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## CITY OF DRED - A TABLETOP RPG LEARNING EXPERIENCE

By: [Lopes, RP](#) (Lopes, Rui Pedro)<sup>[1]</sup>

Edited by: [GomezChova, L](#); [LopezMartinez, A](#); [CandelTorres, I](#)

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#### Abstract

Learning experiences are not typically used to describe formal learning activities, such as in classroom, transmissive methods. Centred in the student, this term describe that the learner is experiencing something that, hopefully, contributes to a change in thinking, understanding, or behaviour afterwards.

For this to happen, learning experiences should be active, meaningful, with social meaning, integrative, and diversified. We consider active learning experiences when the student has the main learning role. They should provide knowledge and skills that directly contribute to the learner's ability to perform more effectively in the context of workplace learning. Sharing and cooperation is fundamental, allowing the learner to interact with other active learners. The inherent increase in complexity demands the integration of different dimensions of knowledge, better achieved through diversified strategies. In this context, teaching and learning is more than the mere acquisition of content. It represents a process of learning by thinking-do-thinking.

The learning experiences should be adequate to motivate the students and provide the necessary challenges for learning to take place. In this context, the concept is understood as a reinforcement of the goal of an educational interaction over its location (school, classroom) or format (course, program).

The diversity of ways in which students can learn from and interact with teachers, in addition to the level of independence they may have when learning, is considerable. In this paper, we propose to include not only traditional transmissive approaches and practical work assignments but also designing and playing games. The latter is regarded as an integral part of the students' knowledge building, with the objective of being instructional with the main focus on the cognitive side of instruction.

This approach is part of a broader pedagogical experience of applying gamification to a higher education subject in the course of computer science. It uses several game design mechanisms, such as adaptive challenges, rewards, curiosity and chance to increase the time students spend working, experiencing and learning. In addition to the award system that is being used to grade students, the learning experiences are also designed using game design patterns. We focus mainly in the design, development and assessment of a tabletop Role-Playing Game, with the purpose of providing an

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environment for reflection and concept learning regarding data survivability. The learning experience is evaluated through a specific Student Observation Record, evaluating the interaction between students, the dynamic of the learning experience and the overall learning degree.

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### Author Information

**Reprint Address:** Lopes, RP (reprint author)

Polytech Inst Braganca, Braganca Paulista, SP, Brazil.

#### Addresses:

[ 1 ] Polytech Inst Braganca, Braganca Paulista, SP, Brazil

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# CITY OF DRED – A TABLETOP RPG LEARNING EXPERIENCE

Rui Pedro Lopes<sup>1</sup>

<sup>1</sup>*Polytechnic Institute of Bragança (PORTUGAL)*

## Abstract

Learning experiences are not typically used to describe formal learning activities, such as in classroom, transmissive methods. Centred in the student, this term describe that the learner is experiencing something that, hopefully, contributes to a change in thinking, understanding, or behaviour afterwards.

For this to happen, learning experiences should be active, meaningful, with social meaning, integrative, and diversified. We consider active learning experiences when the student has the main learning role. They should provide knowledge and skills that directly contribute to the learner's ability to perform more effectively in the context of workplace learning. Sharing and cooperation is fundamental, allowing the learner to interact with other active learners. The inherent increase in complexity demands the integration of different dimensions of knowledge, better achieved through diversified strategies. In this context, teaching and learning is more than the mere acquisition of content. It represents a process of learning by thinking-do-thinking.

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This approach is part of a broader pedagogical experience of applying gamification to a higher education subject in the course of computer science. It uses several game design mechanisms, such as adaptive challenges, rewards, curiosity and chance to increase the time students spend working, experiencing and learning. In addition to the award system that is being used to grade students, the learning experiences are also designed using game design patterns. We focus mainly in the design, development and assessment of a tabletop Role-Playing Game, with the purpose of providing an environment for reflection and concept learning regarding data survivability. The learning experience is evaluated through a specific Student Observation Record, evaluating the interaction between students, the dynamic of the learning experience and the overall learning degree.

Keywords: Gamification; Higher Education; Educational Games; Tabletop Role-Playing Game.

## 1 INTRODUCTION

Higher Education Institutions (HEI) have three primary missions: education, research and cooperation [1]. While differing in strategic importance, most institutions try to cope with these missions to contribute for population education at high level, scientific and technological advances and economic and social development.

Concerning education, HEI must create an appropriate environment for learning. However, the way students manage and control the effort on academic tasks and the cognitive strategies used to learn, remember, and understand materials, contribute to the overall education process and is fundamental to achieve high-level academic performance [2].

Students must be motivated to use the strategies as well as regulate their cognition and effort [3]. Delivering content alone has virtually no effect on students' beliefs about the world. They can memorize data, but without active engagement and hands-on application, they do not really confront the implications of the new content.

There are several factors that determine motivation, and usually they also depend on the person characteristics. To foster motivation it is important that students understand what they can and can't do and have accurate and realistic feedback that can help them acquire the expertise needed to learn. It is also fundamental to provide tasks that should be neither too easy nor too difficult, but challenge students in appropriate ways [4]. High-degree of motivation is usually achieved when the expectations are high [5]. Low stakes and high expectations are precisely the typical conditions of a good game.

With this in mind, we designed a higher education subject, of the computer science course, around game concepts and mechanics. This gamification approach allowed us to define adaptive challenges, a reward system, curiosity and chance to increase the time students spend working, experiencing and learning in a HEI. The sections in the course's curriculum were transformed into levels, awarding stars for increasingly complex achievements. There is also the concept of soft currency, which is used to foster students' autonomy and incentive the workload. Some games are also used as learning experiences, allowing collective knowledge building in the preparation and also playing the games.

This paper describes the design and evaluation of an educational game, of the tabletop Role-Playing Game. It is structured in five sections, starting with this introduction. The next section describes related work as well the overall gamification approach, including the award mechanism, grading and some learning experiences. It proceeds by describing the design and evaluation of the City of Dred and, we finish with some conclusions.

## 2 RELATED WORK

Playing games is something that is intrinsic to human life. More than learning, training or simply enjoying, game play contributes to faster reactions as well as to increasing the brain activity, allowing people to live longer and delaying dementia.

The use of games for learning in higher education aims to make complex theoretical knowledge more accessible, providing the means for students to repeat and simulate situations that may lead to a more in-depth learning. Based on the possibility of fantasy, challenge and curiosity that characterizes games, the online game Internal Force Master (IFM) is educational game software specifically designed and developed for the study of Civil Engineering [6]. It was developed in Macromedia Flash and made available to master level students. The authors concluded that the learning result of the playing group is at least equivalent to the group who learned using the traditional method. Moreover, they also state that gambling can be a new, modern and also useful learning method.

Effective learning and learner autonomy promotion is a recommended by several governments and education institutions. In this context, learning by doing is instantiated in the development of games by the students, allowing them to acquire a diverse set of skills. The Adventure Author used this approach, showing that game making provides a range of opportunities for successful learning [7]. Children were motivated and enthusiastic, showing determination to achieve and ability to learn collaboratively and alone. They also showed evidence of being able to link and apply their learning to new situations.

Off the shelf, commercial games can also provide valuable learning experiences for students. The choice and evaluation of games allows better adaptation of requirements and learning goals [8], [9].

On the other hand, specific, custom developed games can provide a uniform and specific learning environment. Digital forensics, for example, is complex and requires a diverse set of skills through expensive specialized tools. Digital Forensics Interactive is developed in Unity to build a virtual environment to students. The game-play consists of the challenges and actions the game offers players and the sequence of the game is the progression of activities that consists of the game [10].

The inherent complexity of such games requires large efforts for their development. Specific frameworks can be followed to maintain the process within controlled complexity without losing sight of the main goals, either in game-play and on learning goals [11], [12].

Some approaches try to replicate historical environment to help students learn an epoch, a place or an historical event. Role-Playing Games can further appeal for students to play a character, providing a rich and immersive environment. This can help building a clear image of history and social relations through playing [13].

Finally, the work described in this paper is performed in the scope of a larger gamification experience, which conciliates a student classification system with the learning experiences to foster autonomy and motivation [14].

### **3 GAMIFICATION IN HIGHER EDUCATION**

Gamification describes the use of game design elements in non-game contexts [15]. This includes the creation of learning experiences that make use of challenges, rewards, points, levels and others, according to the goals of the game. Moreover, using games as learning experiences allows taking advantage of the motivational and entertainment the characterizes them to increase the student knowledge [16].

The game described in this paper was developed and used in the subject Network and System Management of the Computer Science course of the Polytechnic Institute of Bragança, Portugal. It was used as a learning experience to help students deal with several concepts related to storage and survivability of digitally stored data.

#### **3.1 Educational Games**

Educational games try to harness the motivational qualities of games in order to create powerful, engaging educational tools [16]. There are two approaches to using games in education. The first seek the engagement that commercial and wide available games (COTS – Commercial and Off-The-Shelf) have to foster learning outside the school environment. Games such as Sid Meier's Civilization or World of Warcraft can provide a challenging and motivating world that require analysing, planning, communication skills and others, contributing to improving the problem solving abilities of players. On the other hand, games can be specifically designed to convey traditional content in a different, non-traditional, form.

COTS games clearly provide opportunities for learning. Although typically associated to the development of soft-skills, such as language, analytical or communication, they also promote planning, collaboration, problem solving and even concepts learning. Games such as Monopoly grasp basic economy concepts and real estate value. Other simulation games, for example, are used by the military to train soldiers on combat missions that could not be completely replicated in the physical world [17]. Virtual worlds, such as Second Life, provide three-dimensional environments used more for social interaction, disregarding specific skills or content.

The weakness of the previous type is that there is some difficulty in covering mandated content areas. This requires the design and development of specific, custom made, games. Traditional teaching methods are essentially based on the transmission of content and this approach is frequently used to design educational games. As a consequence, many games lack in either fun or on educational benefit [18].

It seems obvious that an educational game is simply not a collection of content organized in a non-traditional way. Educational games should follow the same principles that makes entertainment games intrinsically motivating [19]. As mentioned above, some of these principles include the existence of medium and long term goals organized as increasingly complex levels, they should require the player to make decisions and take actions, provide immediate feedback, include a reward system for achievements, gradually teach the player new skills necessary to overcome more challenging obstacles [20].

We decided to design and develop a custom educational tabletop Role-Playing Game, trying to both convey specific content knowledge and be fun to play. The process should not start by simply connecting the content. Content should be an inner part of the game, integrally linked with the game-play. This requires the definition of the learning objectives and the identification of specific parts that can be made part of the story or a set of challenges.

We created the game for the Network and System Management subject of the Computer Science course, focusing concepts of networked systems.

## 3.2 Network and Systems Management

Network and System Management is a third year, second semester, subject of the Computer Science course of the Polytechnic Institute of Bragança. At the end of the subject, it is expected that the learner be able to:

- use a basic set of virtualization tools;
- install and configure both disconnected and networked computer systems;
- manage secondary storage medium, user accounts and system startup and shutdown procedures;
- install and configure basic network services; install and configure network file servers and authentication domains;
- identify and describe the role of integrated network management in modern organizations, and use some related tools.

The current curriculum is structured in four sections or chapters. Each section has several topics that should be mastered before advancing to the next section. The final assessment and the associated grade depend on the success on each of the section as well as the creativity and the knowledge level demonstrated in every topic. Students are graded from 0 to 20, which is translated to the ECTS grading scale, demonstrating how she performed relative to other students (the best 10% are awarded an A-grade, the next 25% a B-grade, the following 30% a C-grade, the following 25% a D-grade and the final 10% an E-grade). Success is only considered if the student has a grade equal or above 10 (0-20).

The assessment and grading follows a reward structure design pattern. All the students have to fulfil the minimum requirements to succeed, meaning that they have to overcome all the sections or “levels”. This will grant him the 10 grade. The student can additionally obtain up to 2 stars, associated to the complexity of obstacles he successfully faced. Whenever a learning experience is completed, BitPoints are awarded, which can be used to “buy” extra tools or help from the teacher. In other words, the reward system will have castles, to represent levels, stars, associated to the difficulty of the challenge, and points, as soft currency.

The diversity of ways in which students can learn from and interact with teachers, in addition to the level of independence they may have when learning, is considerable. In the subject of Network and System Management, these include traditional transmissive approaches and practical work assignments but also designing as well as playing games. City of Dred was developed in this context, providing the students with an educational tabletop RPG, including concepts and content from the second level (Isolated Systems).

## 4 CITY OF DRED

In the context of the gamification work developed for Network and System Management course, several games were developed, such as Cabinet, a strategy, worker placement game for managing an enterprise data-center [21], the Virtualization Game, based on decks of cards, and City of Dred, a Role-Playing Game.

A Role-Playing Game (RPG) consists of a game in which each participant assumes the role of a character, usually in a science fiction or fantasy scenario, interacting with the imaginary world of the game. The players are responsible for performing an active role in the narrative, developing a character and deciding on several actions.

This game, in particular, is a tabletop RPG, in which the participants describe orally the characters' actions. Improvisation is allowed (and incentivised), as long as within the rules, since it contributes to the development and the outcome of the game. The game is played collectively, generally around a table. One of the participants, the Game Master (GM), prepares a set of rules and a fiction scenario in which each player perform the role of his character.

Each player creates the character, defining his personal history and some numeric parameters that represent his characteristics. These will be used to determine the result of events, such as battles and the consequences of certain options.

The GM starts the game by describing the scenario and the characters. The players describe the actions of their characters and the GM gives feedback regarding these actions. Generally, the results are determined by the environment and by the GM's good sense, although they are usually immediate and simple. For example, if the action is to look around, the GM quickly describes what the character is able to see. However, the results of certain actions are determined by the game rules. For example, when looking around, the character may or may not notice a secret passage, depending on his ability and perception. In this case, the result may also depend on luck, depending on dice roll. The result of combats and fights is determined in a similar way assuming, also, the physical attributes and previous training of the character.

## 4.1 Characters

The players in the City of Dred assume the role of Datuist monks, performing the missions assigned by the Game Master. Each player uses an Action Sheet, where the character characteristics and abilities are registered, as well as the development of the adventure (Fig. 1).

Fig. 1 – Action Sheet for the City of Dred.

First, it is necessary to find the combat and resistance of the character using a 10 face dice (D10). Combat represents the fight capacity, and resistance defines the opposition and defense. In addition, the character is also characterized by strength and coordination, obtained using a similar process.

The character may also demonstrate other skills and characteristics. The player is allowed to choose five skills from the following list:

- Camouflage – allows the character to better hide from enemies;
- Hunter – ability to find food and quiet movement;
- Sixth sense – ability to sense danger or potentially threatening situations;
- Tracking – find and follow tracks;
- Healer – recover resistance and heal from wounds;
- Arm of weapons – carry and use weapons;

- Mental shield – prevention of being psychically influenced by wizards or other psychic creatures;
- Telekinetic – ability to move small objects with the mind;
- Essence of the nature – communicate with and guess the intention of animals;
- Good-nature – allows loosening a tense situation through mood changing ability.

Whenever the players meet an opponent in the game, there is the possibility that it results in violent confrontation. Combats are decided according to the combat capability of the character and the value resulting from a dice roll. The combat outcome depends on the combat and resistance values, with a chance factor. First the combat and resistance values are registered in the action sheet. A D10 (10 sided dice) is rolled and the value is added to the combat value of the player. The D10 is rolled and the value is added to the combat value of the opponent. The difference of these two values is the impact factor, subtracted from the resistance of the losing party. Finally, the player dies when the resistance value reaches 0. Skills, such as Arm of Weapons or Healer can also contribute to the course of combat.

## 4.2 Adventure

The City of Dred defines a science fiction set, happening in the year 4700 A.D. The narrative includes educational challenges and concepts, designed around data storage and survivability, consistent with the section 2 of the course's curriculum. In short, an unknown plague killed 99% of the habitants of the earth, including plants and animals. The remaining species evolved during 2500 years, developing strange abilities and features, resulting in a very strange biology. Some of the creatures include Lupigars, a wolf like animal with some intelligence and able to collaborate when hunting, Araczui, a strange looking spider which injects a poisonous toxin, Mircedo, similar to a bat and capable of complex reasoning, a Serpress, a quiz loving spider, that constantly challenges whoever it encounters, and a Treprende, carnivorous climbing plant that grabs animals and digests them. In addition, it is also possible to encounter Wizards, Bandits and Mercenaries.

In these 2500 years, the knowledge of the typical XXI century technology was lost, except among the Datuists, a cult responsible for preserving the long forgotten knowledge of devices and technology that was once used. The Datuist monks live in monasteries, according to a rigid set of rules, hard work and discipline. From time to time, people request their help to solve mysteries of strange looking artifacts, found occasionally.

There is a place where the number of artifacts found is considerably higher. Covered with a persistent mist, the place is filled with ruins and broken buildings, surrounded by a daunting quietness. Many times, people disappear in this place, never to be heard again. However, the number and quality of the artifacts pose an irresistible interest, drawing people to the City of Dred.

The educational content is associated to the artifacts and to the quizzes that challenges the players when they face some opponents, such as a Serpress or a Wizard. The artifacts consist of the hardware necessary to store digital information, such as a hard disk drive, a disk controller, a motherboard or a power source unit, and software, such as operating systems, diagnosing software, backup and restore applications and others. The Datuist monks have to assemble the artifacts in a correct form, power it, install operating system and necessary software, and solve all the problems to successfully read and interpret the data stored in it.

The challenges also include having to deal with the dangers of flora and fauna, as well as from other humans. Of course, each opponent can also be persuaded to help, with the appropriate skills and the Game Master willingness.

## 4.3 Playing the City of Dred in class

The City of Dred was played in classroom, in a class with 16 students. The class was divided in four groups with 4 students each. In each group, a student played the Game Master role, except in one in which the GM was played by the teacher (group with 5 elements). The remaining students played a Datuist monk role, contributing to collaboration and teamwork (Fig. 2).





Fig. 2 – Playing City of Dred in class.

The teacher distributed two documents, one for the GM and the other for the remaining players. The documents describe, in detail, what a RPG is, how it is played and the rules for building the characters and combats. It also included a complete adventure proposal that the students could follow instead of creating their own adventure.

The GM role is fundamental to maintain a dynamic and interesting experience. He should be well prepared and should have a clear idea of the challenges, obstacles and suspense in the adventure. He should also contribute to the focus on the educational aspect of the game. The quizzes should be prepared in advance and he should also build an interesting data recovery approach to challenge the Datuist monks.

Previous experience as GM can benefit the overall experience. For example, the four groups of students were playing, three with a student as GM and the remaining group with the teacher as GM. The group that played more and with a more complex narrative was the latter. All the groups with student GMs finished earlier and kept entirely to the provided script. It is clear, from this experiment, that GMs should be previously trained and that the game should be rehearsed beforehand.

However, all the students played and enjoyed the game, contributing to improve the knowledge of the subjects at hand, the communication skills, and teamwork in a playful and pleasant format.

## 5 EVALUATION

The gamification of a higher education subject promotes the change of traditional learning approaches. This demands a careful and systematic evaluation in order to assess the learning process and to evaluate the gains. For the overall evaluation, we are using a qualitative research approach, with observation of classes, interviews, questionnaires and others.

In the context of this paper, a specific evaluation is performed regarding the City of Dred. The educational game has the main goal of providing a pleasant learning experience to students and, as such, it is necessary to assess the way students learn, their motivation as well as the game dynamics and joyfulness.

To understand the impact of this learning experience in the motivation of students (a), the quality of the interactions (b) and the quality of students' knowledge (c), a Player Observation Record was created and used [21]. The details were registered in specific form, to better systematize data. However, the observation process is not a mere exercise in data collection but it also intends to create awareness of what is experienced in class, enhancing professional reflection about the learning opportunities.

The form starts by identifying the date, time, and the student's name, sex and age. Considering the motivation, the Player Observation Record uses a list of signals that are recorded on a five-point scale. These range from level 1 to 5, corresponding to the following behaviors and attitudes:

1. Absolutely hated it;
2. It had some good points, but I didn't like it much;

3. It was OK, I'd play if you asked me to again;
4. I liked it, and would gladly play it again;
5. It was fantastic! Let's play it again.

The quality of interactions was analyzed around four dimensions: Player-Player Interaction, Player-Game Interaction, Player-Self Interaction, Outside the Game. Each dimension includes summarizing the actions each player take.

The goal of the students is to collaborate in order to successfully finish the adventure. They all play the role of heroes that should deal with the difficulties and challenges as a team, using creativity and knowledge to succeed. Initially the students were very skeptical and afraid of the experience, feeling that the constant necessity to communicate would excessively expose them. As the adventure progressed, the students felt more comfortable, and started to build more complex actions.

However, all of the groups kept to the adventure described in the documents that were distributed. None of them created a different adventure nor deviated from the provided script. Another important aspect is that the actions that each player took were individual, not considering even the possibility of discussing collectively the available options or possibilities. Playing, as learning, has always been an individual effort, and this was noticed during the game play.

## 6 CONCLUSION

Games can be used to foster learning, either by taking advantage of the motivation that characterizes Commercial Off The Shelf titles or by introducing custom designed and developed games, conveying the content required by the subject's curriculum.

In the context of Network and System Management, a subject of a Computer Science course, a gamification pedagogical approach was followed. Students grading was associated to an awards system, composed of Levels, Stars and BitPoints, a soft currency to buy tools and knowledge.

The learning experiences were also adapted to game mechanics and contexts, including the design and development of a strategy board game of the worker placement type. The City of Dred RPG provided students with learning goals related to isolated systems, requiring them to assemble hardware parts and recover data.

A two-dimension evaluation was made, to assess the learning of students and the gameplay, to allow future improvements. The lesson taken from this evaluation is that GMs should be better prepared and with previous experience. The GM should be motivated and resourceful, since he is the catalyst of the game. The remaining participants should challenge the GM, providing creating actions and using tools in different ways. This would make the game more interesting and motivating.

All the students should be intrinsically aware of the benefits of communicating and team decision taking. They demonstrated some difficulties in oral skills, which limited the freedom of building and following a complex and creating adventure. This is a skill that has to be reinforced during the learning process and that can contribute to their performance as computer scientists professionals.

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