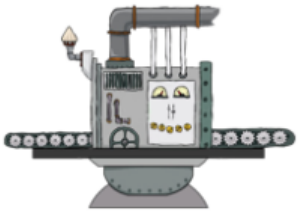
The adventure is the heart of the D&D game. It's like a fantasy movie except the characters that you and your friends create are the stars of the story. The DM sets the scene and no one knows what is going to happen next. And anything can happen. You might explore a dark dungeon, a ruined city, a lost temple deep in a jungle, or a lava-filled cavern beneath a mysterious mountain. You solve puzzles, talk with other characters, battle all kinds of fantastic monsters, and discover fabulous magic items and treasure.

The 4th step: select the most important nonplayer characters and create profiles for them. Shorter profiles are also created for monsters and potential combat opponents

The reality show:

The boss - Inga is the main character that directs the player through the game. Inga is a strict boss and requires the player to be accurate and fast.





The miraculous machine is an assistant in the restaurant, which is, however, unsuccessful during cooking, so the player gets another task. Among all the dishes he has to choose those that are properly cooked. The player meets the machine in the second day.

Smiley face on the tablet:
The player meets it in the third day of the competition. Smiley face is there for the player, to help him, because he tells him the secret about magic cocoa and warns him that he must avoid Inga, since she must not know that he knows about magic cocoa.

Guest: In the third day of the competition, a regular guest of the restaurant, who loves cocoa, also comes for breakfast. The guest orders a croissant with cocoa and the player must deliver it.

Recipe book: It contains all the necessary recipes that the player needs. The book is always present somewhere on the scene so that the player can help with it. In it, precise procedures are presented to the player to successfully complete the task.

D&D:

D&D has different nonplayer characters, including humanoids and magical beasts. They have different abilities and quirks which make them unique and memorable to the players.

The 5th step: conduct further research on the historical and cultural background of the story in order to add more detail to the game world.

The reality show:
Specific activities/challenges (described below) are result of further research of the story (cooking reality shows).

The 6th step: create a skeleton for the original story, divide it into shorter episodes and scenes, and plan the game module accordingly.

17. What areas of your game receive extra attention and colour? Why?

The reality show:

1.) episode/scene: Preparing the pancake

- Learning Objective: A student follows an algorithm prepared by someone else.
- Instructions: Inga gives the instructions to character/player. They must prepare a pancake in exactly the same way that Inga did.
- Description: The player first watches Inga, who bakes a pancake. Then, by clicking on the ingredients and pulling them in the precise order, they prepare the pancake. If the player is successful, this means that they followed the instructions carefully.
- Award: The player progresses in Day 2 and is closer to victory.

2.) episode/scene: Decomposing on building blocks - meat, sauce and potato

- Learning Objective: The student can decompose the algorithm into building blocks.
- Instructions: The player appropriately submits the recipe to smaller sensible units. They move a single square by dragging it over the appropriate inscription.
- Description: The player by dragging squares into the appropriate »basket« (meat, sauce, potatoes). If the player is successful, it means they can separate the entire recipe into smaller parts.
- Award: The player progresses to the next task.

3.) episode/scene: Sort the unit in the correct order - MEAT, SAUCE, POTATOES

- Learning Objective: The learner can present an algorithm with the help of instructions in a simple language.
- Instructions: Sort the unit in the correct order. You can make 10 mistakes. You need to observe the error counter.
- Description: The player must correctly arrange squares within one building block (meat, sauce, potatoes). If successful, then the player can present an algorithm in a simple language.
- Award: The player progresses to the next task.

4.) episode/scene: Let's help the machine

- Learning Objective: A student can connect multiple algorithms to a whole that solves the problem.
- Instructions: From all dishes, select those that are made according to the previous recipe. Ring on button at the end.
- Description: In the task, the player must choose the correct dishes between several. But they're not all right. Therefore, the player must be attentive and must be aware that the order of preparation of the building blocks is not important. So, for example, if you first prepare the sauce and then the potato and then the meat, it would be right. It will also be correct to first prepare the meat, then the sauce and then the potatoes. They must be careful that the dish will really be

Cordon bleu in a raw sauce with fried potatoes. In the task, we verify that the student knows that several different algorithms can produce the same whole.

- Award: The player progresses in the third day.

5.) episode/scene: Day plan

- Learning Objective: A learner can describe everyday problem as a sequence of steps.
- Instructions: On a tablet located on the table, look at the day's plan and the implementation of the last challenge. However, because a mistake occurred in the table, »smiley face« tells them that the opponent has defrauded them, since they mixed the schedule of the day. That is why it is their job to organize the plan of the day. The player has three chances to solve the problem.
- Description: It is important for a player to select the correct squares and to correctly arrange them.
- Award: »Smiley« tells them about the magic cocoa, and so the player goes to the next task.

6.) episode/scene: Preparing a table

- Learning Objective: The learner can present a simple task with an algorithm.
- Instructions: Help us prepare a table for a guest. Do it by dragging objects on the table in the correct order. For help, you can use a recipe book. The game cannot continue if the table is not prepared correctly.
- Description: The player must correctly set the table by dragging elements to it.
- Award: The player progresses to the next task.

7.) episode/scene: Serving the breakfast for the guest

- Learning Objective: The learner can present a simple task with an algorithm.
- Instructions: The player must prepare a croissant and cocoa in a given time and serve the guest.
- Description: In the task, the player must be resourceful and prepare breakfast as quickly as possible. It can be prepared with magic cocoa, which is in a pantry. On the way there, the player must avoid Inga and her questions. If Inga finds out that the player has magical cocoa, he may lose the game.
- Award: The player wins and becomes the owner of the Restaurant.

D&D:

D&D is a cooperative game in which you complete adventures with your friends and have fun. It’s a storytelling game where the only limit is your imagination. It’s a fantasy-adventure game which is built on the traditions of the greatest fantasy stories of all the time. It’s an adventure where you can attempt anything you can think of. You can talk to the dragon instead of fighting it. Your actions might work or they might not, but either way you’ve contributed to the unfolding story of the adventure.

You »win« the game by participating in an exciting story of the adventures. The game has no real end; when you finish one story you can start another one. Many people who played the game kept their games going for months or even years.

18. Which part of your game are you most excited about or interested in? Why?

The reality show:

Activities. Because they determine / show how much the student has learned about algorithms in the role of chef master.

D&D:

There is something for everyone to love in the game. The game gives you a chance to be the hero. All players have equal chance to »save the day« and what happens in the plot of the game is up to the players. If you don't want to be a hero you can also play a villain or anti-hero role. You have a lot of options when you create a character and your / his / her personality is something you are in complete control of. Until it's fictional, killing stuff is a great stress relief. You can experience anything from one on one bar brawls, to battle of epic proportions.

19. Where does your game take the players that other games can't, don't, or won't?

The reality show:

Use of computer concepts in real life situations.

D&D:

You create your own story and everything is possible.

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