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Uso de advergames para promover a imagem de um Instituto de Ensino Superior

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Using advergames to promote the image of a Higher Education Institution

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Resumo

O mundo da publicidade tem evoluído ao longo dos anos e com esta evolução têm surgido novas necessidades. Uma destas necessidades é uso o de canais de publicidade que tenham maior impacto no público-alvo. Para tal, as empresas apostaram num novo canal publicitário, os jogos sérios, de forma a publicitar produtos, conceitos ou marcas. Neste tipo de jogos, intitulados de advergames, as empresas relacionam o seu produto ou marca a aspetos positivos do jogo. Desta forma, os jogadores associam pensamentos positivos em relação ao produto enquanto jogam e este pensamento é depois transferido para o contexto para além do jogo.

Este projeto foca-se no estudo e desenvolvimento de um advergame, em parceria com o grupo de investigação e desenvolvimento *Games, Interaction and Learning Technologies*, do Instituto Superior de Engenharia do Porto. O objetivo é promover a imagem de uma instituição de ensino superior, de forma a possivelmente aumentar o número de candidaturas ao ensino superior na mesma. Para este trabalho, o caso do Instituto Superior de Engenharia do porto foi usado como prova de conceito.

Para tal, foi necessária uma pesquisa mais aprofundada no mundo dos jogos digitais, jogos sérios e advergames, assim como casos de sucesso na indústria de advergames. Foi também explorado o conceito de valor e outros conceitos relacionados, de forma a compreender com maior precisão as necessidades do cliente, o que contribuiu para a criação da proposta de valor e do Modelo de Negócio Canvas e para escolha do género do jogo. No processo de desenho da solução foram debatidos possíveis conceitos e mecânicas a utilizar no jogo, assim como o motor de jogo a utilizar e foi descrito o processo de implementação. São também explorados diversos métodos de acompanhamento do desenvolvimento, assim como formas de avaliar o produto final. Por último são retiradas conclusões a partir dos resultados obtidos. O projeto foi considerado um sucesso, evidenciando que os jogos digitais conseguem efetivamente transmitir mensagens e promover marcas, sendo o jogo em questão um exemplo disso.

Palavras-chave: Jogos Digitais, Jogos Sérios, Advergames, Publicidade, Desenvolvimento de Jogos

Abstract

As the world of advertising kept evolving, so did the needs of its customers. One of these needs is the use of advertising channels which have a higher impact on the target audience. For this reason, companies invested in a new advertising channel, the industry of serious games, to promote concepts, products, and ideas, leading to the creation of advergames. In these games, companies link their product or brand with positive aspects of the game, associating the positive feelings a player experiences during the game with the products themselves in a context outside of the game.

This project focuses on the study and creation of an advergame, in partnership with the Games, Interaction and Learning Technologies research and development group, for the *Instituto Superior de Engenharia do Porto*. The goal of the project is to promote the image of the institution, possibly raising the number of applications it receives.

To achieve this, further studies on digital games, serious games and advergames are performed, as well as detailed analysis of successful advergames. Additionally, the definition of value for the customer is analysed, to create a fitting value proposition and Business Model Canvas and to determine the game genre. The game concept and possible game engines are explored, the implementation is described, the methods for tracking the development and evaluating the final product are discussed and lastly conclusions are reached based on the results obtained. The project was considered a success, showing that digital games can be used to spread messages and promote brands, as the advergame at hand evidenced.

Keywords: Digital Games, Serious Games, Advergames, Advertising, Game Development

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Glossary

List of Acronyms

AHP Analytic Hierarchy Process

BMC Business Model Canvas

GEQ Game Experience Questionnaire

GILT Games, Interaction and Learning Technologies

ISEP *Instituto Superior de Engenharia do Porto* (Higher Learning Engineering Institute of Porto)

NCD New Concept Development Model

QEF Quantitative Evaluation Framework

SUS System Usability Scale

TOPSIS Technique of Order Preference by Similarity to Ideal Solution

List of Symbols

$ United States dollar

1 Introduction

This chapter summarizes the purpose of this project and the way it was executed. It starts by introducing the context that brought this project to its creation, and the field of work it is included in. Secondly, it describes the problem at hand, the objectives of the project, the approaches taken to reach these goals, and the project's contributions. Lastly, it details the structure of this document, and the purpose of each section.

1.1 Context

Advertising has taken different forms over the years, being a constantly evolving field. One of these methods of advertising is through advergames. This type of digital games focuses on promoting the image of a concept, product, or brand through entertaining, adding extra impact to the user and distinguishing companies. In fully branded advergames (further explained in section 2.1.3.3), brands typically associate positive thoughts with the collection of the products in-game, such as candy in *M&M's Amazing Crispy*, which leads players to believe that obtaining candy is beneficial – a thought that can transpire to the real-world (Lee, et al., 2009). These games are made to be entertaining forms of advertising, which is often integrated into the story line, creating an almost seamless experience at times (Moore & Rideout, 2007).

This field at work has been consistently growing throughout the years, and remains effective, as is shown by the way successful companies such as *M&M's* and *Burger King* keep creating new advergames, even decades after their first entry into the advergame industry. Additionally, business have been created with the intent of bringing advertising and game developers

together, such as *plinq* (plinq, 2020) and *Bidstack* (Bidstack, 2021), making the addition of branding in digital games easier than ever.

For the specific case of *Instituto Superior de Engenharia do Porto* (ISEP), upon considering the main target audience of its advertising – teenagers who just finished high school – it was determined that advergames were a fitting form of promoting the institution's image in an engaging way. This project focuses on the creation of a serious game that promotes ISEP, working with the Games, Interaction and Learning Technologies (GILT) research and development group.

1.2 Problem Description

As a proof of concept, the higher education institution to be promoted through an advergame is ISEP, an Engineering institute located in Porto, Portugal. There were no restrictions as what the game itself should be, or what technologies should be used. The focus of this project is on advergames themselves and the success that they can create. To further describe this need for advertising, the overall objects and approach used in this project are explored, as well as its contributions.

1.2.1 Objectives and Approach

The main objective of this project was to create an advergame that effectively promotes ISEP's image. It was intended to advertise this institution, and in a best-case scenario, to lead more students to enroll in it. Therefore, the project revolves around guaranteeing that effectiveness. This factor was measured through a series of different sources that evaluate the different aspects of user experience. The first is the System Usability Scale, which evaluates the user's experience with the game as a system. The second is the Game Experience Questionnaire, which relates to the player's feelings and emotions through the course of their playthrough, and groups their answers in different components, such as tension and immersion. The third source of data comes from a questionnaire dedicated to determining the impact of the game as a serious game, and as an advergame. Lastly, game analytics were used to analyse the players' experience from a distance and see in a more concise way which actions they took

while playing the game. The effectiveness of the project was determined through analysis and triangulationof the data that these sources provide, giving special attention to the last two.

To design the scientific project, further information was necessary. Consequently, research on the realm of digital games, serious games and advergames was executed, and different advergames were analysed, as to understand what made them successful. Additionally, the concept of value for the customer was explored, as to determine how to further improve the quality of the product that is being developed, and create a fitting value proposition, develop an informed Business Model Canvas, and determine the game genre that fit this project best. Furthermore, design decisions were taken to make the game concept fitting to the objectives that are trying to be achieved. After that, the game itself was developed, taking in consideration the previously made design decisions. Lastly, research was also executed on different methods of tracking the progress of the development and evaluate it, and the process of testing and analysis of results took place.

1.2.2 Contribution

The development of this advergame contributes to extending the world of serious games. The research executed during this project analyses the industry of serious games, and more specifically, the realm of advergames. It demonstrates successful examples of previous implementations of this method of advertising and identifies the factors that lead to their success. By making this game public, this project spreads the concept of serious games to people who may not yet know it, while keeping the experience entertaining.

Additionally, this project contributes to the scientific research that is developed on advergames. In a broader scope, it helps discover if advergames can promote a company's brand or product. By sharing the successes and obstacles that were experienced during the project, the scientific community can gather new information on advergames.

Lastly, if this project proves to be successful in promoting ISEP's image, it can create an increase in the number of people pursuing higher education. This game creates the possibility to spike curiosity in people who are skeptical of following this academic path. If they are entertained by the game, they may develop a more positive image of ISEP and higher education itself and inform themselves further. Overall, these sequences of actions may create new and better opportunities for students that otherwise would not enroll in higher education.

1.3 Report Structure

This section details the structure of this report. In this chapter, the context for the problem at hand is exposed, and a description of the problem is provided. In chapter 2, the state of the art is analysed, starting with the definitions and types of digital games, serious games and advergames, and ending with an analysis of existing examples in the field of advergames. Value Analysis is explored in chapter 3. It explores key elements of innovation, defines the concept of value and associated terms, identifies the project's value proposition, displays its Business Model Canvas, and explores the possible game genres that can be chosen, as well as process to determine the most fitting one. Chapter 4 possesses the design decisions made during the project, specifically the game concept, the design of each level and the engine used to develop the game. Chapter 5 details the way the project was implemented, explaining its general structure and main mechanics. Chapter 6 enumerates the various methods of development tracking and evaluation used in the project. Lastly, chapter 7 compiles the results of all methods of testing and evaluation to determine which objectives were completed, which limitations were present during the project, and future work that could be performed.

2 State of the Art

In this chapter, digital games, serious games and advergames are described and previously existing examples are analysed. Specifically, when analysing existing advergames and games with product placement, features that are relevant to this project are identified and a comparison of the analysed games is performed.

2.1 Digital Games, Serious Games and Advergames

To ease the understanding about the main support tool for the advertising strategy to be developed in this project, a few concepts are detailed, namely the definitions of digital games, serious games and advergames.

2.1.1 Digital Games

Dörner et al. define digital games as “games that use some kind of computing machinery (e.g., a personal computer, a smartphone or a piece of electronics dedicated for playing games such as a video game console)” (Dörner, et al., 2016). The popularity of digital games has skyrocketed in the last couple of decades – the Entertainment Software Association discloses that 65% of Americans adults play digital games daily and 79% of gamers say games provide mental stimulation. It is also reported that “2018 was a record-breaking year for our [the computer and video game] industry, with total video game sales exceeding $43.4 billion” (Entertainment Software Association, 2019).

Dörner et al. also discuss how the success in digital games can be used to further explore gaming in areas that do not involve entertainment. Digital games already possess so many features that motivate and immerse a player, that it would seem a natural fit to use them for purposes other than entertainment. Figure 1 displays the many competences that a player can develop or enhance when playing a digital game.

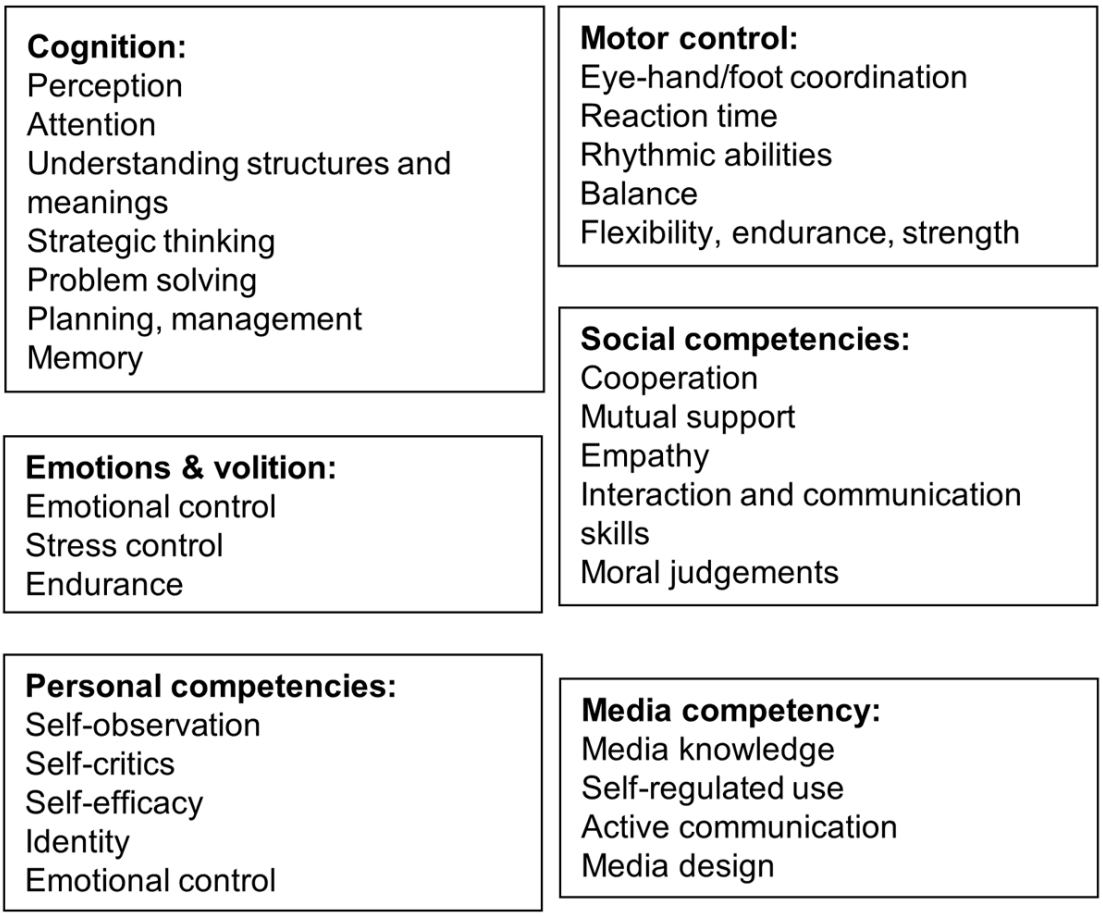

Figure 1 - Competencies potentially enhanced by playing digital games (Wiemeyer & Hardy, 2013)

This shows that there are several areas that digital games can focus on, and it allows for the creation of many different types of digital games, depending on which competence they intend to affect.

2.1.2 Serious Games

Pursuing the need to use digital games for purposes other than entertainment led to the creation of serious games. Corti defines serious games as "leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills" (Corti, 2006). Zyda, however, considers a serious game as a "mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives" (Zyda, 2005). Moreover, Dörner et al. refer to a serious game as "a digital game created with the intention to entertain and to achieve at least one additional goal (e.g., learning or health)".

It is important to note that serious games are often mistakenly considered the same as educational games or learning games. The latter two are considered subgroups of serious games. Educational games tackle the formal education sector, as well as vocational and workplace training. Learning games work very similarly, but are used in less formal contexts, whereas educational games are used in schools or in the workplace. A game can also be considered a serious game when used as a marketing tool or a medical treatment, for instance (Dörner, et al., 2016). As such, serious games can also be described as going beyond entertainment games, which are games with the sole purpose of entertaining the player.

However, games made specifically for entertainment can be great learning experiences, too. As Squire and Steinkuehler conclude, "it will be important that, in an effort to fit games to existing classrooms, we do not end up unintentionally flouting the very features that make them provocative tools for thought in the first place" (Steinkuehler & Squire, 2014).

An example of this is Arena's study (Arena, 2012), which tested preparation for future learning. Students played Call of Duty 2 (a first-person shooter set in World War II) and Civilization IV (a historical simulation game where the player must construct their civilization, being set initially in 4000 BC and lasting until the present) before a World War II lecture. An increase in attention during the lecture and in the grades in the test that followed were observed.

For this project, it is then considered that a serious game is a digital game with the ability to provide new knowledge, competences or awareness using entertainment as a resource to develop those cognitive aspects and not as the main object of the game. Serious games can split

into different subsets, depending on their purpose and the field they work on. Sawyer and Smith have created a taxonomy that shows the goal of each different type of serious game, as can be seen on Table 1.

Table 1 - Taxonomy of Serious Games (Sawyer & Smith, 2008)

	Games for Health	Advergames	Games for Training	Games for Education	Games for Science and Research	Production	Games as Work
Government & NGO	Public Health Education & Mass Casualty Response	Political Games	Employee Training	Inform Public	Data Collection / Planning	Strategic & Policy Planning	Public Diplomacy, Opinion Research
Defense	Rehabilitation & Wellness	Recruitment & Propaganda	Soldier / Support Training	School House education	Wargames / planning	War planning & weapons research	Command & Control
Healthcare	Cybertherapy / Exergaming	Public Health Policy & Social Awareness Campaigns	Training Games for Health Professionals	Games for Patient Education and Disease Management	Visualization & Epidemiology	Biotech manufacturing & design	Public Health Response Planning & Logistics
Marketing & Communications	Advertising Treatment	Advertising marketing wth games, product placement	Product Use	Product Information	Opinion Research	Machinima	Opinion Research
Education	Inform about diseases / risks	Social Issue Games	Train teachers / Train workforce skills	Learning	Computer Science & Recruitment	P2P Learning Constructivism Documentary?	Teaching Distance Learning
Corporate	Employee Health Information & Wellness	Customer Education & Awareness	Employee Training	Continuing Education & Certification	Advertising / visualization	Strategic Planning	Command & Control
Industry	Occupational Safety	Sales & Recruitment	Employee Training	Workforce Education	Process Optimization Simulation	Nano / Biotech Design	Command & Control

From this list, the project revolves around the topic of advergames. More specifically, it focuses on advergames for marketing and communications, attempting to advertise a product.

2.1.3 Advergames

As digital games started developing as a media, companies realized that the knowledge acquired by players could be of their own brand and products. Marketing companies who already had experience in advertising in digital media saw the potential for these strategies in digital games as well. One of the most advertised fields in television, for instance, is the food retail industry, with emphasis on low-nutrition foods aimed at children. It has been reported that until the age of four of five children cannot discern advertisements from the remaining programming in television, and they only start being able to defense themselves against this

advertising around age twelve (Lee, et al., 2009). It is not surprising that these companies would see the appeal of applying the same strategies to the gaming industry, as this distinction between regular content and advertising becomes even thinner. This is perhaps the reason that so many of the first advergames promote low-nutrition food. Developers began adding references, subtle and prominent, to products, brands and ideas that did not exist in the context of the game, and in some cases developed games around a pre-existing product or brand that would typically be advertised elsewhere. This created the distinction between three different types of advertising in games, as described in the next sections.

Additionally, advertising in games can be categorized through its dynamic nature (or lack thereof) and by its impact in gameplay. In the first set of these categories includes static and dynamic advertising. Static advertising is included in the game at its release and cannot be edited. It can be used for single-player games that will not be constantly updated or to ensure a long-term deal with the brand that is being advertised. That way, the player does not need access to the Internet to be exposed to the advertisement, which can increase its reach, since not every player can be connected to the Internet while playing the game (Terlutter & Capella, 2013). However, having static advertising also means that no changes can be applied to the advertising after the game's release, which can be a detriment to developers and advertising companies. If a better marketing opportunity arises or the product added to their game becomes irrelevant, nothing can be done about it. Figure 2 shows an example of this type of advertising on the left, in the game *WRC Rally Evolved (*2005), where static advertising exists in the cars the player uses, as well as the billboards spread around the tracks.

On the other hand, dynamic advertising offers the flexibility to change the brands and products that are displayed in the games. This can ensure that the advertisements present in these games can remain relevant while the game keeps being updated and offers developers a chance to keep promoting and profiting from their games. This requires users to have an Internet connection to either receive the update or the stream that the advertisement is displayed through. However, in games like *Fortnite* (2017), where players are already expected to have an Internet connection to use the game's online features, such as the popular *Battle Royale* mode, dynamic advertising can be utilized to its full potential. The game has made several collaborations with music artists such as Travis Scott and Marshmello and with movie franchises like *Marvel*. Figure 2's right side shows *Fortnite* debuting the trailer for 2020's film *Tenet*.

Figure 2 - Examples of advertising in digital games: *WRC Rally Evolved* (left) (Patil, 2018) and *Fortnite* (right) (Hando, 2020)

2.1.3.1 Advertising that does not influence gameplay

In-game advertising consists of inserting brands, products, or ideas into a game (usually an entertainment game) that does not revolve around them. This means that the product placement does not have to be a key part of gameplay (although it can be), and instead be a subtle addition to it. Product appearances that do not affect gameplay refer to brand placement that shows up in the game's world but does not add additional gameplay features by interacting with it (Skinner, 2020). These kind of additions to the game's environment can help create a more realistic world where these product placements already exist. The right of Figure 3 shows the game *Crazy Taxi* (1999) where its world is comprised of stores with real-life brands such as *KFC* and *Pizza Hut*. This demonstrates an example of this kind of brand presence, where driving in a world with existing brands can further immerse the player into the idea of the environment that is trying to be conveyed. To the left of Figure 3 is an example of advertising in *Angry Birds* (2009) that does not make the game more immersive, focusing instead on revenue.

Figure 3 - Examples of advertising that does not influence gameplay: *Angry Birds* (left) (Zenn, 2017) and *Crazy Taxi* (right) (WhatCulture, 2017)

Advertising in mobile apps has become increasingly popular, as 80% of free apps on the Google Play Market relied on targeted advertising as their main business model in 2011 (Leontiadis, et al., 2012). As this app-sharing software, now called Google Play, features a tab dedicated to games (which also acts as its homepage), it can be deduced that many games present in this platform follow that same business model. These offer alternatives for small developers to increase their revenue through their games, without making financial deals with advertising companies, as they can use mobile ad networks such as Google Mobile Ads and Apple iAD instead (Gui, 2017).

2.1.3.2 Advertising that influences gameplay

Product appearances that impact gameplay involve action from the player. Using items that contain the image of a brand to power up the player's character or progress with a game's story has a much bigger influence on how the player perceives the product and brand. These placements are no longer just elements that help build a world for the game to be set in, but objects that are key to the players experience with the game. A recent example of this is 2019's *Death Stranding*, a post-apocalyptic game set in the United States, where the player can drink *Monster Energy* drinks, shown on the right of Figure 4, to recharge the main character's stamina. In this type of product placement, the player becomes aware of the purpose of the product and can associate feelings of usefulness and practicality to its brand, which can then lead to a more appeasing perception of the brand outside of the game. Another example of this can be observed in the mobile game *Idle Food Truck Tycoon* (2019), where watching an advertising video can allow players to earn in-game benefits. This strategy is specifically utilized in mobile games since users can easily be transferred to other webpages and sources of media where they can watch targeted content after clicking it in the game.

Figure 4 - Examples of advertising that influences gameplay: *Idle Food Truck Tycoon* (left) (Edelmayer, 2019) and *Death Stranding* (right) (Campbell, 2019)

Certain games prefer to intertwine the product placements with the gameplay itself. These are games where the core gameplay features are typically associated or even dependent on the products that are presented. Popular examples of this type of placement exist typically in realistic sports games, such as the racing franchise *Gran Turismo,* where the player can choose from a wide spectrum a car brands and their models; skateboarding franchise *Tony Hawk's Pro Skater*, in which there are many real-world skateboard brands, as well as the companies that manufacture the several components that make a skateboard; and football franchise *FIFA*, which features not only the football club logos, but also 3D models that resemble the football players themselves, as well as the apparel they wear and brands associated with said clothing. These are all games that do not necessarily make the player use these products and brands to power up their characters, but instead offer a wide range of options to choose from, all with detailed specifications of each product's abilities, such as top speed or handling, in the case of *Gran Turismo*. When playing games that intertwine gameplay with product placement, a player might not even realize the multitude of brands they are being exposed to, as these games simply offer the options that a player is already accustomed to outside of the context of the game. These brands in these games help developers create a cohesive and realistic world for the player to be immersed into, where choices between brands exist in abundance.

2.1.3.3 Fully Branded Games

Fully branded games, also called standalone advergames, differ from other types of advergames in the sense that the whole game is created around the brand or product that is being advertised. They are developed with the intent to promote services or ideas, increasing a

brand's reach. These games are usually short and easy to play, and tend to be downloadable for free, and made available by the brand itself (Terlutter & Capella, 2013). Full branded games try to give players quick rewards, so that their attention can be obtained faster, meaning that these games make use of small levels that allow the player to pick the game up for a short period of time.

Whereas games that intertwine gameplay with product placement have a fixed theme that will be associated with the brands they display, such as skateboarding brands being associated with skateboarding itself in *Tony Hawk's Pro Skater*, fully branded games can take a much more creative approach to advertise brands. In a list of 110 standalone advergames, 73 were related to food and drinks, and yet only two of those fit in the genre of management (plinq, 2019). While this genre could accurately describe the work that these companies do, such as managing the logistics of distributing their products around the world, throughout their factories, or directly to their customers in a restaurant, brands choose to instead advertise their products using genres that are distinct from what their products are associated with. Most of these games are platformers, action, adventure, or racing games, and in some cases these fully branded games even take the form of first-person shooters or stealth games. Standalone advergames gravitate towards genres that make their brands seem more exciting and thrilling, and possess the ability to take a creative approach on a brand's product and the environment it is inserted into, meaning that fully branded games can take many forms.

2.2 Related Examples

This section details examples of fully branded games, as well as their main features, gameplay, reception, and relevance to the project at hand. Since this project is not restricted to any genre or type of standalone advergame, but instead focuses on determining what makes a successful fully branded game, the games portrayed in this section were chosen having diversity across genres and release dates in mind, to further understand what each type of advergame can bring to the industry and how they are received. After analysing each game, a comparison is made to sum up the main differences between each advergame.

2.2.1 Tapper

Tapper is a 1983 arcade game developed by *Marvin Glass and Associates*, released by *Bally Midway,* and sponsored by *Anheuser-Busch*, and American brewing company. The player takes the role of a bartender pouring *Budweiser* tap beer and sliding it over a counter to customers who are walking towards the player. The game features simple controls, having only directional inputs and one action button, which can be used to pour beer and released to slide the beer away. Players start with three lives, which can be lost if a customer reaches the player, or if a beer mug is dropped, which can happen if the player slides a mug in a counter that had no customers, or if the player fails to catch a mug that was thrown by a customer. The aim of the game is to achieve a high score, by completing levels and grabbing mugs and money that the customers leave behind. The goal of each level is to clear all customers off the screen, which can be achieved through repeatedly giving them beer, which gradually moves them towards the exit door. *Tapper* also contains different aesthetic areas and customers, and bonus levels where the player can earn extra points.

The game was well received, selling over 3300 arcade machines (plinq, 2019) and being considered by *Compute!'s Gazette*, a 1980's computer magazine, as "one of the most addictive games lately" and a "very well-designed strategy game" (Keizer, 1985). The game makes sure to keep advertising the *Budweiser* brand, with the ever-present logo in the background and the constant appearances of the same logo on other graphic components such as the taps and the mugs themselves, to a point where it becomes clear that the player is not just serving any beer, but they are indeed serving a *Budweiser*, creating a mental link between the concept of beer and the brand itself. However, the arcades were not exclusively sold to bars as intended, and got in the reach of underage players, which lead to the responsible companies re-releasing the game as *Root Beer Tapper*, which featured aesthetic changes such as the complete removal of the *Budweiser* logo and the replacement of the beer mugs by mugs that contained non-alcoholic root beer, as can be seen in Figure 5.

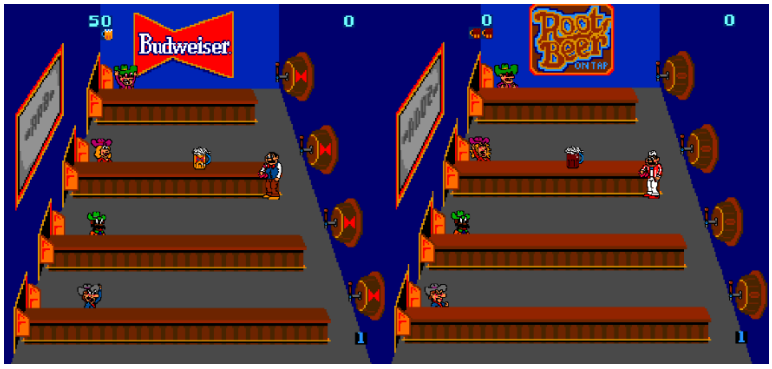

Figure 5 - 1983's *Tapper* (left) and its 1984 re-release *Root Beer Tapper* (right) (Play Retro Games, 2018)

This game was chosen to be analysed for this project since it is one of the first examples of standalone advergames on the market, showing how a game of this nature can be successful even with simple concepts and mechanics. It is also one of the few cases where a standalone advergame's theme and genre match the real-world use of the product that is being advertised (although with added speed and gamified components), showing that although it is possible to take a creative approach to the advertised brand, a real-life simulation can be effective as well. Lastly, this game was also displayed here to show the risk of having a brand associated with a digital game. This kind of collaboration requires a kind of quality assurance that some companies may not be used to, since a graphic detail or an expected audience group could associate the brand with unintended concepts.

2.2.2 Cool Spot

Cool Spot is a 1993 game developed and published by *Virgin Games* and sponsored by *7up* for the Sega Mega Drive and the Super Nintendo Entertainment System. The player controls *Cool Spot*, the mascot that represented *7up* at the time, through a series of 11 platforming levels. The aim of each level is to find a caged ally, which looks identical to the controllable character, that is hidden in the map and release them. To do so, the player must first collect 60 red spots that are spread across the stage, while avoiding level-themed enemies with different moving patterns, as can be seen on the left of Figure 6. The game has simple controls, featuring directional inputs (which also allow to climb up and down), a jump button and an action button that shoots soda bubbles that damage enemies. All the objectives of the game are explained in a screen that appears before the start of the first level, as shown on the right side of Figure 6.

Figure 6 - 1993's *Cool Spot* gameplay (left) and tutorial screen (right) (Play Retro Games, 2018)

The game is heavily themed around coolness. Firstly, the playable character itself is described as cool, both by its name and reveal in the first scene of the game, where it is surfing on top of a *7up* bottle. Immediately on the tutorial screen the player is informed to collect the red spots and the *7up* logo if they are cool, which is a theme that is constant through the game, as collecting these elements in the levels increases the player's "cool meter" on the top left corner of the screen. Additionally, the levels themselves could be described as cool, with names such as "Radical Rails" and "Dock and Roll", themes like the beach, and a soundtrack with a sped-up rhythm. By consistently exposing the player to this notion of coolness, the game attempts to associate that same concept with the *7up* brand itself. Making brands and products appear as cool is something typically done by food advertisers on other medias as television and can be especially effective on children (Jenkin, et al., 2014). Cool brands are usually "perceived to be extraordinary, aesthetically appealing, energetic, high status, rebellious, original, authentic, subcultural, iconic, and popular" (Warren, et al., 2019).

The relevance of this game to the project lies within its genre and execution. Like *Virgin Games*, many other advertising companies opted to make their games revolve around platforming, action, and adventure, making this game a solid example of a good portion of the advergame industry. However, *Cool Spot*, being a sequel to *Spot: The Video Game* and *Spot in the Cool Adventures*, had a more positive reception and reach than most of these similar games did, getting a sequel called *Spot Goes to Hollywood*. *Pelit*, a Finnish game magazine, considered it "one of the most enjoyable platform games in a long time" (Pelit, 1994) and ranking 88th on Complex's list of "The Best Super Nintendo Games of All Time" (Knight, 2018). In that list, not only is *Cool Spot* described as an enjoyable platformer, but it is also mentioned that other games

with commercial mascots, such as *Yo! Noid*, are considered inferior. This shows that for a fully branded game to be considered successful, not only must the advertising be well executed, but also (and perhaps more importantly) the game mechanics and dynamics themselves need to be on par with the expected from the digital game industry.

2.2.3 America's Army

America's Army is a 2002 tactical first-person shooter game developed and published by the United States Army and released for free. In this game, players take the role of a recruit in the United States Army and perform a series of training courses and military missions. Upon first use of the game, the player must complete at least four training courses to be allowed to play online. These stages (which can be seen in the left of Figure 7) teach the player the basic movement and weapon mechanics, just as any other game in the genre would in their tutorial. However, unlike other first-person shooters of the time, the player is provided with an accurate depiction of United States military training grounds, as well as their practices and values. This realism further immerses the player in the experience, turning a common tutorial into a realistic recruit experience. Upon achieving the required score in the ballistics training, the player acquires the possibility to engage in online matches (as shown on the right of Figure 7). These lobbies split players in two teams – the United States Army, and a generic terrorist force called *OpFor*. The rounds are short but do not allow respawns, motivating the player to work together and play strategically to avoid being out of the round early.

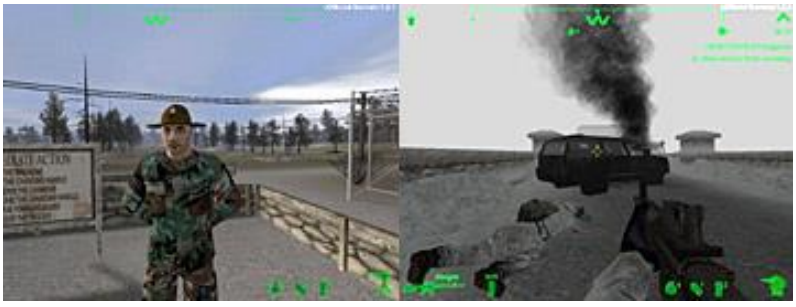

Figure 7 - 2002's *America's Army* training course (left) and military mission (right) (Osborne, 2002)

America's Army was well received by the gaming community. Players and critics enjoyed the realism this game provided. Small details such as the player's weapon being lowered while sprinting, being able to lean around corners and automatically switching out of the weapon's

zoom mode when changing stances are features that players did not commonly see in games of this genre at the time. From the serious training speeches given by drill sergeants to the intense combat scenarios in online matches where a player can die by being shot two or three times, the game's realism and setting gave players the immersive experience they desired. The graphics did not stay behind, showing the developer's attention to detail, "from the little patches on a sergeant's uniform, to the moths swarming around an outdoor light at night, to the sophisticated reloading animations" (Osborne, 2002). Lastly, the sound design was also praised, as both the weapon and the background's sound effects seemed realistic and fitting. Players were pleasantly surprised to see this level of quality in a free game, which further increased its reach and improved its reception. With the success of the first game, the army was able to create several expansions and remaster the game into newer versions that are being updated to this day.

The reception of *America's Army* brings about a couple of points that are important for this project. The first one is the importance of the involvement of the product or brand that is being advertised. With this game, we have a perfect example of the organization that is being advertised being also the one that is developing the game. When making a game about the United States Army's training, values and procedures, the best source of information is the army themselves. This ideal scenario is usually not possible, since advertising companies seldom possess teams that could model and develop a game, like the army does in their many military schools. However, it still important and possible for any advertising company to be in close contact with the developed team they hired and provide them with as much information as possible about the product or brand they are advertising.

The second relevant aspect of this game is its seriousness, not only in its content but also in its distribution. *America's Army* is openly described as a recruitment tool funded by the United States government. With an average recruitment cost of fifteen thousand dollars per soldier, the army expects to make profit by obtaining 300 to 400 new recruits per year (Kennedy, 2002). To increase the game's reach, the development team made the decision of removing most blood from the game, to reach a rating that was fitting for teens. However, this political side of this game does not stop users from playing it. Although accompanied by some controversy (GamePolitics, 2009), players seem to not mind the army's intent when distributing the game, focusing instead on its worth as a first-person shooter. This shows that if a fully branded game

is entertaining, players can look pasts its advertising nature and remain immersed in the experience.

2.2.4 Sneak King

Sneak King is a 2006 stealth game developed by *Blitz Games* and published by *Burger King* for the Xbox and Xbox 360. It was part of campaign called *King Games*, which included three different games featuring *Burger King*'s mascot, *The King*, that were sold for an additional $3.99 after buying a *Burger King* value meal, during a month-long period. The player controls *The King* through 4 different areas, each containing 20 different missions. The goal of each mission varies, but the general concept is that the player must deliver *Burger King*-branded food without being seen. To do this, the player must avoid the targets' cone of vision and walk slowly (or sneak) as to not make noise. Alternatively, the player can also go to pre-determined hiding spots where there is no risk of being spotted (Figure 8), being even required to do so for certain missions. The controls are comprised of directional inputs, a sneak button, a hide/unhide button, a sprint button (which creates noise) and a button to both give food to targets and stop the gauge that determines how surprised they are upon receiving the food. If timed right, this gauge can give the player extra points, which may allow the player to achieve a higher ranking in a mission.

Figure 8 - 2006's *Sneak King*'s hiding (left) and sneaking (right) mechanics (Brudvig, 2006)

The game achieved mediocre reviews from game critics. The graphics were considered sub-par for its time, looking like a "a barebones-looking world with limited animation at best" (Gerstmann, 2006). The game was also considered to be bare, that even though the missions had some diversity, the mechanics still "got old" quickly and the level of exploration left much to be desired. Additionally, game-breaking bugs and crashes were somewhat common (Brudvig, 2006). However, even if *Sneak King* was not acclaimed graphically and mechanically, it received

praise for its advertising. Critics enjoyed the "hilarity of watching the King creep around and then cap off a crazy dance by handing over some sort of food" (Brudvig, 2006) and called it "compelling in some strange and insidious way" (Gerstmann, 2006) saying that the game "is far from a great game and closer to just a great marketing idea" (Brudvig, 2006). *Burger King Holdings* revealed that quarterly earnings rose 40% due to the *King Games* campaign, and that more than 3.2 million games were sold (USA Today, 2007). In a year where the bestselling game was *Madden NFL 07* with 2.8 million units sold (Sinclair, 2007), *Burger King*'s games were widely distributed.

Sneak King is relevant to this project due to the great success it obtained as a marketing campaign and the way it regards its own theme. This game can almost be considered the opposite of *America's Army*, in the sense that while one game tries to gather players through its realism and sense of severity, the other tries to advertise its products by being purposely silly. *Sneak King* is highly self-aware of its lack of seriousness, and takes it to another level, deliberately having over-the-top animations for sneaking and hiding, making the character clearly visible while hiding, creating dances that *The King* executes upon a successful food delivery and using expressions such as "those blue vision zone things" when referring to game elements such as the targets' cone of vision. These are all factors that make the game funnier, provoke laughter and create interest in new players. It is an interesting approach to fully branded games, as the developers seem aware of the backlash that smaller implementations of advertising in games can create (Petitte, 2013) and how it can sometimes make experiences less immersive, they fully embrace the silliness that comes from a disguised mascot sneakily serving food to people on the street. The result is a game that connects with players not for its gameplay, but for its humour.

2.2.5 Magnum Pleasure Hunt

Magnum Pleasure Hunt is a 2011 web-based flash game developed by the *Lowe Brindfors Stockholm* marketing agency and sponsored by *Unilever*. In this platforming game, players take control of a "pleasure hunter", a woman who seeks the ultimate *Magnum* pleasure. The controls are simple (players can move left, move right, and jump) and the game takes five to ten minutes to complete. The goal is to collect as many *Magnum* bonbons as possible to increase their score, while navigating through depictions of popular brand's websites. Players can use the websites' elements creatively to jump higher and collect bonbons, as can be seen

on the right of Figure 9, where players must first reach the windows displayed on the right to collect the bonbons at the top. Transitions between website pages are mostly achieved by walking to the edges of the screen, which triggers an animation of the player's character interacting with the new webpage, such as becoming part of a *YouTube* video and diving into a picture of a pool in a hotel's website. Certain transitions are made through interaction points marked by an arrow that indicates the player to press the jump button (as shown on the right of Figure 9). These points show the player what action to take in areas where the path to progression is not as clear, and mark locations where the character's transition is made through jumping, such as diving into a smartphone's screen or flipping into a car. The game ends once the player reaches a clothing website, where the character changes into a different outfit and discovers a newly-released *Magnum* ice cream.

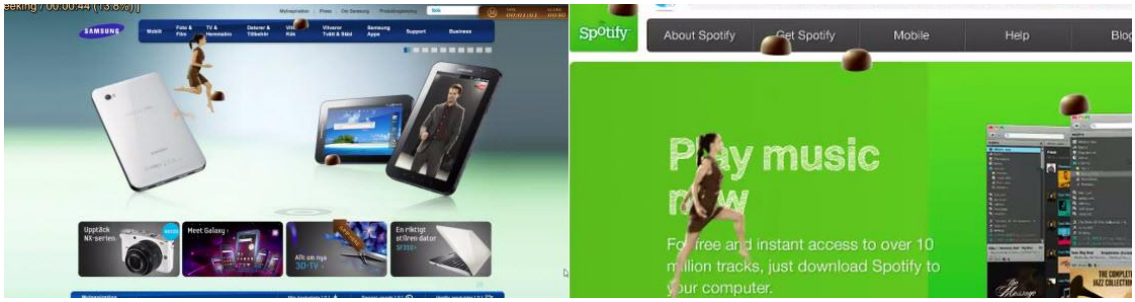

Figure 9 - *Magnum Pleasure Hunt*'s journey through websites such as *Samsung* (left) and *Spotify* (right) (Singh, 2011)

Magnum Pleasure Hunt was successfully spread across social media. Having an integrated functionality to challenge friends on different social media platforms, players were motivated to share the game online. On the 14th of April 2011, *Magnum Pleasure Hunt*'s website was the most tweeted website in the world and in just five days it had over 725 thousand unique visits, with an average of 8.5 minutes spent on the page per user (MullenLowe Group, 2013). The game's success further increased the reach and awareness of *Magnum*'s brand and its newest product, as well as the other brands depicted in the various webpages of the game, being considered one of the most impressive campaigns seen in a long time (MindJumpers, 2011). Despite being successful as a viral campaign, to the point where the game had two sequels in the following years, *Magnum Pleasure Hunt*'s flaws as a game were pointed out. The game features no consequences for performing poorly other than a lower score, since the player cannot lose the game, which can be "disappointing from a ludic perspective" (Ferri, 2013). Additionally, the player loses control of the character many times in an already short game,

through its transitions and animations, which shortens the areas where the player has agency. The game instead opts to create a consistent narrative experience rather than a player-controlled environment so that the user always reaches the end, achieving the ultimate pleasure and luxury that *Magnum* associates with their products through all the upscale websites that are being navigated.

This game is relevant to the project at hand because it shows a creative approach to the concept of fully branded games. While most standalone advergames of its time focused on giving the player as much agency as possible so that they identified themselves with the brand or product they were playing as, *Magnum Pleasure Hunt* instead focuses on the narrative instead. Players' actions and experiences do not diverge much from each other. Most players will explore each screen until they find the platforms to reach the bonbons in their own way, but their options are limited. This promotional campaign could be a video or animation rather than a digital game, and yet it was the player interaction and shareability that created its success. It is a notable example of the balance between open player agency and a linear consistent narrative, which gives player space to explore while still forcing them into the right direction, all in a five-minute experience.

2.2.6 Example Comparison

Table 2 shows the comparison between the games analysed in this chapter, showing the diversity amongst them. Most games described in this section are related to the food and drink industries, which is purely a result the large number of games of this nature that exist in the realm of fully branded games. The diversity intended in this chapter does not contemplate the industries that are being advertised in these games, since the brand to be advertised in this project has already been decided, but it is still important to note that advergames span across many industries, such as the clothing, automobile, and personal care industries.

Table 2 - Example Comparison

Game	Advertised Brand	Type of Brand	Game Genre	Goal
Tapper	Budweiser	Retail	Arcade	Bartending
Cool Spot	7up	Retail	Platformer	Saving 7up's mascots
America's Army	United States Army	Political	First-Person Shooter	Protecting the country
Sneak King	Burger King	Retail	Stealth	Surprising customers with food
Magnum Pleasure Hunt	Magnum	Retail	Platformer	Achieving maximum pleasure

By observing the table its can be seen that both the genre and the goal of each game varies greatly between every game, except for the two appearances of platformers. It is also noteworthy that some games take a more serious approach than others. *Tapper* contains game elements that are identical to the actions of bartending and *America's Army* puts the player in a realistic environment, offering them the necessary training before stepping into its precarious world. On the other hand, *Cool Spot, Sneak King* and *Magnum Pleasure Hunt* do not focus on realism, as can be seen by the existence of anthropomorphic spots, a mascot hiding from people in haybales and a model hijacking several luxury services, respectively. This shows that in the past advergames have been successful regardless of genre and game concept if the game mechanics remain consistent with its theme.

3 Value Analysis

Value analysis encompasses an array of methods used to discover how value can be increased at the lowest cost, without sacrificing quality. It focuses product development in continuous and iterative learning processes that works on customer value (Hughes & Chafin, 1996). It is an activity that requires planning, control, and coordination, in a process of analysis and evaluation. It focuses on the purpose of the product at hand, as well as the demands of the customer. By understanding the value for the customer, as well as the design choices and improvements that can be taken, the product's quality can increase. In this chapter, the key elements of innovation are explored, and the definition of value itself, as well as related concepts are explained. Later, the value proposition, the business model and the value chain are detailed, to show the strategy business decisions that took place in this project. Lastly, the different criteria and alternatives for deciding the game's genre are evaluated, to provide extra value for the customer.

3.1 New Concept Development Model

The New Concept Development (NCD) Model was used in this project as a method of identifying the opportunity to create this project and developing an idea and a concept that would take advantage of said opportunity. The NCD serves as way of identifying the first stages of the Front

End of Innovation, which represents the activities that come before the formal and well-structured New Product Development (Koen, et al., 2001). Figure 10 shows the key parts that make the NCD model – the engine, the five key elements and the influencing factors.

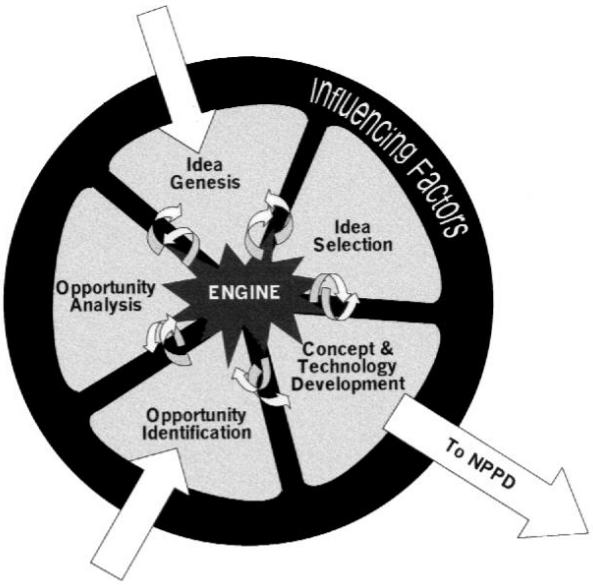

Figure 10 - The New Concept Development Model (Koen, et al., 2001)

The influencing factors consist of factors such as organization capabilities, business strategy, distributions channels, customers, and competitors. The engine refers to the leadership and culture of the organization, and it serves as a driving force to the five front-end elements. These five elements, which are influenced by the outer area and the engine, are the opportunity identification, opportunity analysis, idea genesis, idea selection and concept and technology development.

For this project, the opportunity identification refers to understanding the need that ISEP possesses to promote its image in a way that is engaging to its target audience. Through opportunity analysis it was decided that the creation of an advergame is fitting to meet this need. Both these elements were further explored in section 3.3. The idea genesis process was executed through the research of the state of the art, in section 2, and identification of the possible types of advergames that could be developed. The selection of the idea was made through a comparison of game genres according to chosen criteria, as is detailed in section 3.6. Lastly, the development of the concept is detailed in section 4, where the game concept and the technologies used to achieve it are explored.

3.2 Value, Value for the Customer and Perceived Value

To further understand how to add value to the project at hand, the definition of value itself must be studied, as well as related terms such as value for the customer and perceived value. It is essential to know the concepts of value in a business-to-client relationship, and in relationships between businesses, from both the customer's and the supplier's point of view, as the product itself may even become a commodity (Frasquet-Deltoro & Cervera-Taulet, 2009). Value can be defined as the needs, desires, standards, criteria, beliefs, attitudes, or preferences that an entity possesses (Nicola, et al., 2012). It represents the way a customer's life is improved by a product or service, or the way a customer approves said product.

The concept of value for the customer revolves around the benefit a customer receives from using a product, and what prevents them from utilizing or acquiring a product, such as sacrifices. To be a customer value leader it must be understood why and how clients choose products and services both initially and during their use, to maximize profits over time (Day & Moorman, 2010).

Perceived value illustrates the way different customers perceive different value for the same products and services (Ulaga & Eggert, 2006). It shows that value for the customer is not unique, that different segments or even customers in the same segments can view products differently. It is also important to note that producers typically have a different perception of value from the users themselves, being less sensitive to price and more aware of development time, while users highly value the product's cost, their use value, and their exchange value (Lindgreen & Wynstra, 2005).

For this project it is important to stay in a mindset of the customer, staying aware of the use they will give to the product, as well as their cost. It is also relevant to determine all the benefits the customer gets from using the product, as well as the current sacrifices that they are performing for not having the product, which is further studied in the next section.

3.3 Value Proposition

A value proposition is a set of sentences that describes a product, the value it delivers to the customer, and which customer jobs and needs it satisfies. It must be short and clear, as to create no ambiguity or doubt in the client, and it must be credible and fill the market's needs. It works as a method to show the customer the results they can obtain through acquisition and use of the product at hand. To fully understand how valuable a product can be to a customer, it is first necessary to understand the customers themselves, as well as their common tasks, what makes them happy, and what troubles them.

3.3.1 Customer Jobs

Customer jobs are the tasks the clients have at hand. They represent the jobs a customer wants to get done with in their work or life, be it functional, social, or emotional. In this project, the main task ISEP is trying to fulfil is promoting its institution, but there are other important ones.

- Promote ISEP
- Recruit new students
- Differentiate from other institutions
- Convey image of technological prowess
- Share the higher education life experience

Overall, through its self-promotion, ISEP desires to stand out. It wants to have something that other institutions do not, which can give an edge when recruiting new students.

3.3.2 Pains

Pains represent the customer's troubles. They are a list of items that shows what is preventing the client from achieving the jobs that were listed above. Pains are useful to understand exactly what the customer needs changed in their lives. A list of pains for ISEP's promoting is listed below.

- Recruiting new students is expensive

- Necessity to hire people to promote ISEP
- Lack of student motivation to join ISEP
- Reputation of other institutions
- Difficulty to reach students in person
- Organizing events each year is expensive and time-consuming

ISEP's main troubles come from the expenses created when using the current promotion and recruitment methods, as well as the difficulties associated with reaching certain students.

3.3.3 Gains

Gains are the aspects that make the customer's jobs easier. They represent the benefits that make the customers happy and allow them to do their job. A list of gains related to promoting ISEP are shown below.

- Promotion that can be used every year, without additional expenses
- Universally reaching all students
- Methods that other institutions do not possess
- No need to hire people to recruit students in person
- Motivating and entertaining students during the recruitment process

The aspects that make ISEP happy revolve around finding inexpensive ways to spread awareness its institution, while still reaching students from all around the world.

3.3.4 Conclusion

Upon laying out ISEP's jobs, pains, and gains, their needs become clearer. Additionally, the gains section is crucial to understanding the benefits that the product at hand can bring to the institution. Using this information, it was possible to craft a value proposition that fits the products features and crosses them with ISEP's needs.

The product being proposed in this project is an advergame made for ISEP, a higher education institution with needs to promote itself and recruit new students. It is a method of publicity that promotes ISEP unlike the current processes, such as open days and participation in conventions, as it is a one-time expense that can be used every year and has the potential to reach students across the Internet. Therefore, this project provides value to ISEP by increasing its reach and highlighting its spot on the market by distinguishing it from other institutions.

3.4 Business Model Canvas

The Business Model Canvas (BMC) is a method of structuring and managing the multiple segments and stakeholders of a business or project. It is a template that prompts managers to list out the variety of customers, partners and suppliers that are involved in the project at hand. It handles the way a company is structured, by enumerating its key activities and resources, as well as its financial side, with associated costs and revenue streams. Lastly, it connects the project's interested parts, by listing the customer relationships, the channels used to connect with them, and the proposition that gives them value. The value proposition has been analysed in the previous section, while the other parts of the BMC are detailed in the next sections. This information is also replicated in the form of one larger table, which can be seen in Table 3.

Table 3 - Business Model Canvas

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="3">ISEP's board;
ISEP's students who may provide their personal experience.</td><td>Game development;
Gathering feedback from ISEP;
Game installation in a public domain;
Advertising the game;
Potential fixes and patches after the game's installation.</td><td rowspan="3">An advergame that provides value to ISEP by increasing its reach and highlighting its spot on the market by distinguishing it from other institutions.</td><td>Direct contact with ISEP during the development and installation of the game, as to understand if their needs are being fulfilled by the game that is being developed;
Potential for fixes and patches after the installation of the game.</td><td rowspan="3">ISEP is the only client of this product.</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td>Personal equipment to develop the game;
Research executed during the development.</td><td>Direct contact with ISEP during the development, and during and after installation of the game.</td></tr>
<tr><th colspan="2">Cost Structure</th><th colspan="3">Revenue Streams</th></tr>
<tr><td colspan="2">Development time;
Research and data collection time;
Personal equipment maintenance.</td><td colspan="3">The final delivered product;
Potential for fixes and patches after the installation of the game.</td></tr>
</table>

3.4.1 Key Partners

The key partners section is dedicated to listing the business's partners and suppliers as well the activities they perform and resources they bring to the project. Partnerships reduce the risk and uncertainty associated with creating a new project, they provide resources that would not be obtained otherwise, and help optimizing the project's economy. The partners for this project are ISEP's board and students which can provide their personal experience with higher education.

3.4.2 Key Activities

This part of the BMC enumerates the activities needed to achieve the business's value proposition, to maintain customer relationships, distribution channels and revenue streams. They refer to the project's production, the problem solving that ensues during its development, and the maintenance of the created platform. The activities in this project are the game's development, its installation, and post-development advertising of the product.

3.4.3 Key Resources

Like the key activities section, the key resources section lists necessities related to the project's value proposition, costumer relationships, distribution channels and revenue streams. It refers to any physical, intellectual, human, and financial resources that may be needed to perform any of the actions revolving the creation of the product. The key resources of this project are the personal equipment to develop the game and the research that is executed during its development.

3.4.4 Cost Structure

This area of the BMC focuses on the most important costs inherent to the business model, and the expenses created by its key resources and activities. It can detail fixed costs, such as rents and utilities, as well as variable costs. The main costs of this project are the development time, the time dedicated to research and data collection, as well as the maintenance of personal equipment.

3.4.5 Customer Segments

Customer segments refer to the different segmented sections of the market the product is destined to. It specifies if the product is catered to a mass, niche, or individual market. In this case, the product is made for one specific client, ISEP.

3.4.6 Customer Relationships

This section enumerates the types of relationships that exist or are desired to be created with the product's customers. It shows how the business is expected to stay in contact with its clients, both during and after the sale of the product. It can refer to the topics of personal assistance, automated services or created communities. For this project there will be direct contact with ISEP during the development and installation of the game, as to understand if their needs are being fulfilled by the game that is being developed. Additionally, there is potential for fixes and patches after the installation of the game.

3.4.7 Channels

The channels section details the methods available or desired to reach the previously mentioned customer segments. It aims to raise awareness of ways to reach the clients, to deliver the business's value proposition and to offer post-purchase customer support. The project's main channel is the direct contact created with ISEP, to be used during the development and installation of the game, as well as after this event, if necessary.

3.4.8 Revenue Streams

Revenue streams are the ways the customers pay for the product developed. It can help a company understand how each revenue stream contributes to the business's overall revenue. It can refer to asset sales, usage and subscription fees, and licensing. It can also be specific to certain customers or developed features. For this project, the revenue streams are the fixed price for the final developed product, as well as the price of later fixes and patches.

3.5 Porter's Value Chain

As a way of analysing the specific activities that create value for a company, Michael Porter described a chain of activities that are common to all businesses and divided them into primary and support activities. This approach focuses on how the inputs are changed into the outputs that are delivered to the customers, instead of looking into the accounting side of the business model (MindTools, 2016). The model for this project can be seen in Figure 11.

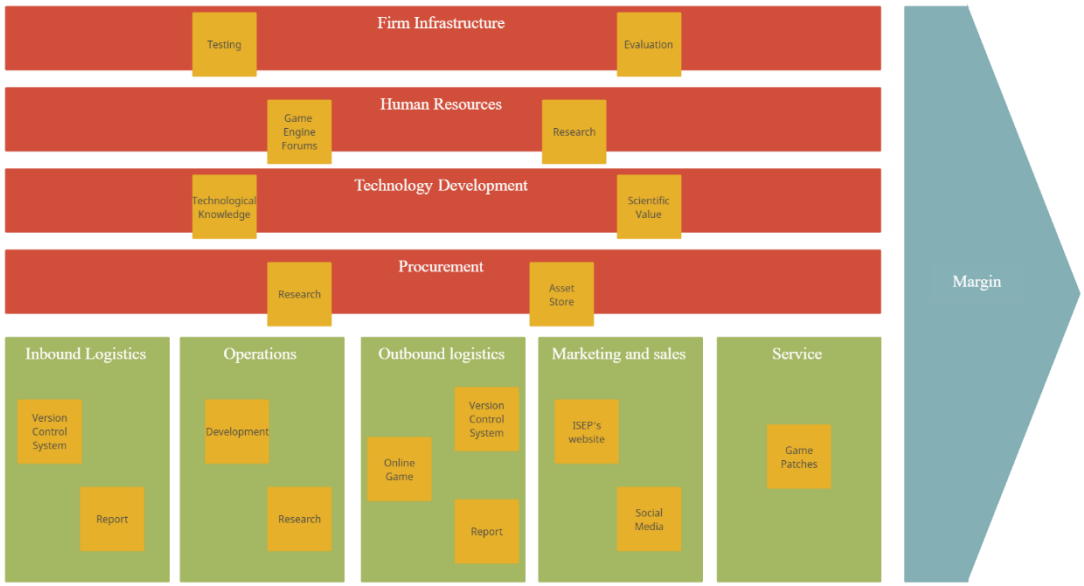

Figure 11 - Value Chain Model

The primary activities are inbound logistics, operations, outbound logistics, marketing and sales, and service. Inbound logics are the methods used to store and receive inputs. For this project, the inputs of the development will be stored in a version control system (VCS) while the inputs of the research will be present in this document. The operations refer to the activities that turn inputs into outputs, which in this case are the development and research. The outbound logistics refer to the management of the outputs. For this project, the developed game will be available online, while the results of the questionnaires will be detailed in this document and game analytics will be available in the VCS. Marketing and sales activities are focused on promoting the outputs, which in this case will be achieved through ISEP's means of distribution, such as its website, and online forums and social media frequented by the target audience. Lastly, service activities refer to the actions taken after the sale of the product, such as maintenance, which will be executed through direct contact with ISEP.

The secondary activities identified by Porter are procurement, human resource management, technological development, and infrastructure. Procurement refers to the way resources and inputs are obtained. This comes from research and the use of assets from the game engine's asset store. Human resource management activities are based on recruiting, hiring, dismissing, and training members of the organization. For this project, training will be achieved through research and the documentation of the features of the game engine. The technological development activities refer to the knowledge and equipment that is created during the process of turning inputs into outputs. During this project, technological development takes the form of the scientific value of creating a new advergame, as well as additional technological knowledge that is acquired through the development of the game. Lastly, infrastructure activities consist of management, quality assurance, legal and accounting actions. In this project, the main infrastructure activities are testing and evaluation.

3.6 Determining Game Genre

Part of bringing value to a client through an advergame consists of the depiction of the product or the client themselves in the game. This means that the type of game must be suitable for the product, client or concept that is being advertised. To decide the specific type of game that will be created, the term game genre will be used. Game genres serve as categorizations of games. They are nebulous, since "players of games—that is, their audience—are not necessarily satisfied with the same generic conventions being endlessly repeated" and they are "expected to evolve to exploit the ever-growing capacities of the hardware" (Apperley, 2006). However, they can be used to provide a general sense of what game a player is dealing with and provide a useful definition of the type of mechanics present (Drachen, et al., 2013).

3.6.1 Analytic Hierarchy Process

There was no description of what sort of image or concept the client wants to be associated with in the game, so for this project the game genre will decided based on different criteria that the client could be interested in transmitting to their audience. The choice of each of these criteria is further detailed later in this section. To aid in this decision, the Analytic Hierarchy Process (AHP) is used. AHP is "an organised way to make decisions and collect information

relevant to them" (Saaty, 2008) created my Thomas L. Saaty. This process was chosen because it is based on the comparison between the importance of the criteria that are being analysed, as well as the comparison of the importance of each of the alternatives when associated with each of the criteria. Since there was no definition of the criteria to be used for the project at end, and consequently their weight, AHP's comparison approach makes the importance of each of the criteria more understandable in this case, as opposed to the weighted approach that methods such as the Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) use. The definition and explanation of each of the possible levels of importance for these criteria and alternatives are shown in Table 4.

Table 4 - Definition and explanation of each level of importance when using AHP (Saaty, 2008)

Intensity of Importance	*Definition*	*Explanation*
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity *i* has one of the above non-zero numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value when compared with *i*	A reasonable assumption
1.1–1.9	If the activities are very close	May be difficult to assign the best value but when compared with other contrasting activities the size of the small numbers would not be too noticeable, yet they can still indicate the relative importance of the activities.

To evaluate the consistency of judgements made when deciding the importance of each comparison matrix, a consistency ratio is calculated. This value is the relation of the consistency index and a random index, which can be displayed in the equation below:

$$CR = \frac{CI}{RI} \quad (1)$$

, where CR is the consistency ratio, CI represents the consistency index, and RI is a random index. The consistency index is obtained through the formula below:

$$IC = \frac{\lambda max - n}{n - 1} \quad (2)$$

, where λmax represents the highest eigenvalue of the matrix that is being analysed, and n represents the size of the matrix. The random index is based on values determined through the studies of large populations of matrixes and can be seen in Table 5. These values show that this method is not suitable for comparing less than 3 variables.

Table 5 - Relation between size of a matrix (n) and its random index (RI) (Saaty, 1987)

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

If the resulting consistency ratio is over 0.1, it can be considered that the comparisons were paired randomly, thus making the results inconsistent. Once all pairing matrixes have been tested for consistency, the weight of every alternative for each criterion is inserted into a matrix, and then multiplied by the weight of criteria, resulting in a value that represents how ideal the alternative is. The alternative with the highest value becomes the solution.

3.6.2 Criteria

The criteria chosen for this analysis were realism, challenge, narrative, interaction, and management. Realism was chosen since it is expected that ISEP wants their game to be an accurate representation of what it is like to be a part of that institution, making it one of the most important criteria. That does not mean the game must be a simulation of a classroom, as that would not be motivating for the player, but it means that there must be direct relations between elements in the game and their equivalent in real life.

Challenge was chosen to reflect the trials a student goes through in a higher education degree. University life is full of challenges, be it exams, projects, presentations, or time management. ISEP wants students who are willing to take on these challenges, and thus this advergame must be challenging on itself. The game does not need to be hard, but it cannot be a game such as *Magnum Pleasure Hunt* (analysed in section 2.2.5), where you cannot fail, as that proves no challenge to the player. For that reason, this criterion is just as important as realism.

Narrative represents the story-driven nature of a game. A student's journey in ISEP is a narrative on its own, and thus narrative must be present in the game in some way. The story will not necessarily be about a student's path through ISEP, but the game must have a narrative that the player can follow from start to end, just as the student's story in ISEP has a start and ending. While the importance of this criteria must not be overlooked, it is not as relevant as challenge is, as it is not such a prevalent factor in a student's life.

Interaction in games can have different meanings, but in this case, it refers to how much the game gives feedback and interacts with the player. Games filled with action constantly present the player with challenges, while other games let the player explore their environment without interfering. ISEP consistently interacts with its students, through feedback of their work, new assignments, and events. As such, the game must also show interaction with the player. This factor is not as representative of ISEP as realism and challenge, sharing the same importance of narrative.

Lastly, management refers to the way the player evaluates their options and acts accordingly. While progressing through ISEP, students must often manage their time, stamina and classes in ways that are beneficial to them, as to achieve positive academic results. Although it is important to have this element in the game, time management in students is also often a source of academic stress (Macan, et al., 1990), and thus must not be heavily present in the game, making it the least important criteria for the choice of genre.

Given the importance of each criteria, a pairwise comparison matrix was created, as can be seen in Table 6, where R stands for realism, C for challenge, N for narrative, I for interaction, and M stands for management.

Table 6 - Criteria pairwise comparison

	R	C	N	I	M
R	1	1	3	3	5
C	1	1	3	3	5
N	1/3	1/3	1	1	3
I	1/3	1/3	1	1	3
M	1/5	1/5	1/3	1/3	1

Upon the creation of this matrix, it is possible to estimate the weight of each of the criteria by normalizing the matrix, as seen in Table 7. This shows that realism and challenge are the most

important criteria, with a weight of 34.24%, while management features the lowest importance, at 5.57%.

Table 7 - Normalized criteria matrix

	R	C	N	I	M	Weight
R	0.3488	0.3488	0.3600	0.3600	0.2941	0.3424
C	0.3488	0.3488	0.3600	0.3600	0.2941	0.3424
N	0.1163	0.1163	0.1200	0.1200	0.1765	0.1298
I	0.1163	0.1163	0.1200	0.1200	0.1765	0.1298
M	0.0698	0.0698	0.0400	0.0400	0.0588	0.0557

The consistency ratio for this matrix is 0.012506, which shows that the judgements performed in the comparisons are consistent, since this value is below 0.1.

3.6.3 Alternatives

The alternatives used in this process are the possible game genres. The description of each genre is based the studies on game genres that were referenced at the start of this chapter. The genres chosen to be compared are simulation, strategy, role-playing, platformer, and arcade. Although there can be creative approaches to develop an ISEP advergame in other genres, such as beat'em up, fitness or music games, these would likely fall short in comparison to the chosen alternatives, as their score in realism would be low. Additionally, certain genres such as platformers and arcade have a long history in the industry of advergames, making them important alternatives. Therefore, the list was simplified to the five alternatives mentioned. It is important to repeat that genres are nebulous, and games have multiple genres. It is also relevant to note that the genres listed here are not mutually exclusive, meaning that there are games which can fall into the category of role-playing and platformer, for example. However, genres where overlap would be consistent, such as action and adventures games, which often associated with other genres, were not considered as alternatives. If the results obtained from applying the AHP return high values for multiple genres, combining them is an option.

Each genre will be further described when comparing them in relation to each criterion, but each of them have defining characteristics that are worth mentioning. Simulation games focus on recreating an aspect of life or fiction, such as driving or managing a business. Strategy games

rely on planning and execution, often consisting of leading a group of avatars to a goal (Drachen, et al., 2013). Role-playing games' definition varies, but common factors between them involve character progression and the existence of quests (Apperley, 2006). Meaning that a player can go through a series of in-game missions to improve and upgrade their character. Platformers are based on spatial navigation, where the environment is the enemy. They may possess items that the player can collect for bonuses, and enemies spread around the platforms to slow players' progress. Lastly, arcade games feature simple controls, mechanics, and story. They are either divided into levels, which may loop as to never end, or be played on a single screen.

Of the five alternatives presented, simulation games are the most realistic since their focus is accurately depicting an aspect of reality or fiction. Although strategy and role-playing games can be played in fantasy worlds, their mechanics work in realistic environments as well. Personal progression and planning are important components of real life, making these genres equally realistic, but less realistic than simulation games. Arcade and platformers can be detached from real life concepts and rules, making them the least realistic, although that does not mean they cannot be realistic. From these judgments, Table 8 was created, where SIM stands for simulation, STR for strategy, RPG for role-playing games, ACT for action, ARC for arcade, and PLT for platformers. This matrix has a consistency ratio of 0.012, which shows that the judgements performed in the comparisons are consistent, since this value is below 0.1.

Table 8 - Realism pairwise comparison

	SIM	STR	RPG	ARC	PLT
SIM	1	3	3	5	5
STR	1/3	1	1	3	3
RPG	1/3	1	1	3	3
ARC	1/5	1/3	1/3	1	1
PLT	1/5	1/3	1/3	1	1

Challenge can vary between games of the same genre. However, certain genres have components that make the games intrinsically more difficult. This applies specifically to platformers. Platformers contain several hazards around their environment, be it the enemies that try to slow the player's progress or the elements of the level itself. Arcade games also have the potential to be challenging, due to their fast-paced nature, but feature simple controls, making them less challenging than action games and platformers. Strategy games rely on the player's ability to create plans and execute them, consequently offering a level of challenge that

rivals that of arcade games. Lastly, role-playing games and simulation games do not focus on challenge. Role-playing games dedicate themselves more on the story, while simulation games specifically try to make the mechanics intuitive to what a player would expect in real life. As such, these comparisons are shown in Table 9, with a consistency ratio of 0.012.

Table 9 - Challenge pairwise comparison

	SIM	STR	RPG	ARC	PLT
SIM	1	1/3	1	1/3	1/5
STR	3	1	3	1	1/3
RPG	1	1/3	1	1/3	1/5
ARC	3	1	3	1	1/3
PLT	5	3	5	3	1

Narrative is one the focuses of role-playing games, to a point where this genre has been associated with literature (Apperley, 2006), making it a reference point when evaluating this criterion. Although narrative is not a main aspect of strategy and platforming games, it is still present and used to further build the environment that the games take place in, making it still an important component. Arcade games have little space for narrative, due to their simplicity, but still integrating it when relevant. On a lower level, simulation games focus on a small environment – on a context that is only relevant to the concept or mechanic that is being simulated, which makes the addition of narrative difficult. These comparisons are shown in Table 10, which has a consistency ratio of 0.029.

Table 10 - Narrative pairwise comparison

	SIM	STR	RPG	ARC	PLT
SIM	1	1/5	1/7	1/3	1/5
STR	5	1	1/3	3	1
RPG	7	3	1	5	3
ARC	3	1/3	1/5	1	1/3
PLT	5	1	1/3	3	1

Interaction, when referring to how the game interacts with the player, making the player respond in return, is specifically prevalent in platforming, arcade, and strategy games. In platformers, constant new hazards are being presented to the player, requiring them to act. In

strategy games, there are new puzzles delivered to the player consistently, prompting them to create more plans and execute them. Arcade games are fast paced in nature, requiring the player to perform inputs in a rapid fashion, asking for their interaction frequently. In simulation games the player must adhere to the rules the game is simulating, but mechanics are slowly introduced, making interaction still important, but less than in the previously mentioned genres. Role-playing games offer quests and opportunities to upgrade the player's character, but they also allow for exploration at the player's pace, not focusing on interaction. As such, Table 11 was created with the importance of these alternatives in terms of interaction. This matrix has a consistency ratio of 0.009.

Table 11 - Interaction pairwise comparison

	SIM	STR	RPG	ARC	PLT
SIM	1	1/3	3	1/3	1/3
STR	3	1	5	1	1
RPG	1/3	1/5	1	1/5	1/5
ARC	3	1	5	1	1
PLT	3	1	5	1	1

Lastly, simulation and strategy possess the most potential in terms of management. On one hand, simulation games contain the subset of management games, which show how to run businesses. On the other, strategy games motivate the player to make the best use of their resources to solve puzzles and fight battles. The other alternatives also make use of management in different ways. When playing platformers, players must manage their space, time and health when navigating through hazards, and in role-playing games players are faced with the choices as to which skills to upgrade and which quests to accept first. Arcade games possess less resources, due to their simplicity, but their management is still important. Table 12 shows the way these alternatives compare to each other in terms of management, with a consistency ratio of 0.012.

Table 12 - Management pairwise comparison

	SIM	STR	RPG	ARC	PLT
SIM	1	1	3	5	3
STR	1	1	3	5	3
RPG	1/3	1/3	1	3	1
ARC	1/5	1/5	1/3	1	1/3
PLT	1/3	1/3	1	3	1

3.6.4 Result

Upon creating the pairwise comparison matrix for all alternatives, the weight of each genre in relation to each criterion was calculated. Table 13 shows a global matrix of these weights. In this table it is possible to review the high importance of simulation, platforming, and role-playing games in the fields of realism, challenge and narrative, respectively.

Table 13 - Global weight matrix

	R	C	N	I	M
SIM	0.4624	0.0737	0.0436	0.1075	0.3424
STR	0.1952	0.1952	0.2017	0.2805	0.3424
RPG	0.1952	0.0737	0.4641	0.0509	0.1298
ARC	0.0737	0.1952	0.0888	0.2805	0.0557
PLT	0.0737	0.4624	0.2017	0.2805	0.1298

To calculate the relevance of these values, they must be associated with the weight of each criteria, which was calculated after comparing the criteria, and is now shown more clearly in Table 14.

Table 14 - Weight of each criterion

	R	C	N	I	M
Weight	0.3424	0.3424	0.1298	0.1298	0.0557

To determine final importance of each alternative, the products of each of their weights in relation to a criterion and the weight of the criterion itself were added. For instance, to calculate the importance of the simulation genre to this project, the 0.4624 weight that it achieved on the realism criterion was multiplied by the 0.3424 weight that realism possesses in comparison to the other criteria. The process was repeated for each criterion and then summed to achieve a result of 0.2222. The same logic was applied to the other alternatives, as can be seen in Table 15, which shows the weight of each alternative to this project.

Table 15 - Resulting weight of each alternative

	Result
SIM	0.2222
STR	0.2153
RPG	0.1661
ARC	0.1431
PLT	0.2533

From these results it can be concluded that the most relevant game genre for this project is the platformer genre, as it achieved a weight of 0.2533, the highest of the group. However, it is important to note that simulation and strategy games had high values as well, of 0.2222 and 0.2153, respectively. This is indicative that although the genre chosen must be platforming game, it is still important for the game to possess elements characteristic of simulation and strategy games, such as realism, problem-solving and management. Additionally, it is also important to note that although the narrative of role-playing games and the simplicity of arcade games can still be positive traits to the game at hand, they are not to be prioritized over the previously mentioned game elements.

4 Project Design

This section details the decisions that were made before and during the development of the game. It details the concept that was created for the game, as well as its links to the serious game objectives of this project. It then goes into detail into the design of each of the levels, explaining decisions for level layout and hazard placement. Lastly, the different options for the game engine to use are analysed.

4.1 Game Concept

The aim of this advergame is to promote ISEP's image. It intended to serve as a potential method of advertising for the institution, increasing ISEP's reach by promoting its values in a universal format, sparking the target audience's curiosity. As shown by existing advergames, the most literal approach to a topic that is being advertised is not always the best one, which is exemplified in the *Cool Spot*, *Sneak King* and *Magnum Pleasure Hunt* games detailed in section 2.2. Detaching a product or concept from its real-world environment can help motivate the player while playing the game. As such, and according to the results of the AHP method, the project at hand will consist of the development of a platformer advergame, which can also benefit from realistic and strategic elements. A way to apply these concepts would be with resources that the player must manage instead of the usual health bar or hit points present in platformers. For example, to go through a level, a player needs to keep a track of their time, stamina, knowledge, and stress. Additionally, the game will feature a female protagonist, as an

attempt to make ISEP more appealing to an audience that is less prevalent in the world of engineering.

Each level represents a project that the playable character is going through. This project can represent a class project, studying for an exam or working in an investigation project. Through the level the player tackles enemies, presented as tasks that the player can defeat and has the possibility to interact with facilities available to them, at the cost of time (which decreases during the level). To complete levels, the player must keep their resources well managed. Stress can be obtaining by touching tasks and falling off the level. Stamina is expended by jumping and interacting with facilities, while knowledge is gained by interacting with these same facilities.

To promote ISEP's image, its values must be present in the game in a way that associates them with good thoughts in the player's mind. ISEP's course diversity is shown through the theme that is prevalent in each level. The first level includes facilities and teachers related to Mechanical and Automotive Engineering, the second level is dedicated to Industrial Management and Civil Engineering and the third level gives exposure to Chemical Engineering and Bioresources. Interacting with these different types of courses will give the player different benefits, once again leading to a better image of this diversity. Themed facilities and teachers in level 1 reward the player with a slight increase in their speed, while the ones in level 2 increase the number of platforms in the later levels and the ones in level 3 slightly reduce enemy speed. A complete diagram of the way the elements featured in this game correlates to each of the values of ISEP is shown in Figure 12, where the left side shows some of ISEP's values and the right side shows game elements.

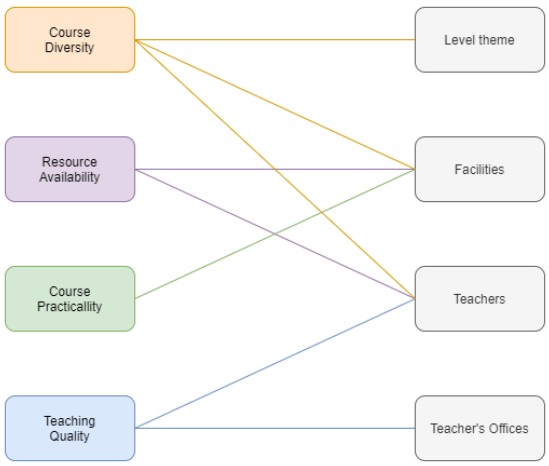

Figure 12 - Associations between ISEP's values and game mechanics

ISEP's resource availability is shown through the buildings present in the levels, such as investigation groups and the library. These facilities increase the playable character's knowledge, which is necessary to complete the level, creating the thought in the player's mind that ISEP's resources are helpful. Other buildings, such as ISEP|GO or aeISEP decrease the character's stress, which is also useful during the levels. ISEP's course practicality is shown through the labs present in the levels, which also increase the player's knowledge.

Lastly, ISEP's teaching quality is shown through the teacher's office that is present near the end of each level, where the player can gain knowledge by interacting with this facility that helps the character with the theme that is at hand in the current level. Additionally, the player can interact with teachers present in the levels to increase their knowledge.

4.2 Level Design

A series of design decisions were executed to ensure that the game experience was catered to the target audience. In the project at hand, this audience is comprised of teenagers who just finished high school, which includes people with different experience with digital games. To suit this audience, the game's difficulty is low at the beginning, slowly increasing as the player progresses in each level, as will be described further in this chapter. Figure 13 shows a draft created for the first half of the first level, where the top part of the figure shows the start of the level, and the bottom part displays the section that follows.

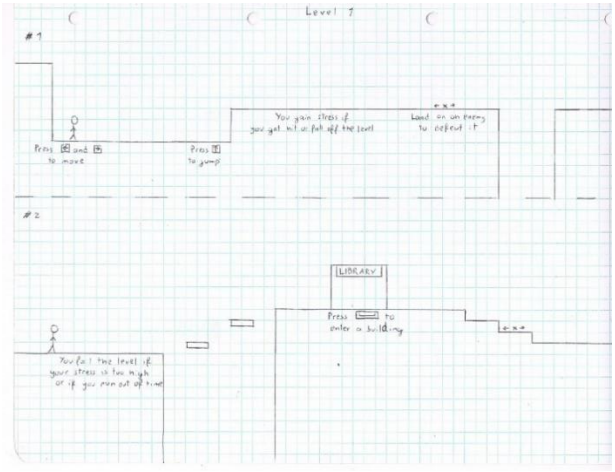

Figure 13 - Example of a draft for the first half of the first level

Sketches on paper as shown in the figure were created for all levels, as they are a versatile method of creating an initial design and allow for versatile and reversible changes. All drafts can be seen in more detail in Annex 1 – Level Design Drafts.

4.2.1 Level 1

The first level sets the difficulty bar for the entire game. If a player finds the first level too difficult, they may not want to continue playing the game, as it would likely only become more difficult as they progress. Figure 14 shows the start of the level. In this section, the game teaches the player how to move.

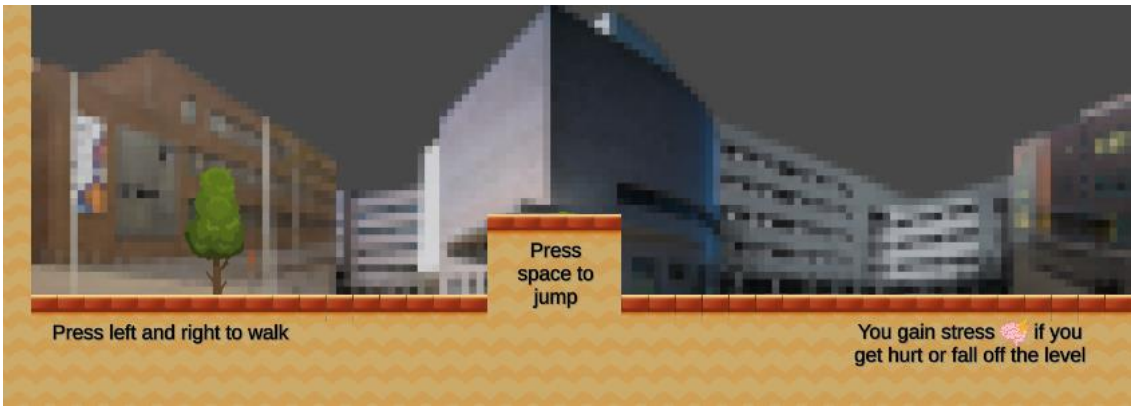

Figure 14 - Start of the first level

These instructions are integrated in the layout of the level itself, allowing the player to read them at their own pace, without having to insert any additional inputs or be stopped by a menu or dialog box popping up. The player is also introduced to the stress mechanic through these instructions. Upon learning about this mechanic, the player is invited to test it, as can be seen in Figure 15.

Figure 15 - First obstacles of level 1

In this section the player is exposed to the two elements that can increase their character's stress – getting hit by enemies and falling off the level. These two elements are shown to the player in a controlled environment – there are no other threats present other than the one the player is learning about. First, the player gets the chance to learn about how an enemy moves and how to best defeat them, and upon defeating or getting past this enemy the player must execute their first jump over a pit. These two obstacles create the basis of platforming that the player must apply throughout the rest of the game. These concepts are further tested in the following section, shown in Figure 16.

Figure 16 - Second obstacle section of level 1

After being exposed to obstacles that increase the character's stress, and potentially having witnessed this increase first-hand, the player is informed of the purpose of stress as well as the timer that has been ticking down through the course of the level and introduced to the concept of stamina. The player must then perform a series of jumps to cross the pit in front of their character. These are still small jumps, as is fitting for the first level, but they do create opportunities to further display the way stress works in the game. Figure 17 displays the introduction of a new kind of interactable element.

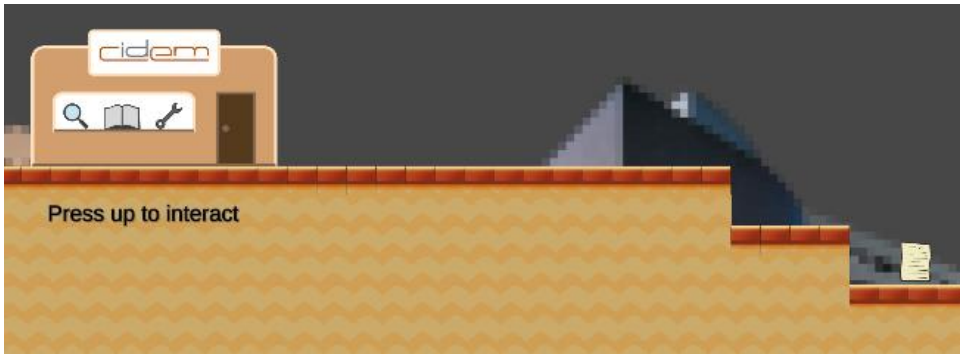

Figure 17 - Level 1's first interactable building

It teaches the player which key to press to interact with the building, but it does not show the player the purpose of this interaction. That is instead shown in the building's menu itself, where the player can see that they can trade time for an increase in certain resources. This area later features an enemy, still in a controlled environment. This section consists of steps, which create a height difference between the player and the enemy, making it easier to jump over the enemy rather than on it, which can help the player realize that in certain situations dodging an enemy can be more suiting than defeating it. The following section, shown in Figure 18, teaches the player the concepts of risk and reward.

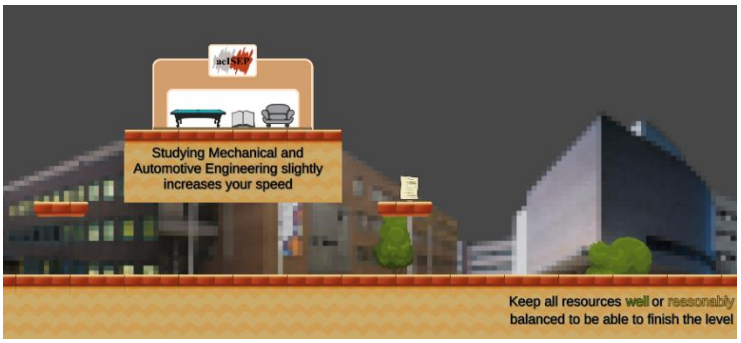

Figure 18 - Level 1's introduction to the system of risk and reward

The first display of this system is in a controlled environment where the player cannot fall off the level. It shows the players two paths – a safe bottom path with no threats, and a top path where the player can interact with a building but must also fight an enemy. Here the player is faced with the choice to either play it safe or take a riskier approach and be rewarded for it. This area also introduces the purpose of resource management. The tutorial text teaches the

player that they must keep their resources well or reasonably managed (symbolized with the colours green and yellow, respectively, in the character's meters). This is the game concept that is used as base to meet the serious objectives of the project at hand. Through management of their resources, the player realizes that the means that ISEP supplies them help them keep these resources well managed. This aspect of the game not only introduces ISEP's resources to the user (research groups, class labs and other facilities), but also indicates to the user that these facilities and teachers help the player on their journey, increasing their knowledge and allowing them to progress, as well as on some occasions reducing the character's stress. Through repeated use of these resources, positive feelings about ISEP and its services are gradually created, promoting its image in the player's mind.

This system of risk and reward is shown in a riskier environment right after as can be seen in Figure 19, where the player must navigate through a series of platforms to get across. These platforms are still close to each other, since this is the first level, but the large number of them creates an environment where the player must successfully complete all jumps in a row to reach the other side.

Figure 19 – Second display of risk and reward

In this section the player is faced with another riskier choice of jumping on two additional platforms to be able to interact with their first professor and/or three platforms to the right to reach the first class lab. As this is the first level, the player can potentially land on the bottom platforms if they fail the jump to the top platforms, making the environment safer. Here the player must then use the knowledge they acquired of interacting with buildings to interact with

the professor as well, learning that these work in a similar fashion. The last section of the level can be seen in Figure 20.

Figure 20 - Last section of the first level

Here the player can realize that there is a platform under them by seeing the professor in its place. Lastly, the player is introduced with a new kind of building that exists at the end of each level – the professor's office – where they must once again use their interaction knowledge.

4.2.2 Level 2

This level builds upon the mechanics that were learnt in the first level, combining them, and creating new methods of exploring the levels. Figure 21 shows the start of the level, featuring a display of the paper draft and the final version (in the top and bottom of the figure, respectively), where significant differences can be seen. Firstly, the professor in the beginning of the level was removed, as the level already possessed two other professors and this one was easy to access in comparison. Additionally, platforms were added to the right which leads to an extra building, rewarding the player for taking the path that seemed most dangerous at first, since it featured an enemy in the first platform. It also adds a building at the top of the climb to introduce the player to the level's theme. In this level the player is further exposed to the stamina mechanic and is taught that jumping expends this resource. This change is slim, but the repeating platforms that the player must jump on help them see first-hand how the resource is affected.

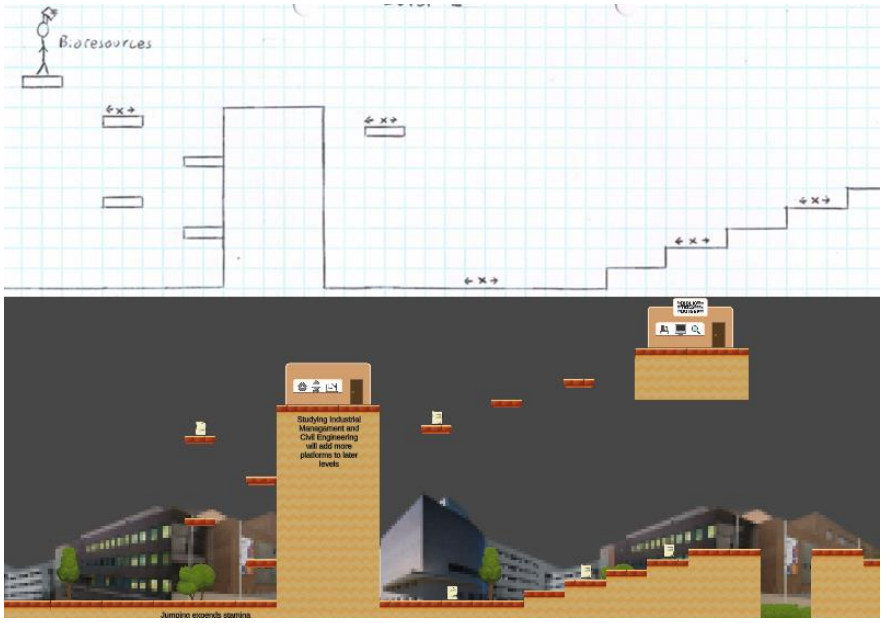

Figure 21 - Start of the second level on paper (top) and in-game (bottom)

The level later possesses two avoidable enemies, one on a platform and one on the ground. The player can avoid the first one by jumping between the platforms, but they will be faced with the enemy on the ground. However, if the player chooses to face the top enemy, it will be easier to jump over the enemy on the bottom. Additionally, if the player chooses the first the enemy that they can see, they are rewarded with an interactable building at the end of the platforming section. Lastly the player is faced with a height difference that benefits the enemies this time. Due to this difference, the player can no longer jump over the steps, meaning they must either defeat the enemies or dodge while on the same step as them. The section that follows can be observed in Figure 22.

Figure 22 - Level 2's second section

In this part of the level the player is exposed to two branching paths that lead to the same area, giving them a choice. This is the first time that the player is given two risky paths, allowing them to choose their preferred method of platforming. Upon reaching the end of the path, the player will realize that they still have access to either path, allowing them to go back and explore both paths, if desired. If they choose to explore both paths, they are rewarded with an interactable in each of them, representing a chance to increase their knowledge. The next part of the level is displayed in Figure 23.

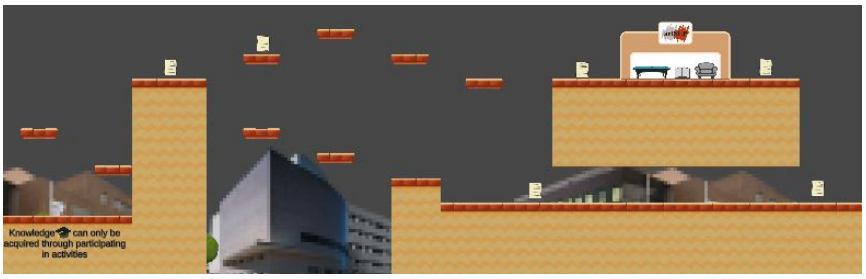

Figure 23 - Third section of level 2

This section starts by explaining that the knowledge resource can only be acquired through participating in the activities available by interacting with teachers and facilities. This indicates that it is only possible for the player to complete the level if they first participate in ISEP's activities. This mechanic invites the player to interact with the resources that ISEP supplies them, once again creating the concept that ISEP helps the player progress. The following part is dedicated to consolidating the concept of backtracking – going back in the level to acquire rewards the player might have missed. This concept was introduced in the previous section where the player could explore both paths for their rewards. However, in this part of the level it works differently. If the player chooses the bottom platforms, as they appear to be safer since they have no enemies, they will be exposed to a platform with a building that they cannot reach. However, they have the chance to backtrack to the platforms, with the acquired knowledge that the top path will lead them to a reward that the bottom path does not possess. The bottom path also introduces the player to enemies that navigate through tight spaces where the player cannot jump. Here the player learns to wait for the enemy to move to an open area, where they can defeat them. The last section of the second level has similarities to the last section of the previous level, as can be seen in Figure 24, once again with noticeable changes between the draft version, seen on the top of the figure, and the final version, which is on the bottom.

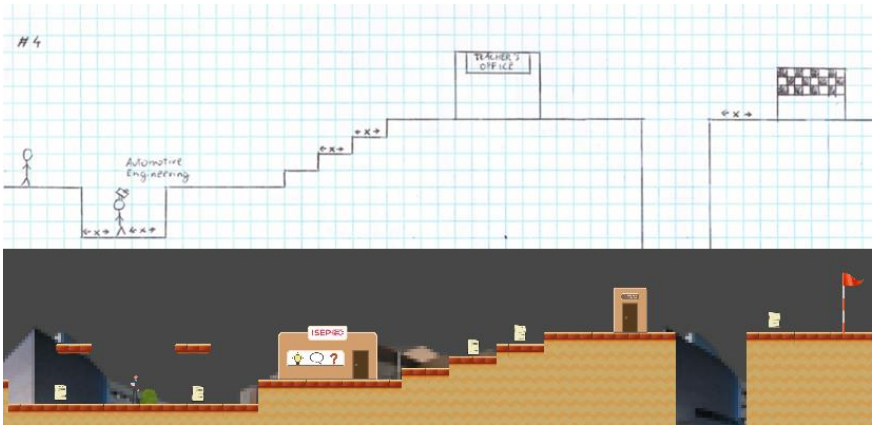

Figure 24 - Last section of the second level on paper (top) and in-game (bottom)

As with the end of the first level, this area possesses a professor that the player can jump over if they choose to not take the risk of facing the enemies, and an office where they can improve their abilities. However, this section is more treacherous than the one in the first level, as the difficulty has been increased, with enemies on steps and another combination of a pit and an enemy, where the player must use their acquired knowledge from their previous encounters with these sorts of obstacles. In the final version, this area was widened to allow for more space for the enemies to move in, as they otherwise could have been landed on with no effort. To accommodate this change, platforms were added that allowed the player to still avoid the danger in case they chose to not interact with the professor. This area features a unique building, the guidance office (ISEP|GO), which greatly reduces the character's stress. As this level possesses 22 enemies, considerably more than the other existing levels, it is expected that the player may accumulate more stress. To combat this stress gain, the player can interact with this building, creating the image that ISEP is present at the times the player needs it the most, and provides whatever resources the player needs at the time.

4.2.3 Level 3

The third level introduces the player to a new kind of enemy. These enemies charge towards the player when the player approaches them. The level is dedicated to exploring the different layouts that these enemies can be placed in, inviting the player to adapt to each environment. The first section is shown in Figure 25.

Figure 25 - Start of the third level

The player is first exposed to this sort of enemy in a controlled environment, where no other threats exist. As the player walks right, they witness the enemy moving towards them faster than usual, realizing they are faced with a new threat. Upon learning the mechanics of this new enemy, they are faced with a new one, this time in a smaller platform, adding the danger of falling off the level. The player is then faced with the choice to interact with a professor, and an enemy that will charge at them after they perform the jump off the platforms. The next part of the level continues exploring environments for the new enemies, as shown in Figure 26.

Figure 26 - Second section of level 3

The player is first faced with an enemy that will move towards their character as soon as they land on the platform, requiring some fast reflexes. In the platform that follows, the player must first defeat the present enemy so that they can safely access the building. After jumping off the platform, the player must now face two enemies which move towards them from both sides, once again testing the player's reaction time. The third section of the level combines the new enemies with the ones previously established, which can be observed in Figure 27.

Figure 27 - Level 3's third part

In this portion of the level the player must navigate a series of platforms that combine the enemies with fixed patterns with the enemies that move towards the player. A choice is presented between taking the safer platform path on the bottom or facing one of each enemy in the path that leads to a professor, rewarding the player for their practice against both types of enemies. Upon traversing the platform section, the player is charged by an enemy. A stress-reducing building is provided so that the player can be prepared for the difficult platforming section that follows, which is seen in Figure 28.

Figure 28 - Level 3's final platforming challenge

The end of the level features a professor's office as is customary of each level. After this, it contains a dynamic platforming section that changes according to the player's performance in the previous level. Depending on the abilities the player acquired during the second level, this platforming area difficulty varies, which is divided into three tiers of increasing distance between platforms, rewarding the player for their effort in the previous level.

4.3 Game Engine

The game engine to be used during the project at hand was not an initial requirement, and therefore a comparison between the possible options was necessary. Three games engines were considered – Unity, Unreal Engine and Godot – as these are commonly listed as popular and effective game engines (Dar, 2021) (Schardon, 2021). For this project, the choice of game engine was based on factors that would facilitate its use during the project, such as versality in terms of 2D and 3D environments, available pre-existing assets, documentation, and community.

Unity is a versatile game engine, allowing developers to either create a 3D or a 2D environment, which has proven to be profitable since Unity became a staple in the development of 2D games (GameDesigning, 2019). This engine provides tools to manage assets, either through different 3D modelling programs or by using their Asset Store, which holds thousands of downloadable game elements, such as textures, materials, audio, and scripts created by the community (Unity Technologies, 2021a). Another relevant community aspect of Unity is their forums and documentation, which are vast and detailed, making sure that any user may be able to find the help they need (Unity Technologies, 2021b).

Unreal Engine is developed by the company Epic Games Inc., and just like Unity, provides an Asset Marketplace, though with limited third-party API support (Schuetz, 2018), and features 2D and 3D capabilities. It shines during the development of very complex 3D games. Being well-known for its powerful graphical capabilities (Thinkwik, 2018), Unreal Engine allows developers to create wonderful environments for their players. It possesses a large community, though the company only links to their forums (Epic Games, Inc, 2021).

Godot is recent when compared to most game engines. Its development started in 2007 and it was publicly released under the MIT license. It gives a lot of power to developers, featuring built-in physics and supporting different programming languages, and both 2D and 3D capabilities (Slant, 2021). However, it is structured quite differently from other game engines, due to its node-based programming, which can make it hard for developers who are already experienced in other game engines but want to try something new (Rosa, 2018). It features a large community on several different channels, linked in their own website (Godot, 2021a) and hundreds of assets available to download (Godot, 2021b).

Upon the analysis of the three game engines detailed above, it was concluded that the use of Unity would be fitting for this project. Unity possesses a vast community across different channels, that has been active throughout several years, resulting in a large collection of documentation that can be used as aid for the project at hand. Although Godot also features a large community, it is a recent engine that can be troublesome to use due to its different structure. As there is already familiarity with the use of Unity, transitioning to Godot could pose unwanted problems. Additionally, its library of hundreds of assets offers less variety than Unity's. Unreal Engine's community and documentation seems scarcer than the previous two, making it less appealing. Lastly, as users of Unreal Engine tend to dedicate themselves to the creation of highly complex environments, which would not be the case for this project, Unity's simplicity better meets this project's needs.

5 Implementation

This chapter highlights the main techniques that were used to implement the advergame at hand, as well as some mechanics that are present in it. It starts by giving an overview of the Unity project's structure and detailing the use of events. It then goes into detail on tilemaps, and their use for the parallax effect and the dynamic platforms seen in level 3. This chapter also explains the use of zones as an event triggering mechanic and lastly details the implementation of game analytics.

5.1 General Structure

The structure of this Unity project can be divided in terms of the game objects that interact with each other in the game's scene and the scripts that are responsible for the behaviour of these game objects. Figure 29 shows the layout for the game object side of the project.

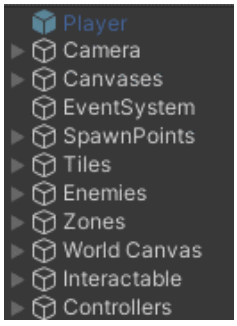

Figure 29 – Unity project's game object layout

The scene is composed of the player itself, Unity's default event system and a set of empty game objects that hold as children the remaining objects. The camera parent holds the game objects that are relevant for the operation of the game's camera, such as Unity's default main camera as well as a more complex camera that can be attached to Unity's main camera, adding extra features to it. The canvases parent holds all the menus that are present in the game, including the main and pause menus, as well as the menus that appear when finishing the game, failing a level, or interacting with a facility. The spawn points object holds information on all the areas the player can spawn, and the tiles object contains all the elements that make the level's platforms and its background. The enemies object possesses every enemy present in the game, as well as the movement paths they take. The zones parent has each of the areas that the player can fall into when falling off the level, as well as the zones that trigger the start of the next level. The world canvas object holds all the tutorial text that is shown across the levels and the interactable objects contains all facilities and teachers that are in the levels. Lastly, the controllers object holds the various controllers that are necessary for the scrips to operate in areas such as analytics, game settings and audio. The layout of the script side of the project is shown in Figure 30.

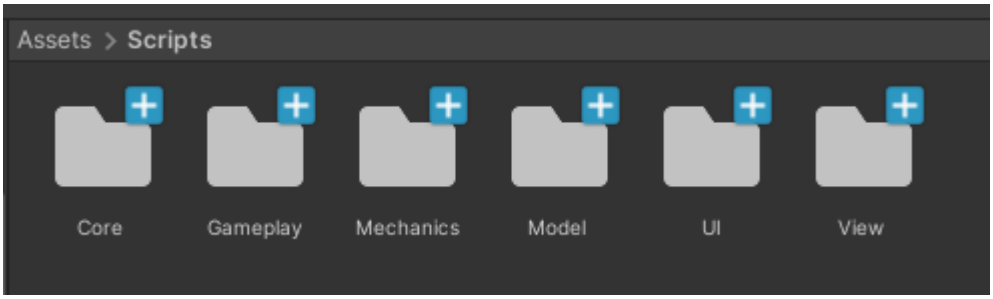

Figure 30 - Unity project's script layout

This layout is composed of several folders that keep the overall logic of the project organized. The core folder holds scripts that are not specific to this game itself, with include functions such as mathematical methods and methods that operate with lists. The gameplay folder holds all events that are present in the game and are triggered through player interaction. This includes events that respond to the player jumping, spawning, and falling off the level, for example. The mechanics folder contains scripts that manage each object's behaviour. This includes the enemies' movement paths, the enemies and player's health, the player's spawn points and

behaviours associated with the interactable facilities and teachers. The model folder consists of only the PlatformerModel script. This script is responsible for holding the business information that most game components need access to. This class is implemented as a singleton, allowing any component to access its instance's attributes. These attributes are variables that can be changed by a few different components, which creates the necessity for a place where they can all be stored consistently. The data of the PlatformerModel is initialized in the GameController component, which is responsible for controlling the flow of the game. The UI folder is comprised of the scripts that operate on the different user interface components that the player is exposed to. This includes scripts that manage the menus for interactable facilities and teachers, the game over menu, as well as the settings and help menus. Lastly, the view folder is responsible for managing the part of the level that the player sees, dealing with elements such as the game's camera and the parallax layer.

5.2 Events

Most of the game's behaviour is triggered through events. Events are managed through the Simulation class, which implements the discrete-event simulation pattern, creating a sequence of events in time that change the state of the system. The use of the scheduling of these events can be seen in Code 1. This code extract makes it possible to see the way jump states are implemented. This method is called every frame that the player has control in, checking if the player has inputted a jump, if the player is currently in the air, or if the player's character has landed on the ground.

```
void UpdateJumpState()
        {
            jump = false;
            switch (jumpState)
            {
                case JumpState.PrepareToJump:
                    jumpState = JumpState.Jumping;
                    jump = true;
                    stopJump = false;
                    break;
                case JumpState.Jumping:
                    if (!IsGrounded)
                    {
                        Schedule<PlayerJumped>().player = this;
                        jumpState = JumpState.InFlight;
                    }
                    break;
                case JumpState.InFlight:
                    if (IsGrounded)
                    {
                        Schedule<PlayerLanded>().player = this;
                        jumpState = JumpState.Landed;
                    }
                    break;
                case JumpState.Landed:
                    jumpState = JumpState.Grounded;
                    break;
            }

        }
```

Code 1 - Event scheduling in the UpdateJumpState method of the PlayerController script

It shows that when a player is jumping and when a player lands, the corresponding PlayerJumped and PlayerLanded events are scheduled. Code 2 shows its execution.

```
public class PlayerJumped : Simulation.Event<PlayerJumped>
    {
        public PlayerController player;

        public override void Execute()
        {
            if (player.audioSource && player.jumpAudio)
                player.audioSource.PlayOneShot(player.jumpAudio);

            player.GetComponent<MeterController>().AddEnergy(-0.5f);
        }

    }
```

Code 2 – Execution of the PlayerJumped event

When a player jumps, the event checks for the existence of an audio source and clip that it can use the play the corresponding audio and uses the player's MeterController script to decrease the character's stamina. This implementation delegates the responsibility of what actions to take during an event to the event itself. This simple example is applied to every event that is present in the game's Unity project, used in scenarios where the player falls of a level, reaches maximum stress, enters a zone that will move them to the next level, and others.

5.3 Tilemaps

Tilemaps are the elements drawn into the scene, creating continuous levels. They were implemented using Unity's tile palette, which allows for sprites to be added and then used as drawing tools. Figure 31 shows the palette used for this advergame.

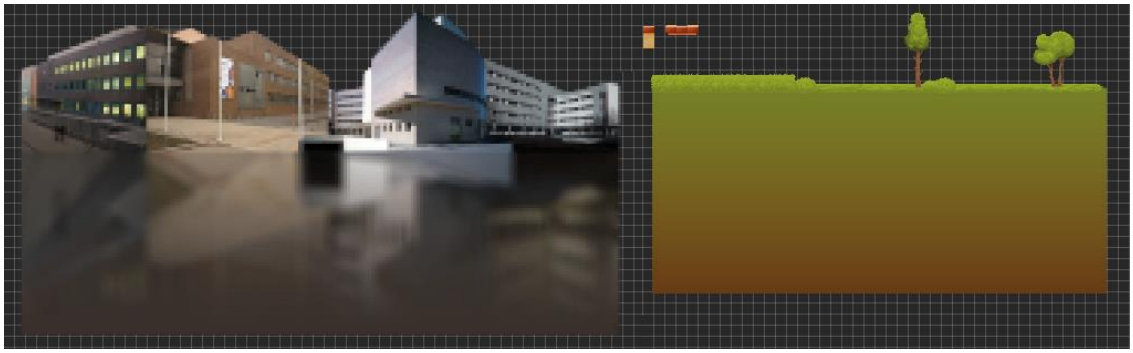

Figure 31 – Tiles used in Unity's tile palette

In this figure, the elements used to construct the game's levels and backgrounds can be seen. The top of the figure features the orange tiles of ground that the player walks on. These blocks can be used as a brush to draw upon the game's level, making it a similar experience to drawing the level on paper, as was done for the initial drafts. The orange platforms tiles seen on the top can be selected at the same time, which can be used to draw a whole platform at a time. The bigger images seen in the palette on the left and right represent the game's backgrounds. Just as with any other tiles, the whole background can be selected at once and drawn onto the level. To create a consistent background effect, the tiles must be all drawn at the same height, and the level must not have drastic height changes, otherwise the bottom end of the backgrounds will be seen, or if the level is too high, the backgrounds will not be seen at all. In the event of a drastic height change in a level, the background must also change height, but this can lead to

noticeable cuts in the transition between the two areas. The bottom of the left background is blurrier and gradually fades away, while the background on the right gradually turns from green to orange, as if emulating the colour of the floor. These effects are created specifically for when the player falls off the level or to counter any unexpected height changes that can happen in a level, so that the player is not faced with a lack of background, and instead creates an idea that they are falling through the gradual background change.

The three different types of elements seen in the figure are separated into different layers, which allows for the parallax effect seen in game. The orange tiles are part of the level layer, while the green tiles are part of the background layer. The ISEP tiles are part of the farBackground layer, which stands behind the background layer. To create the parallax effect, these layers move at different speeds in relation to the camera. The level layer does not move, as it is the floor that the player walks on. The background and farBackground layers both move in the same directions as the player, but the farBackground layer moves faster than the background layer, creating an additional illusion of movement that complements the player's movement. This forms the idea that the character is moving through world space. The dynamic platforms are each in their own layer and their appearance can be seen in Figure 32.

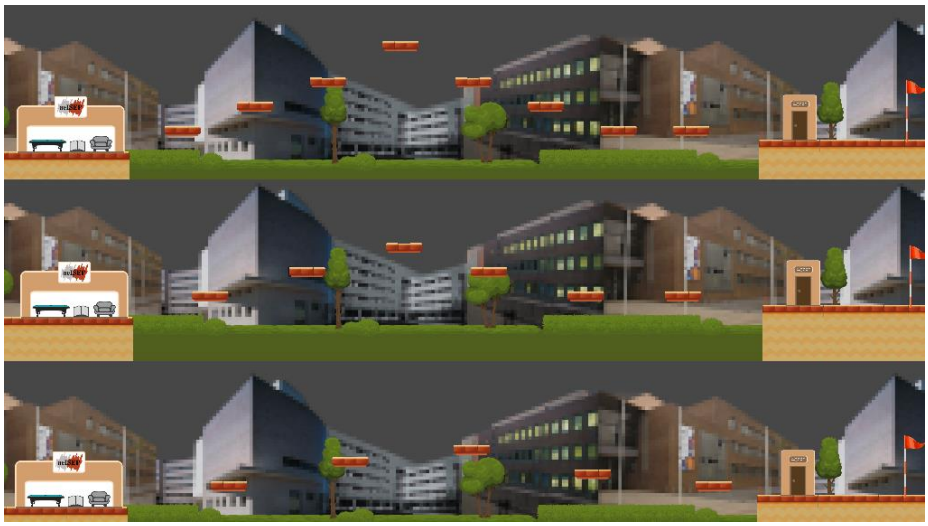

Figure 32 – Level 3 easy (top), normal (middle) and hard (bottom) platforms

As these tilemap grids are game objects just as any other Unity scene element, they can easily be toggled on and off. This creates the possibility to use whichever tilemap is desired depending

on the player's actions. In this case, interacting with the thematic facilities and teachers in level 2 increases the industryLevel attribute that the player component possesses. Upon completing the second level, the game objects for each type of platforms are enabled or disabled accordingly, creating three stages of difficulty, depending on how much the player interacted with said elements. This rewards the player for exploring the previous level, and once again propagates the thought that interacting with ISEP's resources is helpful.

5.4 Zones

One of the main event-triggering components in the levels are zones. Zones are invisible box colliders that trigger events when the player enters them. Figure 33 shows two examples of these elements.

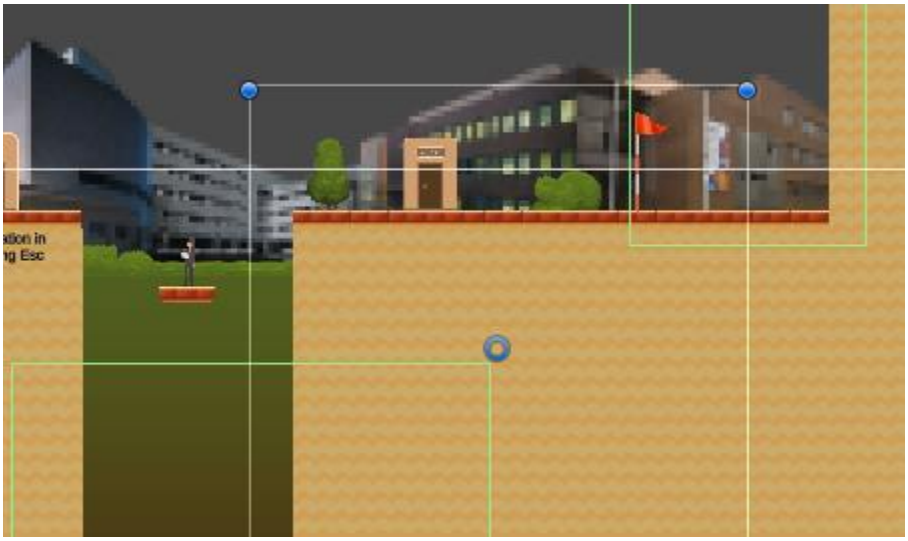

Figure 33 – Level 1's final death zone (shown in green on the left) and victory zone (right)

The figure shows the zones as green-bordered boxes in Unity's scene editor. The bottom left box is an example of one of the many death zones that are present in the levels. When the player collides with one of these boxes, an event is triggered, warning the system that the user fell off the level, giving the event the responsibility to act accordingly. Although the game could have only one death zone that spanned across all levels, separating them into each level drop adds extra information to game analytics and allows for the analysis of which areas of each level

the player fell into more often, hinting at possible flaws in design. Victory zones, as shown on the top right corner of the figure, manage the transition between game levels. Part of their behaviour can be seen in Code 3.

```
void OnTriggerEnter2D(Collider2D collider)
{
    var p = collider.gameObject.GetComponent<PlayerController>();
    if (p != null)
    {

        if (CanFinish())
        {
            {
                TogglePlatforms();

                var ev = Schedule<PlayerEnteredVictoryZone>();
                ev.victoryZone = this;
                ev.spawnPoint = spawnPoint;
                ev.lastLevel = lastLevel;
            }
        }
    }

}
```

Code 3 - OnTriggerEnter2D method of the VictoryZone script

In this script, the system first checks if the collider that entered the zone belongs to the player. It then checks if the player has all resources well managed, as this is the only way they can finish a level. It later toggles level 3's platforms if necessary, depending on the player's industryLevel, and lastly it schedules the PlayerEnteredVictoryZone event and its necessary attributes, giving the event the responsibility of handing the player's respawn logic. The usage of the zones mechanic proved to be very useful through the development of the game and can be used for other elements that can be added to the game, such as triggers to gradually reveal each of the player's resources as they learn about them, or zones that would trigger checkpoints.

5.5 Analytics

The final example of development to be highlighted in this document is the implementation of game analytics. The Unity Analytics framework makes this process simple, as all that is required is an Analytics Event Tracker to be attached to the analytics script where the custom events are created. Code 4 shows an example of where an analytics reporting method is called.

```
public class PlayerDeath : Simulation.Event<PlayerDeath>
    {
        PlatformerModel model = Simulation.GetModel<PlatformerModel>();

        public override void Execute()
        {

            [...]

            var player = model.player;
            MeterController meters = player.GetComponent<MeterController>();
            float stress = player.GetComponent<Health>().currentHP;

            model.analyticsController.ReportGameOver(model.level,
model.levelTime, meters.timeRemaining, stress, meters.knowledge,
meters.energy);

        }
    }
```

Code 4 – Partial execution of the PlayerDeath event

In this partial behaviour of the PlayerDeath event, it is possible to see that when the player fails a level, their current resource values are reported to the analytics framework. After the system gathers the attributes it needs from the PlatformerModel singleton and the player's MeterController and Health components, the reporting method is called. This method can be seen in detail in Code 5.

```
public void ReportGameOver(int level, float levelTime, float timeRemaining,
float stress, float knowledge, float energy)
    {

        ReportLevelDamage(level);
        ReportLevelBuildings(level);

        Dictionary<string, object> parameterList = new Dictionary<string,
object>() {

            { "Level Time", levelTime },
            { "Time Remaining", timeRemaining },
            { "Stress", stress },
            { "Knowledge", knowledge },
            { "Energy", energy }

        };

        string eventName = "Level " + level + " Game Over";
        AnalyticsResult ar = Analytics.CustomEvent(eventName, parameterList);
        GetComponent<AnalyticsEventTracker>().TriggerEvent();
    }
```

Code 5 – ReportGameOver method of the AnalyticsController script

This code extract shows an example of the implementation of an analytics reporting method. Upon receiving the necessary data as parameters, the method starts by calling two other analytics reporting methods. This is because whenever a player fails a level, the system records not only their resource values, but also the damage inflicted by each of the level's damage sources, and which buildings the player interacted with in that level. After reporting that data, the method creates a list of parameters, each corresponding to the resources that the player possesses when they failed the level. Lastly, the method gives the event the name that will appear later in the Unity Analytics dashboard and sends the event. The name for this event specifically would be for example "Level 1 Game Over", which can be seen and analysed in section 6.2.5.

6 Testing and Evaluation

This chapter details the methods used to keep track of the project's development, as well as the ways to test and evaluate it. It starts by explaining the use of an evaluation framework as a tool to track development progress, followed by the types of testing utilized to further understand the progress of the game. Lastly, it enumerates the various options used to evaluate the result, in terms of its usability and game experience, following pre-existing guidelines.

6.1 Development Tracking

To keep track of the quality of the project during its development, different methods were used. Firstly, the use of the Quantitative Evaluation Framework (QEF) is detailed as a way of observing the progress of the project in different dimensions, their completion rate, and fulfilment requirements. Automated testing is used to speed up the debugging process and identify problems as soon as possible. For this project, unit and functional testing were chosen as ways to test the software during development, as they are not expensive methods. Tests that operate on a larger scale like integration tests would not be worth the expense to implement in an application that is not expected to contain large modules or services that will interact with each other.

6.1.1 Quantitative Evaluation Framework

The QEF evaluates the quality of a system on a three-dimensional space, where each dimension is represented by different criteria that is being analysed. Each of these dimensions is then divided into multiple factors, which are components that represent system performance from a particular point of view and are evaluated based on the number of valid requirements in their dimension, the weight of each requirement, and its fulfilment percentage. The result that is provided by the QEF is a single number that represents the quality of the project (Escudeiro & Bidarra, 2008). This makes it easier to assess the quality of an application and compare it to others previously evaluated.

For this project, the evaluation dimensions chosen are functionality, gameplay, and usability, as shown in Table 16. The choice of these dimensions is further explained at the end of this section.

Table 16 – Dimensions and factors used in the QEF

Dimension	**Factor**
Functionality	Player
	Enemies
	Levels
	Interactables
Gameplay	Difficulty
	Progression
Usability	Interface
	Control
	Help

Functionality refers to the operation aspects of the game and includes factors related to the game's features and user interaction. Since this dimension depends on the specific functionalities of the game, the factors used in the functionality dimension of a QEF can be very

different from game to game. The gameplay dimension describes the requirements related to the users' experience. Specifically, it can detail features that refer to the game's difficulty, level length, and mechanics that facilitate learning. Lastly, the usability dimension refers to the elements that make the game easy and intuitive to use. It contains requirements related to the user's interface, providing the user with feedback, and use of content that is easy to understand. A version of the QEF for this project can be seen in Annex 2 – Quantitative Evaluation Framework Draft. This is an early version that refers to the current game concept that has been designed and was subject to changes and additions, detailed later.

Although the QEF is an effective tool to determine the overall quality of a software system, its results are not enough to evaluate the objectives of this project. Since this project aims to determine the game's efficacy as an advergame, factors such as usability and game experience must be prioritized. The value resulting from the QEF is a number that does not reflect these factors, but the quality of all the components of the game. Even though usability is a dimension of the QEF, the requirements presented in this dimension tend to depend on the answers of user questionnaires which are then converted to the equivalent fulfilment requirement value, without any further analysis on the user responses. For these reasons, for this project the QEF serves a different purpose. The QEF is used as a tool to keep track of the game's progress during its development cycle, which allows for early detection and correction of any requirements that are lacking. In this case, the functionality, gameplay, and usability dimensions were chosen as ways to determine the progress of the game's development in terms of its features, as well as keeping constant track of the state of the usability and game experience that the game will provide to its players. The use of a dimension that measured the game's impact as a serious game was also considered, but as this QEF will focus on the development itself, and impact is a post-development concern, it was not used.

The final version of the QEF can be seen in Annex 3 – Quantitative Evaluation Framework. The changes between the draft and final versions of the document are caused by the game design decisions that were taken through the game's development, resulting in the creation of new concepts that required implementation, such as interactable facilities and teachers and the use of dynamic platforms for the final level. Some initial concepts were also scraped from the final version of the game, such as the presence of abilities that player could actively use and choose from (which were replaced by passive abilities upgraded through facilities) and the appearance of collectibles in the levels.

The development of the game ended with an 85% completion in the QEF. Most of the present requirements were fully fulfilled, especially the requirements contained in the functionality and usability dimensions. The only requirement in these dimensions that did not obtain a fulfillment percentage of 100 was “UI01 - Main Menu allows access to main functions”, as the final game did not separate the functions of starting a new game and continuing the previous game. The biggest flaws of the implementation of the game come from the gameplay dimension and are relevant in both the difficulty and progression factors. As is further explained in section 6.2.5, game analytics show that the game proved to be more difficult that desired. Although players managed their resources well, they took longer than expected to defeat enemies, and needed more attempts to clear levels. Besides the flaws presented in the aforementioned section, another source of difficulty may come from the incomplete implementation of a progression system. Although upon failing a level the user restarts from the level they were at, rather than the very start of the game, the game does not possess checkpoints in the middle of each level. Additionally, the player loses their progress if they close the game. This was not a factor the testing sessions that took place, as the game was completed in one sitting, but is relevant in the case of a public game release, as players might struggle to complete all levels in a row without taking breaks. The gameplay dimension received a total completion rate of 50%. The lack of mid-level checkpoints was intentional, but as this is the most testing-dependent dimension, there was a struggle to discern during development how difficult the game became. However, generally the implementation of the game was a success, with most of its features receiving the desired implementation.

6.1.2 Unit Testing

Unit tests focus on the source of the application, being considered low level tests. They are cheap and quick to execute, operating on methods and functions that are contained in classes, components, or modules of an application. This sort of testing allows for quick discovery of any problems that may arise during the development of new features, allowing developers to spot any errors when editing their methods. They can run when a new build is initiated, informing the developer of any error that was identified, even before they start functionally testing the application. They can be easily automated, as most coding languages and platforms possess frameworks to do so. For this project, the chosen method of unit testing is with the Unity Test Framework, which enables Unity developers to test code both while editing their game and

while playing it (Unity Technologies, 2019). It was chosen for its ease of use with Unity projects, adding a low learning curve to the process. Code 6 shows an example of these tests.

```
[Test]
    public void DuplicateEnemyHitIsIncreased()
    {

        AnalyticsController ac = new AnalyticsController();
        ac.Initialize();

        ac.enemyHitList1 = new Dictionary<string, int>
        {
            {"enemy1", 1},
            {"enemy2", 3},
            {"enemy3", 5},
            {"enemy4", 7},
        };

        ac.AddtoHitList("enemy2");
        int count;
        ac.enemyHitList1.TryGetValue("enemy2", out count);
        Assert.AreEqual(4, count);


    }
```

Code 6 – DuplicateEnemyHitIsIncreased test in the CoreTestSuite script

The DuplicateEnemyHitIsIncreased test is used to operate on lists of Dictionary variables, incrementing the value of each key when a duplicate key is inserted. It is used for tracking how many times the player took damage from each enemy. In this simple test, the AnalyticsController that holds the method in question is instantiated, and its list of enemies is filled. Upon calling the AddtoHitList method that is being tested, passing a duplicate key as parameter, an assertion assesses if the value for the provided key incremented by 1. The result of each test suite can be seen in Unity's test runner, displayed in Figure 34.

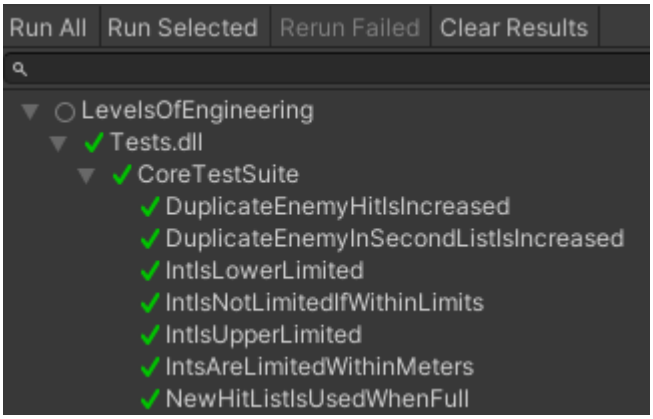

Figure 34 – Unity's test runner, displaying successful unit tests

This figure shows a selection of unit tests that were executed to test the logic of methods that operate on lists of enemies and integers that need to be limited according to specific parameters. In case of test failure, the test runner will indicate which test failed with a red icon and inform the developer of what the assertion result was. Unit tests were very useful for this project. They specifically shined during the operations that were executed on enemy lists. Due to Unity Analytics' limitations, enemies had to be grouped in lists of 10, meaning that whenever a list was full a new one needed to be used, and the check for duplicates needed to operate on all the existing lists. Although the logic for these methods was not very complicated, without unit testing the only form of testing if the data was being organized properly would be through analysis of the game analytics themselves. These analytics can take up to 24 hours to be received on Unity's dashboard, and to confirm that the methods were working, they would need to be inspected individually and manually. Unit testing prevented all of this, creating a fast and easy method of confirming the results of the analytics list operations.

6.1.3 Functional Testing

Functional tests focus on their output, rather than what specifically caused such output. They verify the outcome of the action they attempt to test, by following a series of steps that should lead to the desired output. These actions can be the use cases or user stories that were identified for a project, determining whether these stories have been fully implemented. They allow developers to keep track of when features were working or not, and the unexpected outputs obtained. They help understand what new additions or changes may have changed the

output of the tests, or in a successful case, ensure that the system is continuously working as intended. For a game, they can be used to make sure that user actions return expected results. Below is an example of a functional test that could apply for a game.

- Title: Player can collect item
- Expected output: Item is in player's inventory only after being collected
- Steps:
    1. Load level 1
    2. Take the path to the left until the end
    3. Confirm there is no item in the player's inventory
    4. Collect the item at the end of the level
    5. Check player's inventory
- Result: Item was in player's inventory after being collected

For this project, functional tests were executed in this fashion, and documented with a version history of successes and failures, as well as their respective dates. These tests were created for each of the key features that are part of the application, as to ensure the system remains working as intended. Below is an example of a used functional test.

- Title: Camera changes upon returning to main menu after a game over, finishing the game or through the pause menu
- Expected output: Camera pans to the middle of the first level
- Steps:
    1. Start the game
    2. Open the pause menu and return to the main menu
    3. Restart the game

4. Fail the level and return to the main menu

5. Restart the game

6. Complete the third level and return to the main menu

- Results:
    1. 05/09/21 Camera pans to the middle of the first level

    2. 07/09/21 Camera pans to the middle of the first level only after completing the game and returning from the pause menu

    3. 09/09/21 Camera no longer pans to the middle of the first level in any condition

    4. 09/09/21 Camera once again pans to the middle of the first level only after completing the game and returning from the pause menu

    5. 11/09/21 Camera always pans to the middle of the first level

Although these sorts of tests would prove to be more useful in a team project, since they serve as a method of keeping the whole team updated in the progress of certain features, they were still relevant to this project and contributed to not only extra organization throughout the development of the game, but also a consistent set of trials that the game would go through after every major update.

6.2 Evaluation

Having players try out the game, seeing their reactions and using questionnaires to further document their experience gives developers a better idea of what features felt more pleasing to their users, and which need further refining. For this reason, a pilot testing session was executed near the end of the project, and participants were asked to answer three questionnaires – the System Usability Scale survey, modules of the Game Experience Questionnaire and a survey dedicated to determining the impact of the game's message. Game analytics were also used to analyse the user's experience without direct contact with them. These analytics, along with the lastly mentioned survey were be the key to discovering if the developed project meets its objectives.

6.2.1 Pilot Testing

Pilot testing is a method utilized in different fields of work, to study the feasibility of the methods and procedures that will later be used in a larger scale (Thabane, et al., 2010). It is an important tool to collect preliminary data and to identify potential practical problems that a system might possess, increasing the likelihood of success in the study (van Teijlingen & Hundley, 2001). In software engineering, pilot testing is executed prior to its full deployment, in a development environment. On larger studies with several testing sessions, it ensures the readiness of the system for the following testing sessions, such as beta testing.

For this project, the pilot testing took place shortly before the end of the project itself. Preferably, it would take place in person, as to witness the players' reactions first-hand. However, due to incapability to provide a personal testing session, for health reasons or and to obtain a wider reach, the sessions instead took place online. During each session, participants were invited to complete all three levels of the game. Upon the end of the playing period, participants were asked to take part in three questionnaires – the system usability scale survey, the game experience questionnaire, and a set of questions related to the game's impact as an advergame – all detailed in their following respective sections. The order of these questionnaires lead the user to first give a more technical report of their experience, followed by a description of how the game impacted them. To share the questions with all overs, a questionnaire in Google Forms was created (Costa, 2021), whose screenshots can be seen in Annex 4 – Google Form Questionnaire, as well as its raw numeric results. Once all answers were compiled, an analysis of the responses took place, determining the mean and standard deviation of each question (except for the questions that possessed a method of evaluation already) as well as other patterns that may seem relevant to determine the success of the experiment.

Testing sessions took place between September 24th and October 2nd and were performed online, with a total of 19 participants. Although this sample size falls short to the usual desired statistical value of 30, it was composed of a demographically mixed group of people that created diverse results in the surveys and game analytics. As this project does not take age or sex in consideration, the focus of the demographic study of the participants was to gauge their experience with the gaming industry, as this could influence their performance in the game. Figure 35 shows the answers to the first question to this survey section.

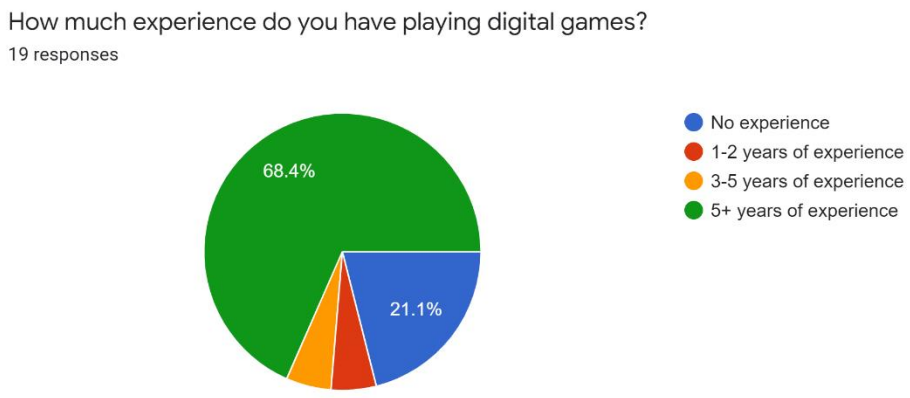

Figure 35 – Pie chart with results for the first survey demographic question

Through this chart in can be seen that most participants (13 to be exact) have 5 or more years of experience playing digital games, while only 4 had no experience with digital games. Ideally the demographic for this study would be more diverse, as people who would be exposed to the game at hand may come from different backgrounds. However, in this digital age it is common to find people with experience in digital games, especially the younger population that may enrol in ISEP. Figure 36 shows the answers to the second question of this same section.

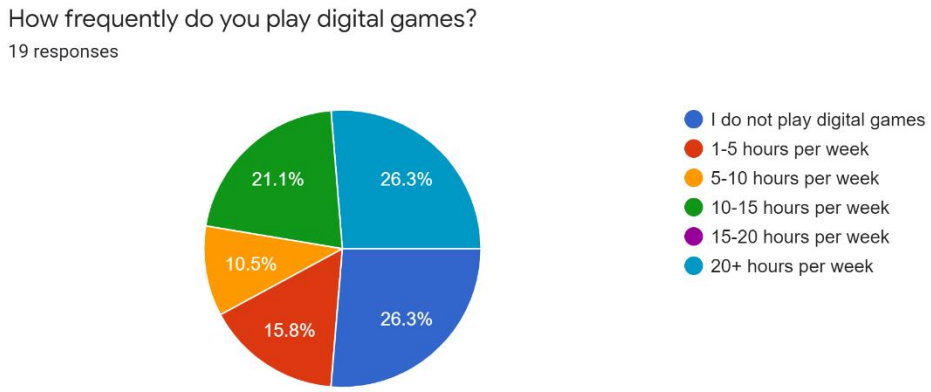

Figure 36 - Pie chart with results for the second survey demographic question

The answers to this question are once again focused on the options on both extremes of the scale. 5 people claim to play digital games for over 20 hours per week, and another 5 people

say they do not play digital games currently. These answers are relevant to understand the user's perception of the game at hand. While the game tries to be approachable for any gaming background, it is natural that people with no experience will struggle more than the experienced players, as is later evidenced in the game analytics results in section 6.2.5. Lastly, Figure 37 shows the results for the number of people that knew the concepts of serious games (left of figure) and advergames (right side of the figure) before participating in this project.

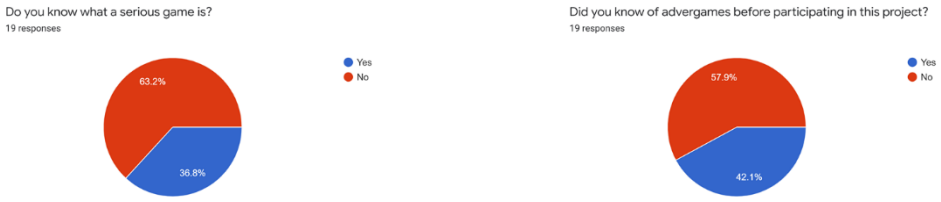

Figure 37 - Pie charts with results for the third (left) and forth (right) survey questions

When observing these charts, it is noticeable that the answers only differ by one participant, hinting that the knowledge of serious games and advergames seems to be coupled. This can change the user's perception of the last questions of the questionnaire, as their perception of advergames can sway their views of this advergame in specific. However, it does make for a diverse audience that can give a wide array of answers for the questions related to the impact of the game message.

The remaining numerical questions will be detailed in their respective sections, but it is still important to note that in the final question of the survey, where users are asked for any observations they might have, some users showed their content with the game, while others suggested changes such as the addition of invincibility frames and a wider or lower camera that allowed them to see the floor under them better. In general, the testing sessions were successful, showing which aspects of the game contained flaws and which were well executed.

6.2.2 System Usability Scale

The System Usability Scale (SUS), created in 1986 by John Brooke, is a "popular questionnaire for end-of-test subjective assessments of usability" (Lewis & Sauro, 2009), being used in the

testing of hardware, customer software, websites and more. Being a quick questionnaire, it consists of 10 item survey questions, listed below.

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

To answer these questions, users are presented with a 5-point scale that ranges from 1 ("Strongly disagree") to 5 ("Strongly agree"). On the event that a user does not answer a question, this item must be rated with a 3 on the 5-point scale. This list of items is created in that way that odd-numbered items are positive effects, while even-numbered items are negative experiences. This separation is further used when scoring the SUS. To add all the responses in an equivalent scale, 1 must be subtracted from user responses for odd-numbered items, while user responses to even-numbered questions subtract from 5. This ranges the result of each question to be between 0 and 4, with four being the most positive answer. To get the overall SUS score, these results must be added and then multiplied by 2.5, achieving a scale from 0 to 100, with 2.5 increments.

While the overall SUS score provides a method of determining how close a system can be to the maximum score of a 100, it fails to provide a comparison to the scores that are usually

accomplished during this sort of test. Through review of 500 different evaluations from over 5000 users using SUS, Sauro created associations between the SUS scores and percentile ranks that compare them to the evaluations reviewed, through a norm-referenced test, as shown in Figure 38.

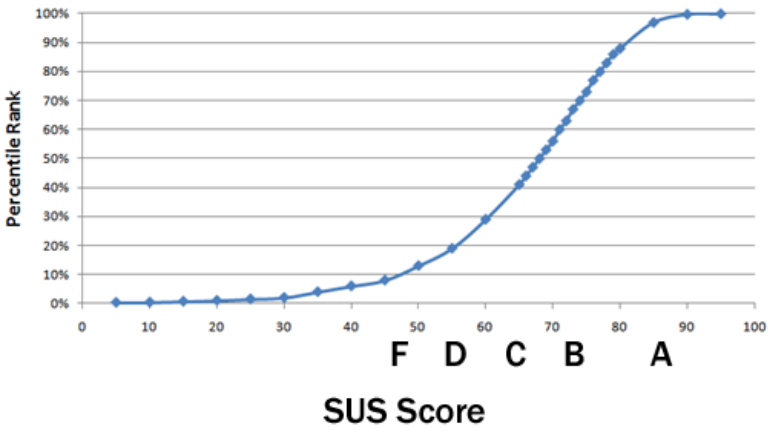

Figure 38 - SUS scores associated with percentile ranks and letter grades (Sauro, 2011)

These results show that the average SUS score is 68, which means that achieving a score higher than this in a SUS test implies the system is above 50% of the products tested, and not 68% as could be misled from the SUS score. Furthermore, it was determined that to achieve the rank of A, representing the top 10% of scores, a score of 80.3 or higher is needed. On the other side of the spectrum, achieving an F means a product is in the bottom 15% of the scores, which can be represented by a SUS score below 51.

In this project, the choice of SUS comes from its universal use in the creation of technological products, as well as its proven reliability. Through several studies, the SUS has achieved a typical minimum reliability goal of .70, a coefficient alpha of .91 in a study of 2324 cases, and a significant correlation of .806 with similar tests (Lewis & Sauro, 2009). Additionally, it has also been documented that the SUS not only evaluates usability, but also tests learnability, through questions 4 (“I think I would need the support of a technical person to be able to use this system”) and 10 (“I needed to learn a lot of things before I could get going with this system”). However, learnability is evaluated in a smaller degree, since it is only being evaluated by 2 questions, while usability is being determined through 8 questions (Lewis & Sauro, 2009).

For this project it was considered that the questionnaire benefited from changes in wording from the original SUS list of questions. The usage of different wording in SUS questionnaires has been analysed in the past. Results have shown that there was no significant difference between questionnaires that used the word “product” instead of “system”, as originally written in the survey items. Additionally, there have also been effective replacements of the word “cumbersome” in item 8 with word “awkward”, enhancing users’ understanding of the question. For the sake of making the participants more at ease with the test, every instance of the word “system” was replaced with “game”. However, the word “cumbersome” was not replaced with “awkward”, since the latter can be misinterpreted as “embarrassing”, which can happen more commonly in games than other pieces of technology, since there is a chance that the user may relate personally to the game. As such, the final wording of the questionnaire is shown below.

1. I think that I would like to use this game frequently.
2. I found the game unnecessarily complex.
3. I thought the game was easy to use.
4. I think that I would need the support of a technical person to be able to use this game.
5. I found the various functions in this game were well integrated.
6. I thought there was too much inconsistency in this game.
7. I would imagine that most people would learn to use this game very quickly.
8. I found the game very cumbersome to use.
9. I felt very confident using the game.
10. I needed to learn a lot of things before I could get going with this game.

Upon execution of the testing session, the replies from the 19 participants averaged a score of approximately 86.18 with a standard deviation of approximately 10.22, which rates this project on the top 10% of scores. The lowest score given was a 67.5, while the highest was 97.5. The

lowest rated questions were number 1 (with a mean and standard deviation of approximately 2.42 and 0.96, respectively) and number 9 (with a mean and standard deviation of approximately 3.16 and 0.9, respectively). The answers to the first question may come from the fact that this game is not intended for multiple playthroughs, as it is supposed to be a short experience. The lack of confidence that users showed, although still rating the question at a high value, may come from the difficulty of the game further explained in section 6.2.5. Overall, users seemed to have a good experience using the system, although perhaps only giving it one use.

6.2.3 Game Experience Questionnaire

The Game Experience Questionnaire (GEQ), as documented by IJsselsteijn, Kort and Poels, is a modular survey which is meant to be answered immediately after a game testing session, though it also contains a section to be answered during gameplay. It is an extensive questionnaire, featuring modules that inquire the user on how they felt during and after playing the game, as well as the involvement with other entities that were part of the game, being called the Core, Post-game, and Social Presence modules, respectively. Each module possesses scoring guidelines that rate the game in different areas. The questions are related to feelings such as enjoyment, boredom, or pressure, and prompt the user to share how they identify with said feelings. The values for the answers are scaled between 0 (“Not at all”) and 4 (“Extremely”), which are then used for the scoring of each component.

Each question of the Core module survey is directly associated with one out of seven components that are being evaluated – competence, sensory and imaginative immersion, flow, tension/annoyance, challenge, negative affect, and positive affect (IJsselsteijn, et al., 2013). This module contains 33 questions, while its In-Game version consists of 14 of those questions, and the same components, having 2 questions per component. The Social Presence module has 17 questions, which correlate to three components. Specifically, they refer to the player’s psychological involvement, through empathy or negative feelings, and their behavioural involvement. Lastly, the Post-game module is comprised of 17 more questions, which are related to four components. These components detail the user’s sense of tiredness, their positive experiences, negative experiences, and the way they felt upon returning to reality.

Although there are studies that question the validity of the GEQ (Law, et al., 2018) and others that warn of the necessity for changes when applied to games that purposely put the player in a bad mood, such as survival horror games (Norman, 2013), this questionnaire was still opted to be used. It has been used in a variety of research settings (Johnson, et al., 2018) and is the International Communications Union's standardized recommendation for subjective evaluation methods for gaming quality, being considered a valuable tool (Schmidt, et al., 2018). Additionally, the presence of a module dedicated to user's experience post-game is relevant to this project, as it is of interest to discover the advergame's effect on the user, making that module necessary. The Social Presence module will not be used, as the game does not have many entities that the player can interact with other than enemies and teacher, since the game at hand is a platformer. The in-game module of the GEQ will also not be used, as to not break the player's flow while playing the game, focusing instead on the user's experience after playing the game. In conclusion, the modules used for this project will be the Core module, which determines the basis of the player's experience, and the Post-game module, which evaluates the player's experience after the play session ended.

Once all participants answered the questionnaire, its results were analysed. Table 17 shows the results of the Core Module. From these values it is possible to observe that in the positive side of the components, the competence and positive affect rated the highest, while immersion and flow rated the lowest. Although these values are above average, they indicate that the game could be more immersive. Immersion is a desirable trait for an advergame, as it benefits from the user feeling in the position of the character that is using the product or brand in question.

Table 17 – Results of the GEQ Core Module

Component	**Mean**	**Standard Deviation**
Competence	3	0.9
Sensory and Imaginative Immersion	2.7	0.7
Flow	2.7	0.7
Tension/Annoyance	0.9	1
Challenge	1.7	0.5
Negative affect	0.7	0.7
Positive affect	3.3	0.7

However, it is natural for a platformer to have less immersion that other genres, in return entertaining the player as they forget they are playing an advergame. Both negative components of tension/annoyance and negative affect were rated low, meaning the player's experience was enjoyable. Additionally, the challenge component was rated slightly below average, indicating that although the game posed some challenges for the players, in general it was not overwhelmingly difficult. Table 18 shows the results of the Post-game Module.

Table 18 – Results of the GEQ Post-game Module

Component	**Mean**	**Standard Deviation**
Positive Experience	2.3	0.9
Negative Experience	0.4	0.5
Tiredness	0.2	0.4
Returning to Reality	1	0.6

This module features an average result in the positive experience component, showing that while the game seems enjoyable during gameplay, it does not leave many lasting effects. This makes sense for the project at hand, since the effect of advergames is commonly subconscious, but it is definitely an important point to keep in mind. The remaining results appear similar to the ones seen the Core Module, as the negative components of tiredness and negative experience remain low, and the low returning to reality component confirms the suspicion that the game lacks some immersion.

In conclusion, the results of the GEQ were positive, showing that the player had an enjoyable experience, but they point to improvements that can be made in the fields of immersion, challenge and lasting effects.

6.2.4 Game Message Impact Questionnaire

To further determine how impactful the proposed game is as an advergame, an additional short questionnaire was developed. This is a survey created specifically for the project, and therefore its questions and results cannot be validated in a standardized fashion. However, the questions were created based on guidelines. For instance, questions are short (less than 20 words) and they avoid words such as ‘and’ and ‘or’ (Williams, 2003). The focus of this questionnaire is to get the user’s opinion on the use of this game for its purpose. In order words, the aim of the survey is to determine if a serious game can be used to promote ISEP. As such, the questions

used for the questionnaire are shown below. As with the SUS, these questions are to be answered on a scale from 1 (“Strongly disagree”) to 5 (“Strongly agree”).

1. After playing the game, I know more about ISEP.
2. I think a digital game can be used to promote ISEP.
3. After playing the game, I know more about higher education.
4. I think a digital game can be used to promote a brand.
5. I think a digital game can be used to spread a message.

The answers to these questions provide information on the player’s perspective towards digital games, serious games and advergames. Additionally, they also show a correlation between the number of participants that think a digital game can promote ISEP (question 4) and the number of players that in fact believe the game at hand promotes ISEP (question 1).

Upon the 19 answers from questionnaire participants, the results were plotted and analysed. Figure 39 shows the results to the first question in a box plot.

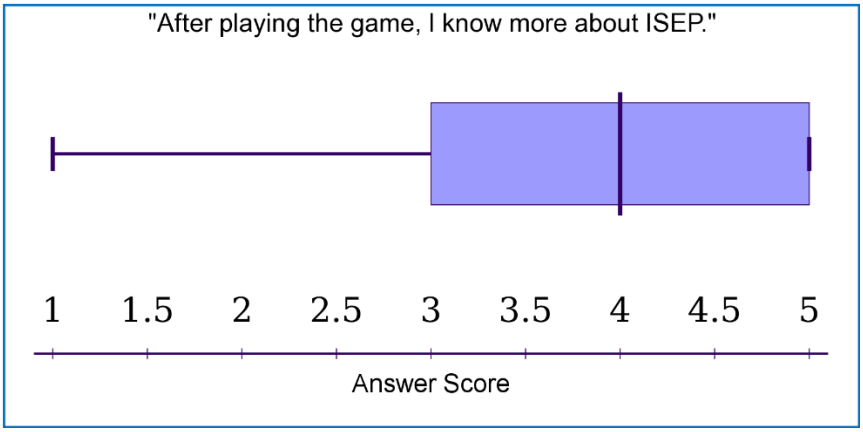

Figure 39 – Box plot of the answers to the first message impact question

From this plot it can be seen that the answers ranged from both extremes, but with much higher prevalence of higher values, as 75% of answers had a value of 3 or higher, 50% had a score of 4 or higher and 25% of them achieved the highest score. Additional analysis revealed that these values have a mean of approximately 3.94, with a standard deviation of approximately 1.10. Overall, it seems that most participants can say with confidence that they learned more about ISEP through usage of the game. This is a great indicator towards the success of the project, as it hints that ISEP's image was successfully promoted to these participants. The same plotting technique is used for the second question, as can be seen in Figure 40.

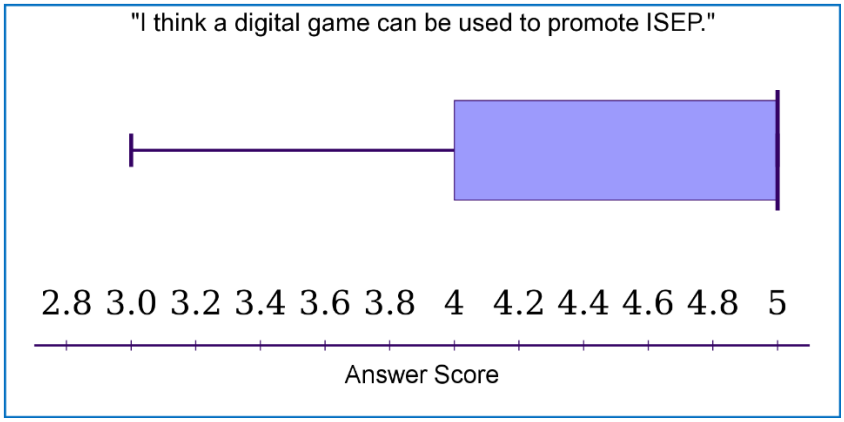

Figure 40 - Box plot of the answers to the second message impact question

This box plot shows that the answers to the question only range from 3 to 5, with 75% of them being scored of 4 or higher, and 50% being rated at the maximum. The mean for this data is of approximately 4.47 with a standard deviation of approximately 0.68. These are high values, which show that not only the participants highly agree that a digital game can be used to promote ISEP, but also not a single participant disagreed. This is great news for this project and future projects of a similar fashion, as it shows that there is indeed space for digital games to help in ISEP's promotion. Figure 41 shows the analysis of the third question of this survey.

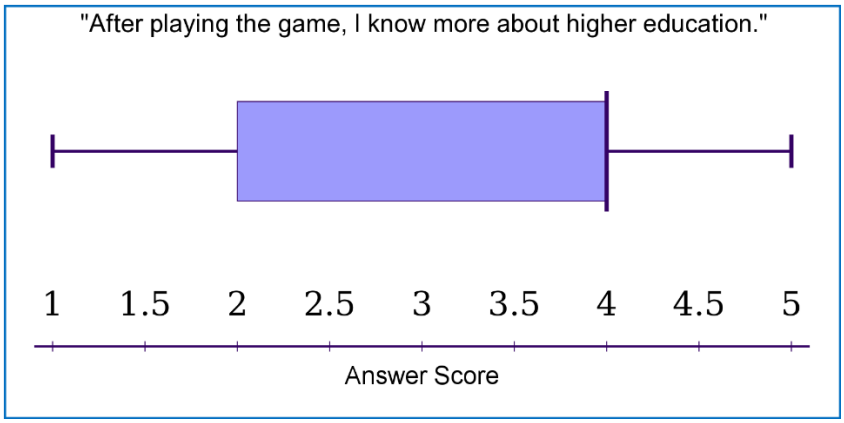

Figure 41 - Box plot of the answers to the third message impact question

This figure shows that the data covers the whole range of options. 75% of the answers had a value of 2 or higher, while 50% of them scored at least 4. The answers have a mean of approximately 3.47 and a standard deviation of approximately 1.19. These answers are lower than the ones to the previous question, but still represent high values, with emphasis on the value of 4. The results to this question likely come from the high specialization of the game at hand. Most elements that are present in the game, such as the facilities, courses and graphics are related to ISEP itself, while only the resources are common to all higher education institutes. It can be important to note that when trying to make the game more relatable to its audience, generalizing its components can be key. However, it is also important to keep the focus on ISEP as it is the brand being promoted. Figure 42 shows the plotted answers of the fourth question.

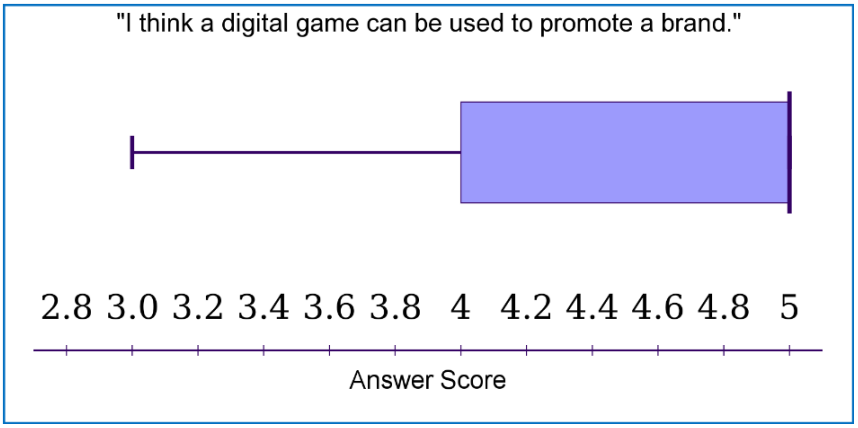

Figure 42 - Box plot of the answers to the fourth message impact question

This box plot is identical to the one that resulted from the answers to the second question, once again featuring answers that range from 3 to 5, with 75% of them scoring at least 4 and 50% achieving the score of 5. However, the remaining dispersion data is slightly different, as the mean for these results is approximately 4.53, with a standard deviation of approximately 0.68. Just as with question 2, these results show that no participant disagrees with the question at hand, meaning that advergames can definitely be successful (as was also proven by previous successful advergames) and that there is space for them and projects like this in the gaming industry. The last question's box plot is displayed in Figure 43.

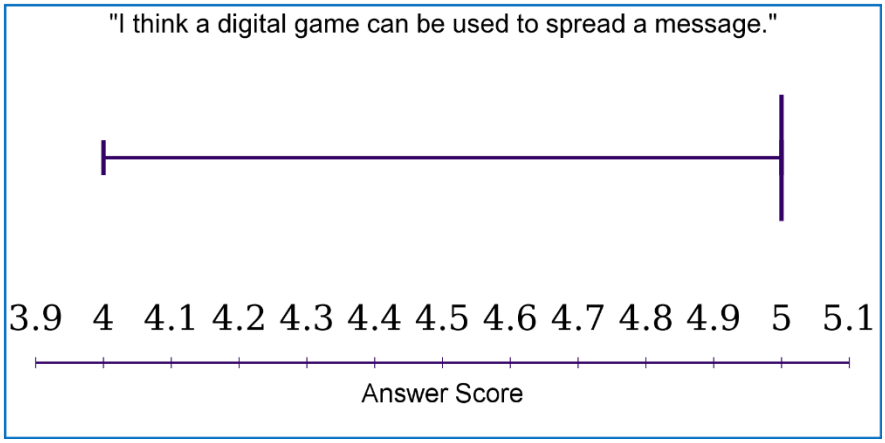

Figure 43 - Box plot of the answers to the last message impact question

The unusual appearance of this chart comes from the high concentration of answers with a score of 5. With only three total answers of 4, most defining sections of the box plot are placed on the value of 5 in the scale, including the first quartile, the median and the third quartile, meaning that 75% of the users gave their answer the highest score possible. This chart evidences the overwhelmingly positive opinion that the participants have of digital games' ability to spread messages. In this data, only 25% of participants responded with a score a 4, while all others answered this question with a 5. The mean for this data is of approximately 4.84 and the standard deviation is approximately 0.36, once again showing how all participants agree to the answer to this question. This shows that digital games can be a powerful tool to get a point across, with the potential of being used as a powerful media.

In conclusion, the answers to the game message impact questionnaire were highly positive, showing the impact that this game had in promoting ISEP, and the potential that digital games possess as a media to spread messages and even promote brands.

6.2.5 Game Analytics

Another way of analysing user experience is through game analytics. Analytics refers to "the process of discovering and communicating patterns in data, towards solving problems in business or conversely predictions for supporting enterprise decision management, driving action and/or improving performance" (Drachen, et al., 2013). Game analytics is the use of analytics in the world of gaming, which can be accomplished through trackers made by the game developers themselves or by third-party software. While analytics can take multiple forms, this project focuses on the use of game telemetry, which is data obtained over a distance. This facilitates the process of obtaining data, as no direct contact with the players is necessary. It also complements the previously enumerated methods of obtaining direct data from users through questionnaires. Telemetry bases itself on the measurement of attributes which are associated with objects. Objects in games can be players, enemies, items or even the environment itself. Attributes can be any measurable concept associated with the objects. For example, when looking at the player as an object, attributes can be measures such as distance travelled, number of deaths, damage dealt or number of jumps. When thinking of items, attributes can refer to the number of times an item has been used, bought, obtained, discarded, or even at what points in the game they are used. This data allows developers to understand how players treat their game, which parts they replay, where they struggle the most, and more. By looking at the locations and number of deaths of the players, game developers can have an idea of which parts of the game are specifically punishing, and through comparison with other areas, determine whether that section of the game is too hard. In a similar fashion, by analysing the items a player obtains and uses, game creators can assume which playstyles their players prefer, and which strategies and items are more appealing.

An example of the use of telemetry in analytics is Unity's own analytics feature, which were used in this project. It provides tracking for events related to the user experience navigation, player progression, first-time player experience, player engagement, and any other custom events that a developer desires to add (Unity Technologies, 2021c). The specific metrics that are chosen for each game depend on its nature, with genre being an important factor (Drachen,

et al., 2013). The use of all these metrics can aid in understanding which parts of the development of the product need further refining, ranging from elements of game design to the implementation of the game components themselves. By analysing the resulting metrics obtained from the game analytics, it is possible to determine which elements of the game worsened the user's experiences, and which kept the user in a state of flow.

As the game at hand is a platformer, gameplay metrics revolve around progression speed, areas interacted with, damage taken and the sources of said damage. The analysis of these combined metrics can give a general idea of the player's playstyle, how long they take to complete a level and which sections are more problematic, which routes they prefer, and which obstacles are the most punishing. Additionally, as the game will have strategic elements to it, it is also important to use metric related to the management of the user's resources. Figure 44 shows a list of some of the custom events used for this project, as well as the parameters of the Player Data event.

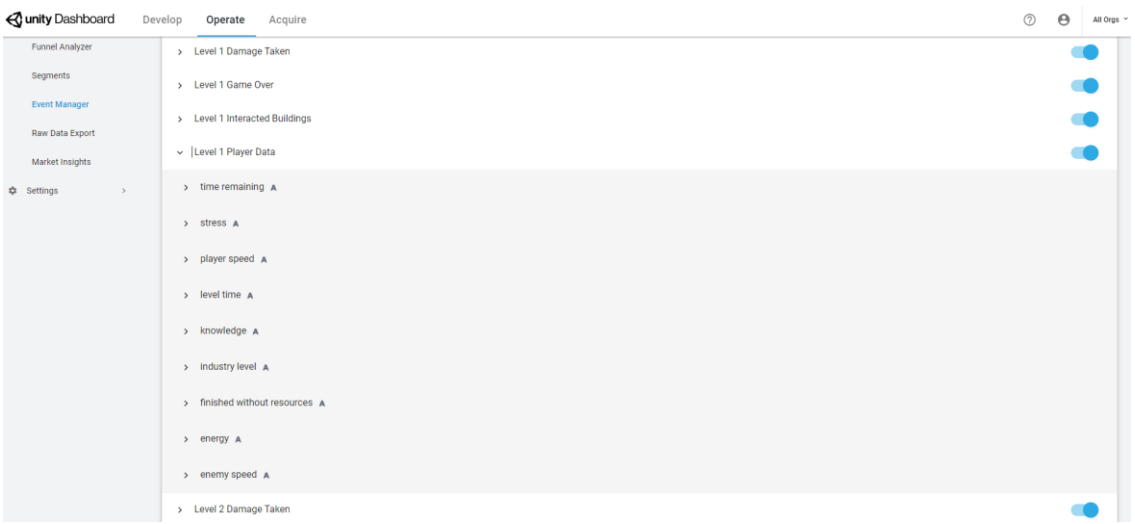

Figure 44 – Unity Analytics Dashboard displaying existing custom events and their parameters

The events are separated in four different types – Damage Taken, Game Over, Interacted Buildings and Player Data. Each of these events has a version for each level with its own parameters. The Damage Taken event keeps track of every source of damage that the player takes, as well as how much damage they take from said sources. This includes both enemies and falling off the level, suggesting which sections of the game the players struggled the most

with and hinting at changes that could be made to the game to improve the player experience. Since the game features over 50 different sources of damage, for this study only the sources that stand out from the others will be analysed. However, a full list of these results can be seen in Annex 5 – Analytics Results. Table 19 shows the most common sources of damage in the game.

Table 19 – Most common sources of damage

Damage Source	Amount of Damage Inflicted
Enemy1.1	36
Enemy3.2	24
Enemy3.1	19
DeathZone1.3	18
Enemy3.3	18

Through this table it is possible to observe that the biggest source of damage by far for players was enemy1.1, the very first enemy that the player encounters. Although this is a natural behaviour, since the under mandatorily encounters this enemy before failing the level, it also shows that it is possible that the player did not fully understand the movement mechanics by the time they encountered this enemy, and therefore struggled to defeat it. To correct this, the game should have a larger initial area without enemies, with stairs and platforms that allowed the player to practice moving and jumping without a death zone that they could fall into or enemies that they could take damage from. From Table 19 it can also be seen that the first three enemies of the third level created problems for players. These enemies can be seen in Figure 45.

Figure 45 – First three enemies of the third level

This is the first time in the game that the player encounters enemies that charge towards their location, which makes it natural for the player to take extra tries defeating the enemy. However, the numbers seen for these enemies' damage are abnormally high, hinting that once again the player did not possess enough space to learn the way enemies operate. Additionally, the beginning of the third level is marked by a sequence of jumps that features this type of enemies on the players' landing platform. Although this was intended as an incentive for players to learn the patterns of the charging enemies, it might have created an environment that was too hostile for the beginning of a level. Deathzone 1.3, the final common source of damage that is listed, is shown in Figure 46.

Figure 46 – Death Zone 1.3

This area is the players' first encounter with a jump that requires platforms, proving that players struggled to get used to the jumping mechanic, specifically on smaller portions of ground. As with enemy1.1, the fix for this problem is to simulate these jumps in a controlled environment where the player will not take damage from falling. Lastly, it is important to mention that on total players took damage 373 times. With 50 hazards present in the game, players average at 7.46 damage per hazard. This is much higher than the optimal value of 2 defined in section 6.1.1, meaning that in general enemies should have been placed in more controlled environments and separated from each other.

The Interacted Building events keep track of which facilities and teachers present in the game were interacted with. In this section the buildings that were least interacted with will be analysed, as discovering why they were avoided can provide insights in design flaws. Table 20 shows this list.

Table 20 – Facilities that were least interacted with

Facility	Number of times interacted
Level 3 Office	3
Level 2 Office	9
Level 1 Office	11
Level 3 aeISEP	12
Level 2 ISEP|GO	13

From this list it is visible that the teacher's offices present at the end of each level were rarely interacted with. However, this is working by design, as teachers' offices are facilities that in the game are clearly shown to the player and are there in case the player needs a little extra knowledge boost before clearing the level. If the player always possesses enough knowledge to clear the level, there is no necessity to interact with this facility, meaning the player can finish the level faster. The other two buildings are in a similar position, as both aeISEP and ISEP|GO are facilities that reduce the player character's stress. These are in paths that the player must mandatorily cross to reach the end of the level, meaning the player did indeed see the facilities but chose not to interact with them, as their meters were well managed at this point. These analytic events show that the player had a good sense of how to manage their resources, and understood which resources each facility provided them, and whether they would benefit them. It is important to note that these facilities are the last ones in each level, which means they also are interacted with less often because the player does not reach them as frequently, but the jump in numbers between these facilities and the remaining ones confirm the previously mentioned theories.

The Player Data and Game Over events work in similar fashion. The Player Data event is triggered when a player finishes a level and the Game Over event is triggered when the player fails the level. However, both events share similar attributes. Through use of these events, it is possible to analyse each of the resources that the player managed, observing their values when the events were triggered. Figure 47 shows an example of this.

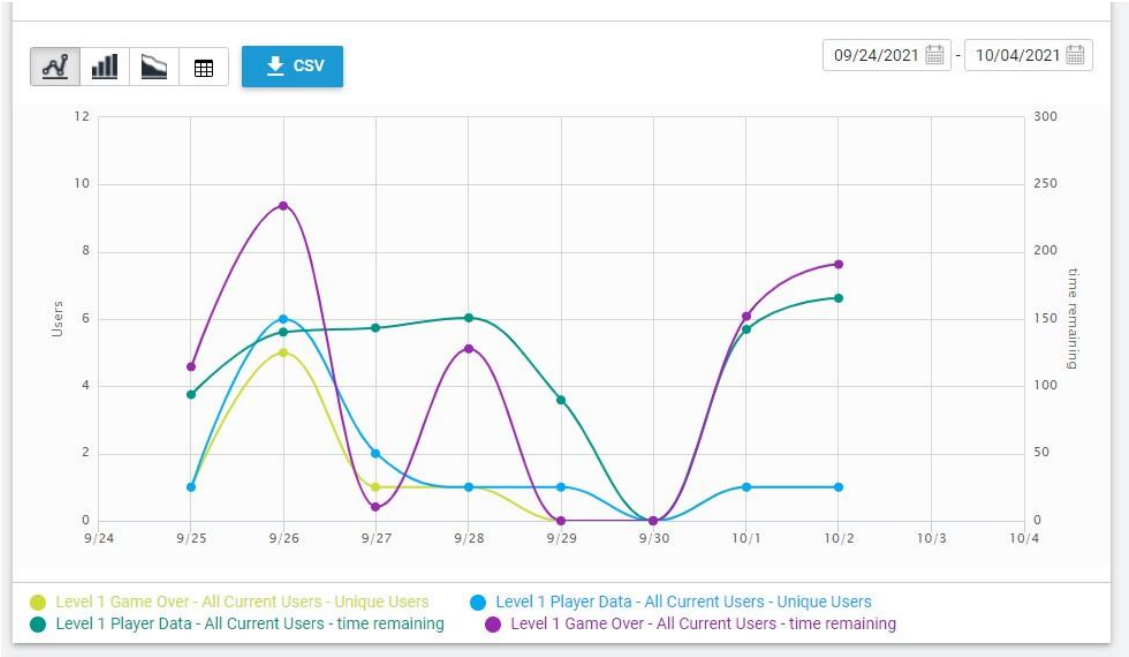

Figure 47 - Unity Analytics spline chart displaying time remaining when users finished level 1

The present chart displays the average time remaining on each day of testing (scaled on the right vertical axis), for events when the player finished level 1 (shown in green) and when players failed level 1 (shown in purple). It also shows the number of occurrences of both events (scaled on the left vertical axis), with level completions shown in blue and level fails shown in yellow. The testing dates are shown on the horizontal axis. Although the Unity Analytics dashboard displays dated graphs, for this project there is no comparison between days of testing, as all game testing sessions were similar. However, the graph is useful to visualize that the number of level fails is similar to the number of level clears. Upon further examination of these values and the corresponding ones for the remaining levels, it was possible to access that on average, players took approximately 1.77 tries to beat the first level, 1.46 tries to defeat the second one, and 2.43 attempts to clear the third level. These values correspond to the objective of creating levels that took three tries of less, as was shown in section 6.1.1. However, a couple of participants opted to give up on level 3. In these cases, there is no analytics data for the completion of level 3, meaning that the average of tries per level would be greater than what can be displayed here, giving this objective a fulfillment percentage of 50 instead of 100.

Through further investigation of the attributes in the Player Data and Game Over events, it can be discerned that players were able to keep their resources well managed. On average, players

possessed 2 minutes to spare when they completed a level and failed the level with an average of 3 minutes remaining, meaning that this was rarely a factor for level failure. Stamina management was not a problem for players either as its averages per level ranged from 40 to 55 (out of 100) on level clears and between 58 and 75 when failing the level. When analysing the knowledge resource, these values ranged from 70 to 80 for level clears and between 25 and 56 when failing a level. This resource cannot cause level failure, which explains its low average in level 1, as if players fail the level in the early stages of a level their knowledge resource will always be low. Lastly, players kept their stress averaging between 50 and 59 across the three levels when cleared. Due to an implementation error, all stress values during level failure are reported as 0. This is the value that stress is reset to when after failing a level, hinting that the event might have been triggered later than desired. However, since all other resources had high values at the time of level failure, it is safe to assume that in almost all cases stress was the cause of level failure. This is the predicted outcome of the analytics results, as the stress resource is the focus of the game, and some design flaws highlighted in the Damage Taken event caused additional stress induced in the player's character.

In conclusion, the use of game analytics was crucial to discern design flaws that the game possesses when it comes to hazards and their placement in each of the levels, and possible solutions for them. The intuitiveness of game mechanics such as the facilities and the resources that were shown to the player is also highlighted, as well as the ways that players chose to manage said resources.

7 Conclusion

This chapter compiles the objectives that were completed during this project and listed across this document, both in terms and implementation and serious objectives as an advergame. It then explains the limitations that were present in this project's work, as well as future work that can be executed to improve the results obtained. Lastly, a final evaluation of the project is given, detailing its importance and relevance.

This project was created fulfill a need that ISEP possesses. As the world of advertising keeps evolving over the years, companies explore new channels to promote their brands and products. With the growth of the gaming industry, digital games became an effective method of spreading messages. Companies saw this potential, creating the industry of advergames a way to connect their products with the positive feelings that are created when playing digital games. Since ISEP aims their advertising at a young target audience, it was determined that the institution could benefit from the use of advergames.

The main objective at hand was creating an advergame that promotes ISEP's image, sparking curiosity in its target audience and creating an inviting environment for student enrollment. To meet these goals, research was needed to determine which game genre and concepts fit the target audience in mind, as well as methods of development tracking. Additionally, user testing was performed to assess the success of the game in terms of usability, user experience and message impact, while recorded analytics provided additional information on each player's experience with the game.

7.1 Completed Objectives

In terms of development, this project completed 85% of its objectives, with a full completion rate in the functionality dimension and 88% completion in the usability dimension. The biggest implementation flaws reflected themselves in the gameplay dimension, in both the difficulty and progression factors. The game lacked progression persistence upon application closure, and it did not feature mid-level checkpoints in its levels. The absence of these features was intentional, as the game is short and during development its difficulty seemed low. When prioritizing tasks and optimizing the time spent on the project, these features fell behind to give space for improvements on the rest of the game. However, later testing proved that these requirements were equal or more relevant than the others listed in the Quantitative Evaluation Framework.

The objectives of this project as an advergame were evaluated through the pilot testing that was executed. The sample used to test the game was smaller than ideal but achieved diversity similar to the desired in terms of gaming experience. The System Usability Scale puts the usability of this system in its top 10% of scores, with a final value of 86.18, showing the success of this advergame as a system. The Game Experience Questionnaire displayed the importance of the user's feelings as they experienced the game. Through analysis of the results achieved in its many components, it was shown that although the game was considered an overall enjoyable experience, it could benefit from features that would increase its immersion and could keep the player in a more consistent state of flow. Tweaks to the challenging aspects of this advergame could additionally make the experience more enjoyable. The Game Message Impact Questionnaire achieved highly positive results. The data from this survey showed that it is widely agreed that digital games can be used to spread a message. Specifically, it was evidenced that digital games can be used the promote brands. 75% of participants completely agreed that a digital game can be used to promote ISEP, and 50% highly agreed that they learned more about ISEP by playing this advergame. Lastly, the game analytics that were running during testing showed that, as evidenced by other sections of the testing, the game proved to be more difficult that desired, and would benefit from changes to its hazard and enemy placement, but also evidenced solutions that could be used to improve the interaction with these damage sources. It additionally displayed the intuitiveness of features such as the facilities available in the game and the management of resources.

7.2 Limitations

The current pandemic that affects the world has posed some slight limitations. The lack of options for work locations made work run less smoothly and the impossibility to easily create testing sessions in person made the sessions less efficient. However, it was a smaller hurdle than expected, and it was a great way of proving the importance of methods of testing that can be used from a distance, such as game analytics. The analytics themselves posed some limitations of their own. Unity limits each custom event to have a maximum of 10 parameters and it poses the limit of 100 custom events per hour, per user. These analytics limitations posed some problems in the beginning of development, but with some refactoring they were easy to work around. One limitation that was not worked around was the necessity for the Unity Pro license to download the raw data of the game analytics. This issue caused some extra manual work to be executed on the data shown in the charts that Unity makes available. Overall, it was still possible for the game analytics section to be well detailed with the data available, which is why the Unity Pro license did not seem worth it for this project, but it would have been easier to operate on the more extensive data, and it could have provided better results. A similar situation exists with the game's graphical assets. The lack of free assets that fit the game's aesthetic made it so a lot of work had to be put into creating some of the assets that are now in the game, since paying for better assets did not seem worth it either. Lastly, a big limitation during this project was understanding how difficult the game was becoming, and how difficult it should be. The project would have probably benefitted from an additional testing session to be performed earlier, even if it had less participants, as a way of gauging the overall difficulty of the game.

7.3 Future Work

The future work for this project revolves around improving the flaws that were discovered through the testing and evaluation that was performed. The top priority would be to tweak the game's difficulty, through the addition of mid-level checkpoints and changes to the levels themselves. Adding checkpoints is a simple task with the current structure of the game, as it can take advantage of the zone mechanics that were explained in the implementation section, as well as the spawn mechanics that are already in play. Changing the levels would take some extra design work, as to discover which is the best layout for each level that can introduce the

player to its mechanics in a safer environment than the one that currently exists. However, these design choices fall under the same kind of design work that was executed earlier in the project, meaning it is not a complicated task. Additionally, player data would need to be serialized so that progress can be saved upon game closure and restored when the game is opened. A few details would be fixed that could improve the player's flow, such as menu navigation with keys instead of the cursor, gamepad support and a few small fixes in the main character's animations. The game would also benefit from having more levels. The three levels created for this project were enough to prove the concept at hand, but for the game to be complete it would require representation of other courses and themes that are present in ISEP. Lastly, an additional study on a potential improvement to the game's immersion could be relevant. Although the platforming genre of this advergame will always add some interesting mechanics at the cost of immersion, it can be important to reevaluate how immersive the game should be, as immersion can be important in advergames.

7.4 Final Evaluation

In conclusion, the project was successful. It was shown that advergames can indeed be used to promote ISEP's image. Furthermore, it was shown that this advergame in specific was well executed as a system, as an experience and as a way of spreading a message. There are improvements to be made in most of these fields, but the final product that was achieved during this project is a game that was able to teach its players more about ISEP, as intended.

Additionally, this project was a success in terms of personal and professional growth, as it further developed abilities in game design, game making, value analysis, research, testing and evaluation, with a special highlight to the use of game analytics as a tool, which proved to be of crucial importance to discern the users' experience the game.

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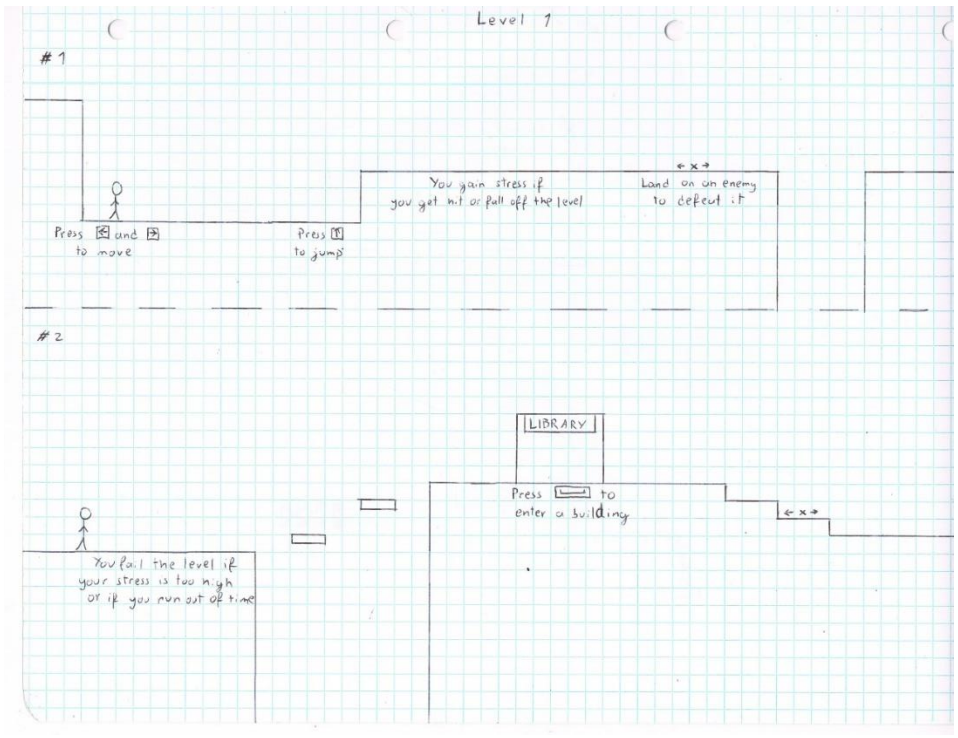
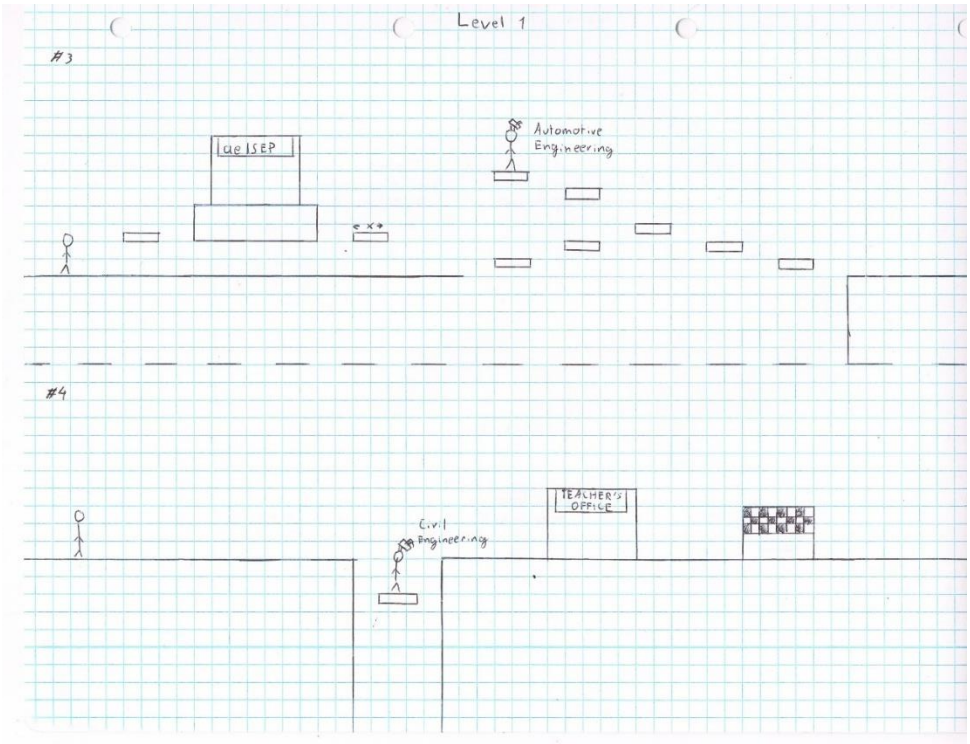
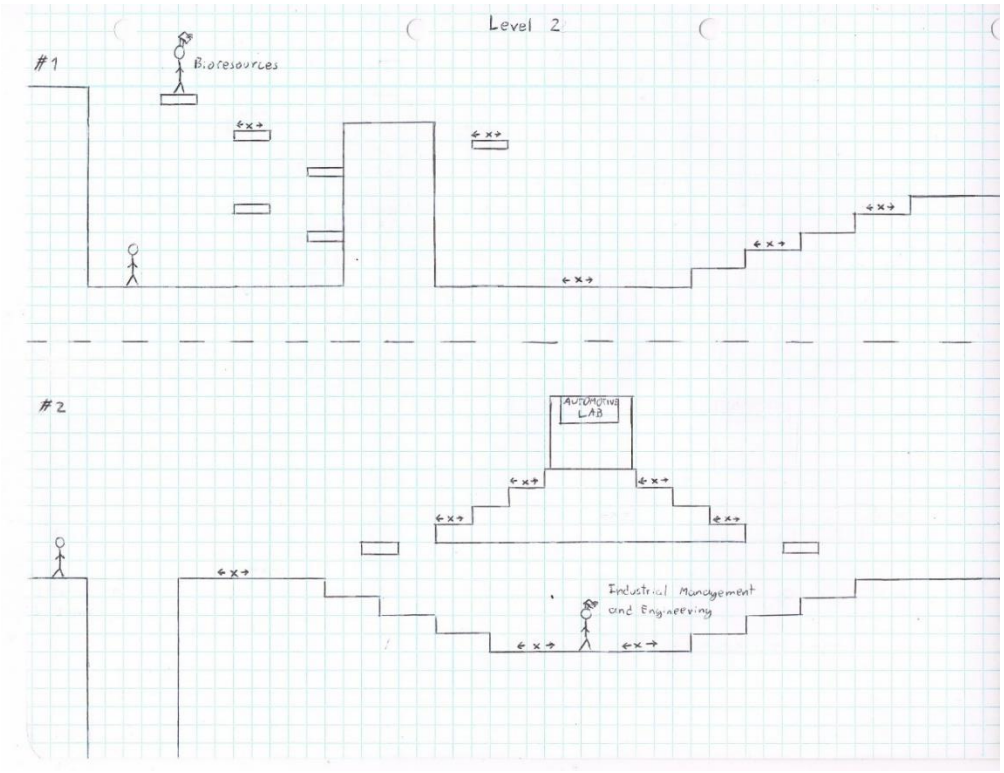
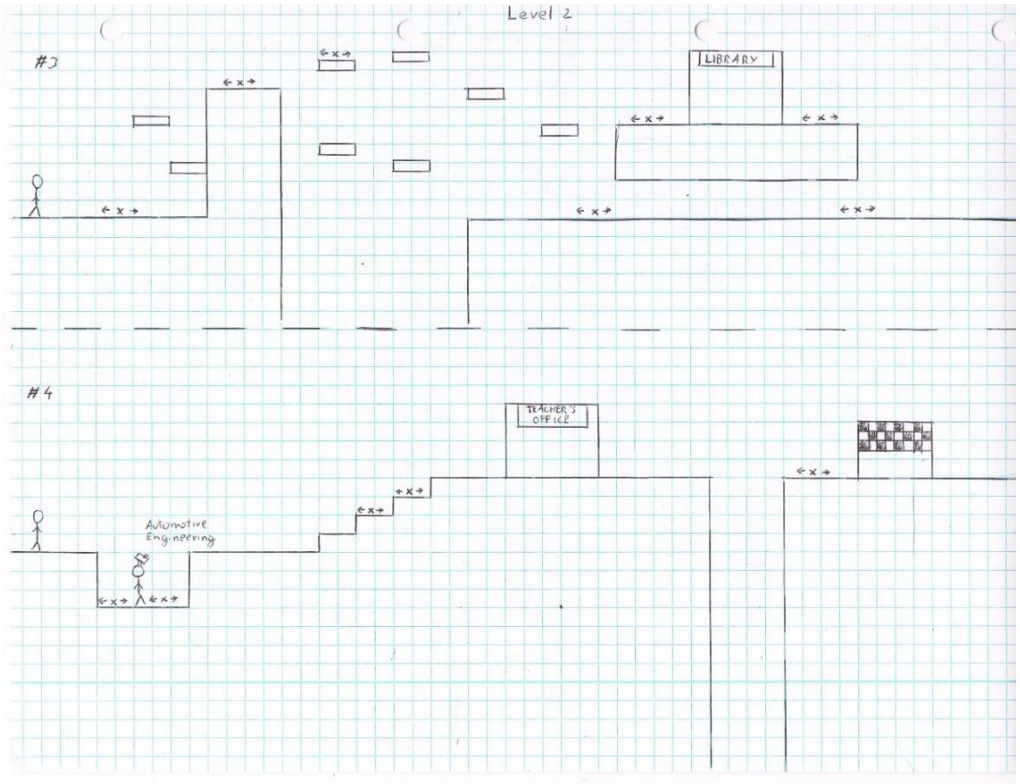
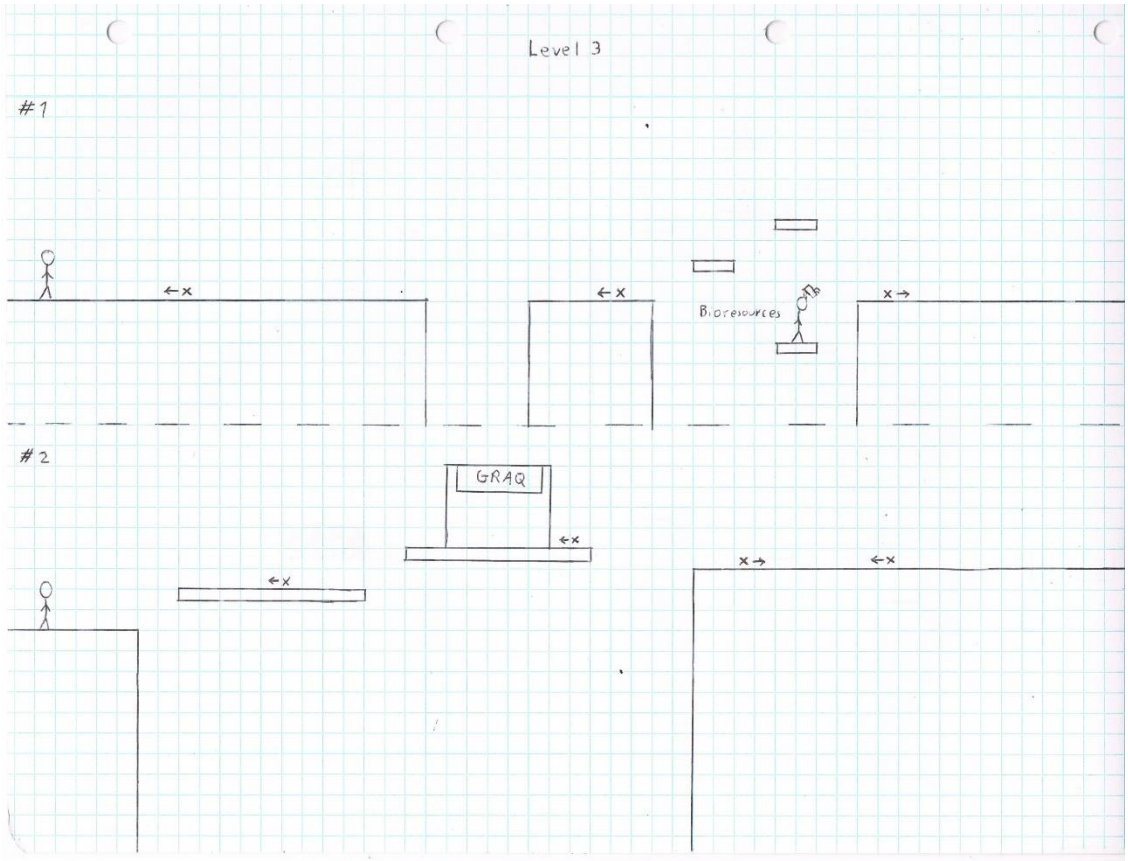
9 Annex 1 – Level Design Drafts

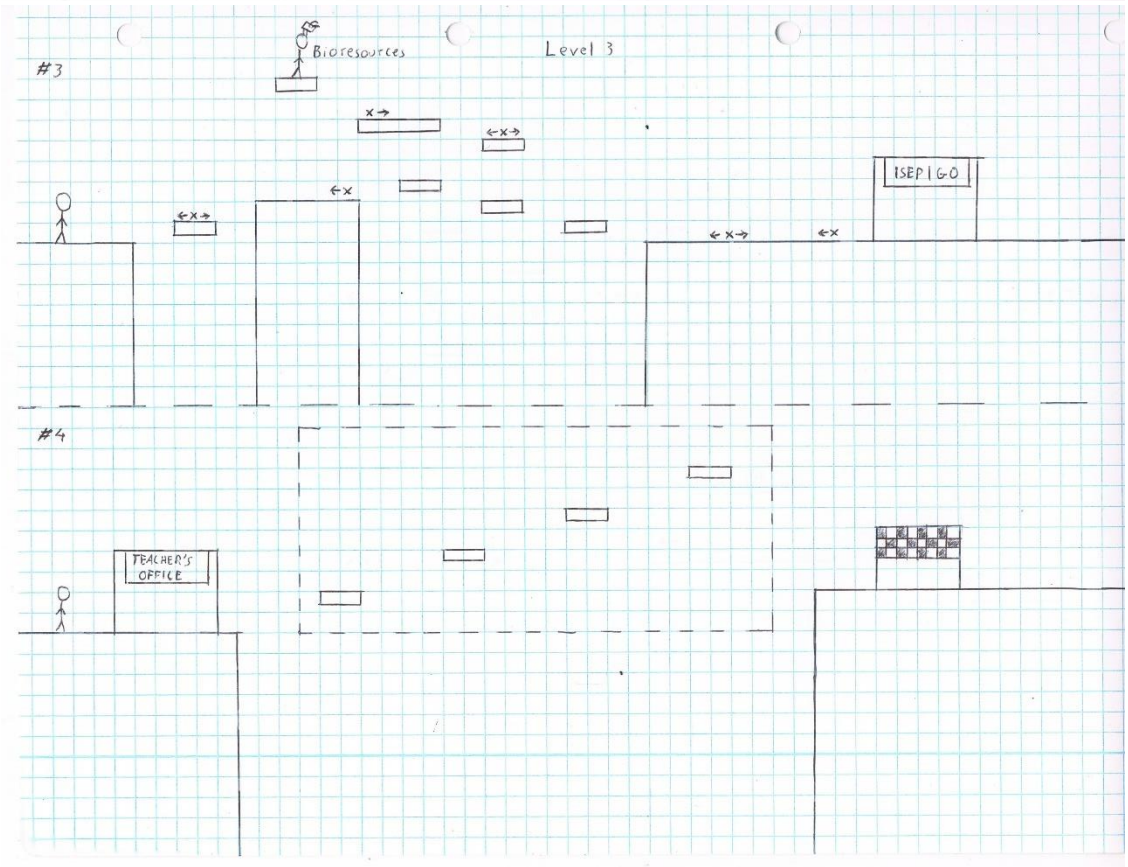





Level 2
#1
Bioresources
#2
AUTOMOTIVE LAB
Industrial Management and Engineering


Level 2
#3
LIBRARY
#4
TEACHER'S OFFICE
Automotive Engineering


Level 3
#1
Bioresources
#2
GRAQ


Bioresources
Level 3
#3
ISEP I GO
#4
TEACHER'S OFFICE

10 Annex 2 – Quantitative Evaluation Framework Draft

q	D	qi	Dimension	Qj	Wij (Factor Weight j in Dim i) [0,1]	Factor	rwjk (requirement weight k in Factor j) {2, 4, 6, 8, 10}	Requirement	wfk % requirement fulfillment k) [0,100]
0%	1.73	0	Functionality	0	0.364	Player	10	FP01 - Player movement	0
							10	FP02 - Player can defeat enemies	0
							10	FP03 - Player can upgrade abilities	0
							10	FP04- Player can use abilities	0
				0	0.273	Enemies	10	FE01 - Enemies move in fixed patterns	0
							10	FE02 - Enemies follow the player	0
							10	FE03 - Enemies change player's meters on hit	0
				0	0.182	Levels	10	FL01 - Levels possess hazards	0
							10	FL02 - Bonus levels award meter bonuses	0
				0	0.182	Collectibles	10	FC01 - Collectibles can be obtained	0
							10	FC02 - Obtaining collectibles changes meters	0
		0	Gameplay	0	0.43	Difficulty	10	GD01 - Difficulty of each level is adjusted	0
							10	GD02 - Difficulty of each enemy is adjusted	0
							10	GD03 - Meters change is adjusted	0
				0	0.57	Progression	10	GP01 - The game can be paused any point	0
							10	GP02 - Progress is saved upon exiting the game	0
							10	GP03 - The game possesses automatic checkpoints	0
							10	GP04 - The game can be continued from the previous checkpoint	0
		0	Usability	0	0.29	Interface	10	UI01 - Main Menu allows access to main functions	0
							10	UI02 - User can change settings	0
				0	0.29	Control	10	UC01 - Player always has control over the system	0
							10	UC02 - Game provides feedback on the player's actions	0
				0	0.43	Help	10	UH01 - Game possesses tutorial	0
							10	UH02 - Each ability has an extensive description	0
							10	UH03 - Main Menu contains extra, more in-depth tips	0

11 Annex 3 – Quantitative Evaluation Framework

q	D	Qi	Dimension	Qj	Wij (Factor Weight j in Dim i) [0,1]	Factor	rwjk (requirement weight k in Factor j) {2, 4, 6, 8, 10}	Requirement	wfk % requirement fulfillment k) [0,100]
85%	0.50	100	Functionality	100	0.364	Player	10	FP01 - Player movement	100
							10	FP02 - Player can defeat enemies	100
							10	FP03 - Player abilities get upgraded	100
							10	FP04 - Player can effect their meters	100
				100	0.273	Enemies	10	FE01 - Enemies move in fixed patterns	100
							10	FE02 - Enemies follow the player	100
							10	FE03 - Enemies change player's meters on hit	100
				100	0.182	Levels	10	FL01 - Levels possess hazards	100
							10	FL02 - Level is dynamic depending on player's abilities	100
				100	0.182	Interactables	10	FI01 - Buildings and teachers can be interacted with	100
							10	FI02 - Interating with buildings and teachers changes meters	100
		50	Gameplay	50	0.43	Difficulty	10	GD01 - Difficulty of each level is adjusted	50
							10	GD02 - Difficulty of each enemy is adjusted	0
							10	GD03 - Meters change is adjusted	100
				50	0.57	Progression	10	GP01 - The game can be paused any point	100
							10	GP02 - Progress is saved upon exiting the game	0
							10	GP03 - The game possesses automatic checkpoints	50
							10	GP04 - The game can be continued from the previous checkpoint	50
		96.4	Usability	87.5	0.29	Interface	10	UI01 - Main Menu allows access to main functions	75
							10	UI02 - User can change settings	100
				100	0.29	Control	10	UC01 - Player always has control over the system	100
							10	UC02 - Game provides feedback on the player's actions	100
				100	0.43	Help	10	UH01 - Game possesses tutorial	100
							10	UH02 - Each meter has a description	100
							10	UH03 - Main Menu contains extra, more in-depth tips	100

Dimension	Functionality
Factor	Player

		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
FP01 - Player movement	The player can move and jump in their enviroment	Not implemented		Player can move but not jump		Player can move and jump
FP02 - Player can defeat enemies	Player can remove enemies from screen through jumping on them or using certain abilities	Not implemented				Implemented
FP03 - Player abilities get upgraded	The player is able to upgrade abilities, such as speed, by interacting with subject-specific buildings	Not implemented				Implemented
FP04 - Player can effect their meters	Player can use abilities to defeat enemies or change the behaviour of their meters	Not implemented				Implemented

Dimension	Functionality
Factor	Enemies

		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
FE01 - Enemies move in fixed patterns	Enemies move back and forth in a designated area	Not implemented				Implemented
FE02 - Enemies follow the player	Enemies chase after the player upon detecting them	Not implemented		Enemy detects player but does not chase them		Implemented
FE03 - Enemies change player's meters on hit	When an enemy hits a player, it changes their meters accordingly	Not implemented		Hit is registered, but no meter is changed		Implemented

Dimension	Functionality
Factor	Levels

		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
FL01 - Levels possess hazards	Levels contain obstacles that can hit the player, changing their meters	Not implemented		Has hazards but they do not affect the player	Hit is registered, but no meter is changed	Implemented
FL02 - Level is dynamic depending on player's abilities	Level platforms change depending on player's interaction with level 2 buildings	Not implemented		Platforms are dynamic, but with only two tiers of difficulty		Platforms are dynamic with three tiers of difficulty

Dimension	Functionality
Factor	Interactables

		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
FI01 - Buildings and teachers can be interacted with	Buildings and teachers that the player can interact with are spread around the levels	Not implemented				Implemented
FI02 - Interating with buildings and teachers changes meters	Interacting with interactables changes the appropriate meters	Not implemented				Implemented

Dimension	Gameplay
Factor	Difficulty

		Wfk - Fullfilment (%)				
Requirement	**Metric Evaluation**	**0**	**25**	**50**	**75**	**100**
GD01 - Difficulty of each level is adjusted	Each level does not take too long to complete	Player takes 7 or more tries to beat the level		Player takes 4 to 6 tries to beat the level		Player can complete level in 3 tries or less
GD02 - Difficulty of each enemy is adjusted	Player does not take long to defeat an enemy	Player gets hit 5 or more times by the same enemy		Player gets hit 2 to 4 times by the same enemy		Player gets hit a maximum of 2 times by the same enemy
GD03 - Meters change is adjusted	Player's meter management must not be overly stressful	All 4 meters get close to running out during a level		3 meters get close to running out during a level		A maximum of 2 meters get close to running out during a level

Dimension	Gameplay
Factor	Progression

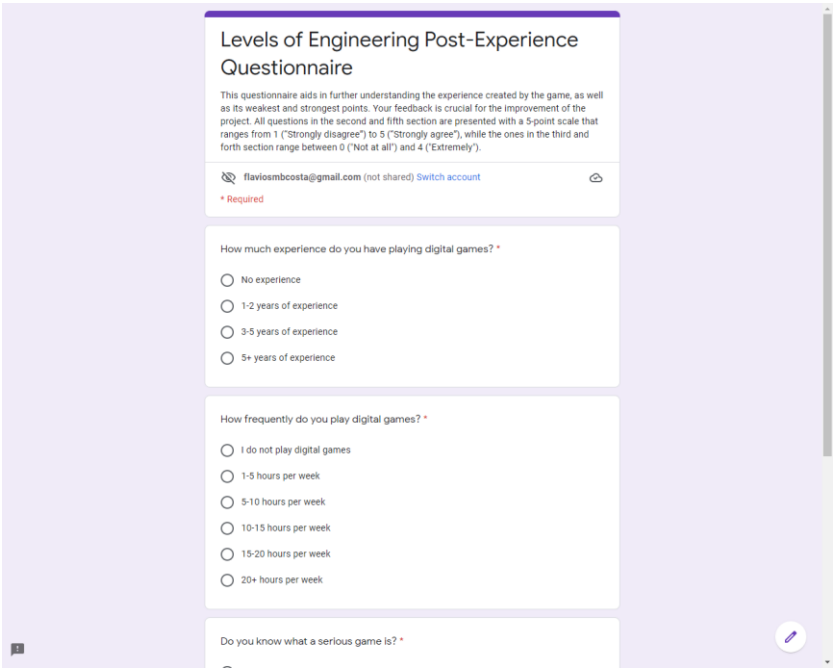
		Wfk - Fullfilment (%)				
Requirement	**Metric Evaluation**	**0**	**25**	**50**	**75**	**100**
GP01 - The game can be paused any point	Game possesses an in-game menu that when activated stops the game	Not implemented				Implemented
GP02 - Progress is saved upon exiting the game	When the player uses the "Quit" function in a game, it saves their current progress	Not implemented				Implemented
GP03 - The game possesses automatic checkpoints	Certain areas of a level count as checkpoints which save the game automatically	Not implemented		Only start of level is a checkpoint		Has checkpoints mid-level
GP04 - The game can be continued from the previous checkpoint	When the player rejoins the game from the Main Menu, they resume where they previously left	Not implemented		Joins correct level but no checkpoint		Implemented

Dimension	Usability					
Factor	Interface					
		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
UI01 - Main Menu allows access to main functions	From the Main Menu the player can resume their previous game, start a new game and access the help, settings and credits menus, as well as quit the game	Not implemented	1-2 Functions	3 Functions	4-5 Functions	6 Functions
UI02 - User can change settings	User can change game's master volume, sfx volume and music volume	Not implemented		1 Function	2 Functions	3 Functions

Dimension	Usability					
Factor	Control					
		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
UC01 - Player always has control over the system	Game never removes control from the player, and never makes decisions without the player	Not implemented				Implemented
UC02 - Game provides feedback on the player's actions	Button presses, jumps, interactables, hitting enemies, game over and completing a level have respective sound effects	Not implemented	1-2 Functions	3 Functions	4-5 Functions	6 Functions

Dimension	Usability					
Factor	Help					
		Wfk - Fullfilment (%)				
Requirement	Metric Evaluation	0	25	50	75	100
UH01 - Game possesses tutorial	Game explains main features as player moves through the level	Not implemented				Implemented
UH02 - Each meter has a description	Every meter is detailed in the tutorial text	Not implemented				Implemented
UH03 - Main Menu contains extra, more in-depth tips	Help menu has tips and strategies on how to beat the levels and approach certain enemies	Not implemented				Implemented

12 Annex 4 – Google Form Questionnaire



Levels of Engineering Post-Experience Questionnaire

This questionnaire aids in further understanding the experience created by the game, as well as its weakest and strongest points. Your feedback is crucial for the improvement of the project. All questions in the second and fifth section are presented with a 5-point scale that ranges from 1 ("Strongly disagree") to 5 ("Strongly agree"), while the ones in the third and forth section range between 0 ("Not at all") and 4 ("Extremely").

flaviosmbcosta@gmail.com (not shared) Switch account

* Required

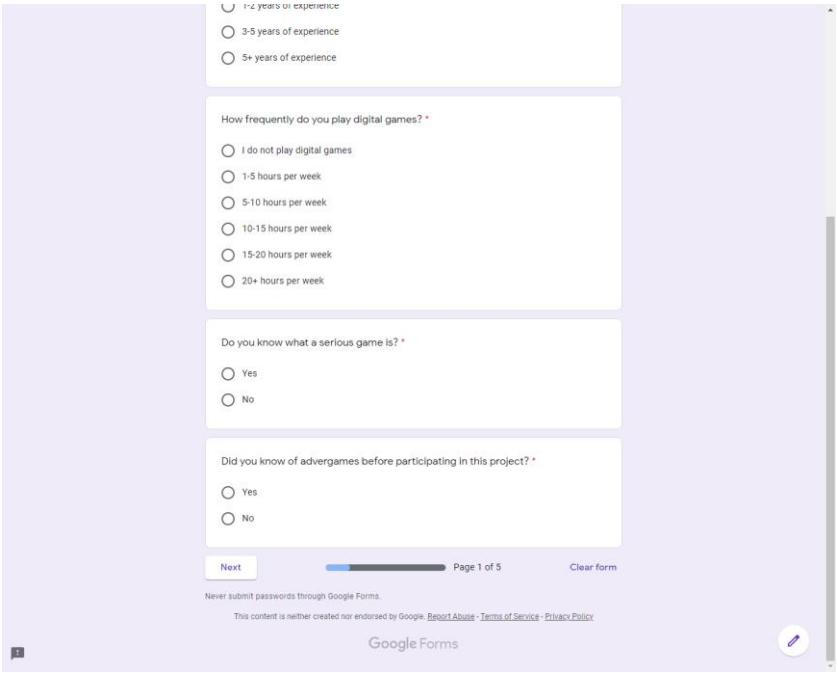
How much experience do you have playing digital games? *

- No experience
- 1-2 years of experience
- 3-5 years of experience
- 5+ years of experience

How frequently do you play digital games? *

- I do not play digital games
- 1-5 hours per week
- 5-10 hours per week
- 10-15 hours per week
- 15-20 hours per week
- 20+ hours per week

Do you know what a serious game is? *



- 3-5 years of experience
- 5+ years of experience

How frequently do you play digital games? *

- I do not play digital games
- 1-5 hours per week
- 5-10 hours per week
- 10-15 hours per week
- 15-20 hours per week
- 20+ hours per week

Do you know what a serious game is? *

- Yes
- No

Did you know of advergames before participating in this project? *

- Yes
- No

Next Page 1 of 5 Clear form

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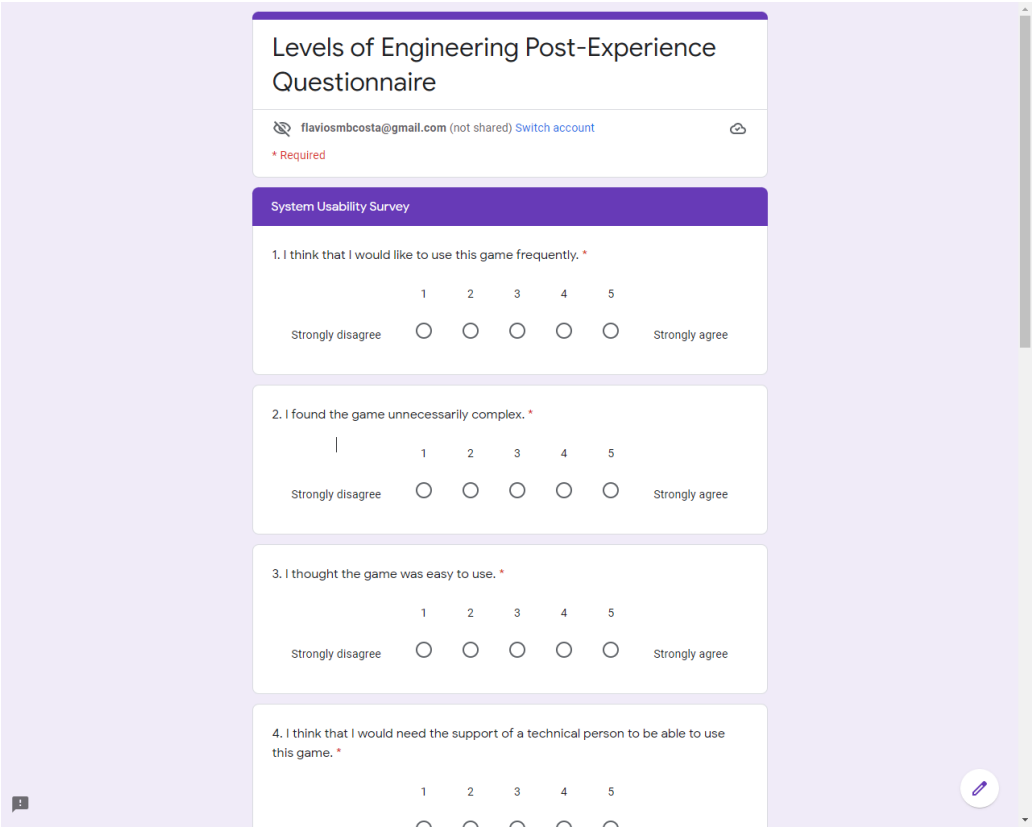

Levels of Engineering Post-Experience Questionnaire

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* Required

System Usability Survey

1. I think that I would like to use this game frequently. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

2. I found the game unnecessarily complex. *

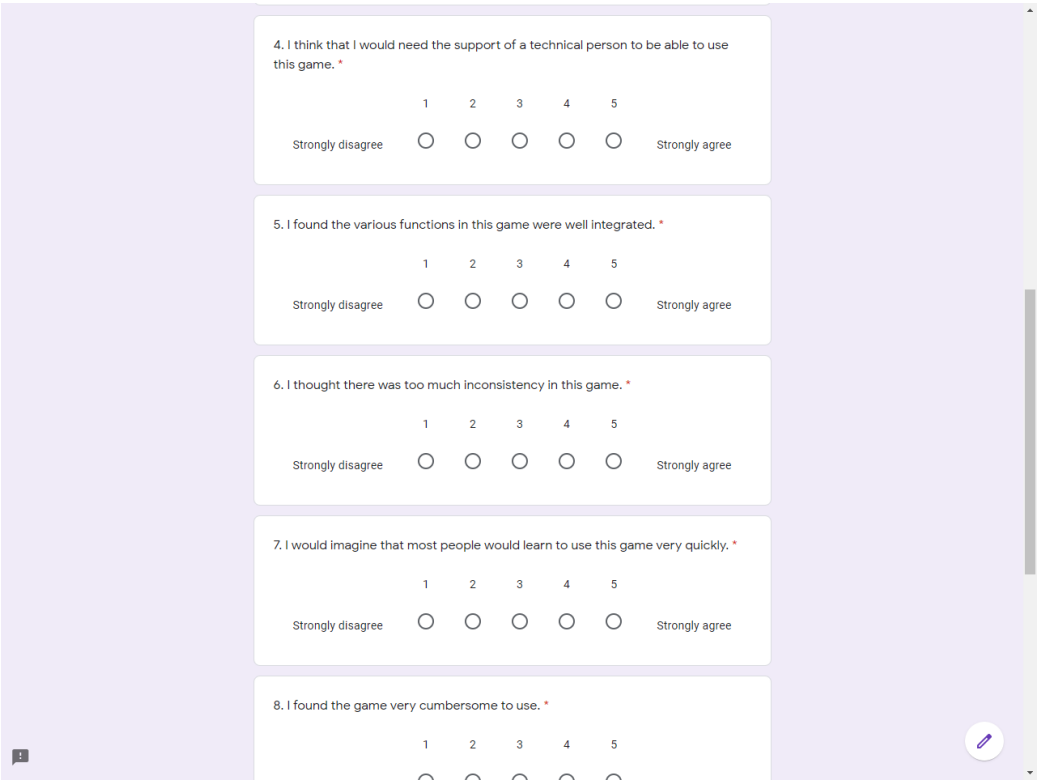
	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

3. I thought the game was easy to use. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

4. I think that I would need the support of a technical person to be able to use this game. *

1	2	3	4	5
○	○	○	○	○



4. I think that I would need the support of a technical person to be able to use this game. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

5. I found the various functions in this game were well integrated. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

6. I thought there was too much inconsistency in this game. *

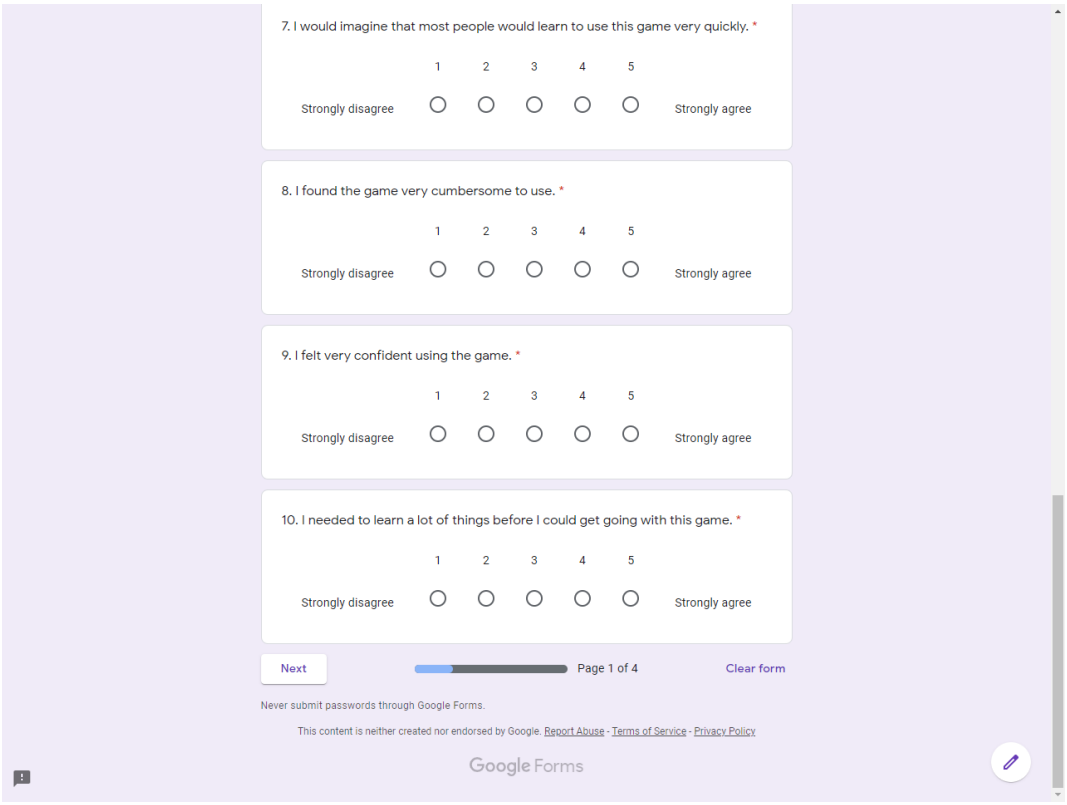
	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

7. I would imagine that most people would learn to use this game very quickly. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

8. I found the game very cumbersome to use. *

1	2	3	4	5
○	○	○	○	○



7. I would imagine that most people would learn to use this game very quickly. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

8. I found the game very cumbersome to use. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

9. I felt very confident using the game. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

10. I needed to learn a lot of things before I could get going with this game. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Next Page 1 of 4 Clear form

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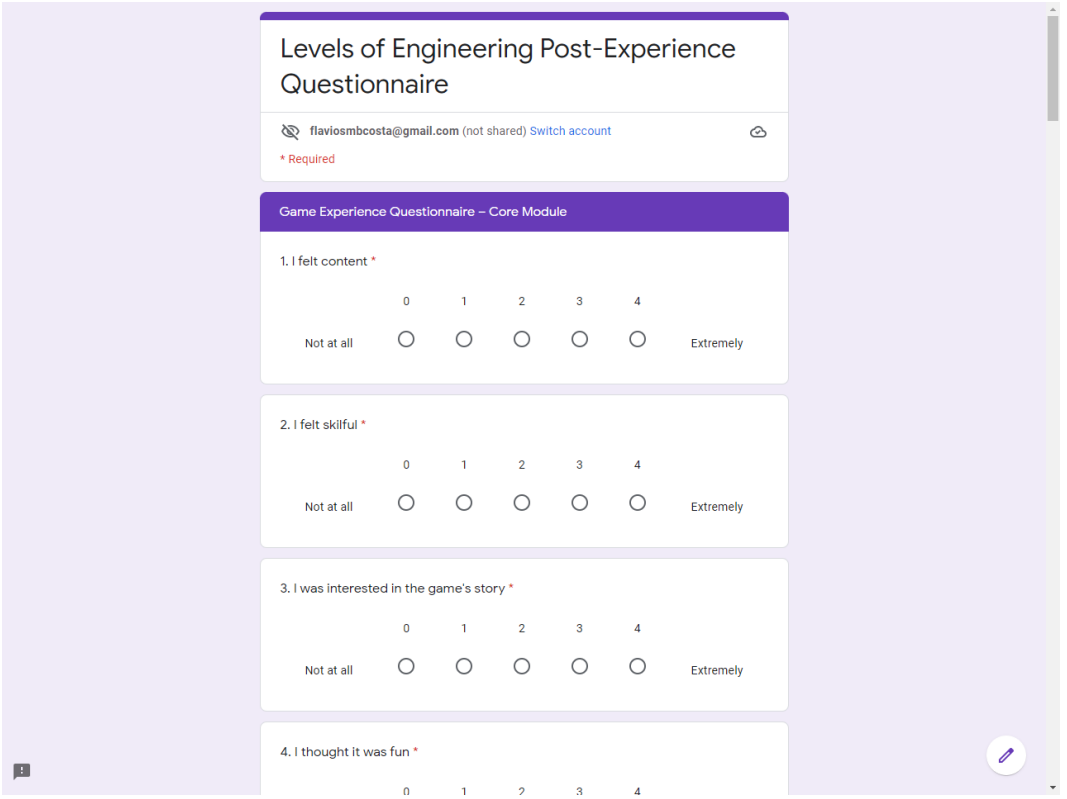

Levels of Engineering Post-Experience Questionnaire

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* Required

Game Experience Questionnaire – Core Module

1. I felt content *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

2. I felt skilful *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

3. I was interested in the game's story *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

4. I thought it was fun *

0	1	2	3	4

4. I thought it was fun *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

5. I was fully occupied with the game *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

6. I felt happy *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

7. It gave me a bad mood *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

8. I thought about other things *

	0	1	2	3	4	
	○	○	○	○	○	

8. I thought about other things *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

9. I found it tiresome *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

10. I felt competent *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

11. I thought it was hard *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

12. It was aesthetically pleasing *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

13. I forgot everything around me *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

14. I felt good *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

15. I was good at it *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

16. I felt bored *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

17. I felt successful *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

18. I felt imaginative *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

19. I felt that I could explore things *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

20. I enjoyed it *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

21. I was fast at reaching the game's targets *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

22. I felt annoyed *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

23. I felt pressured *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

24. I felt irritable *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

25. I lost track of time *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

26. I felt challenged *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

Not at all	○	○	○	○	○	Extremely

27. I found it impressive *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

28. I was deeply concentrated in the game *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

29. I felt frustrated *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

30. It felt like a rich experience *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

31. I lost connection with the outside world *

30. It felt like a rich experience *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

31. I lost connection with the outside world *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

32. I felt time pressure *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

33. I had to put a lot of effort into it *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

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Levels of Engineering Post-Experience Questionnaire

flaviosmbcosta@gmail.com (not shared) Switch account

* Required

Game Experience Questionnaire – Post-Game Module

1. I felt revived *

	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

2. I felt bad *

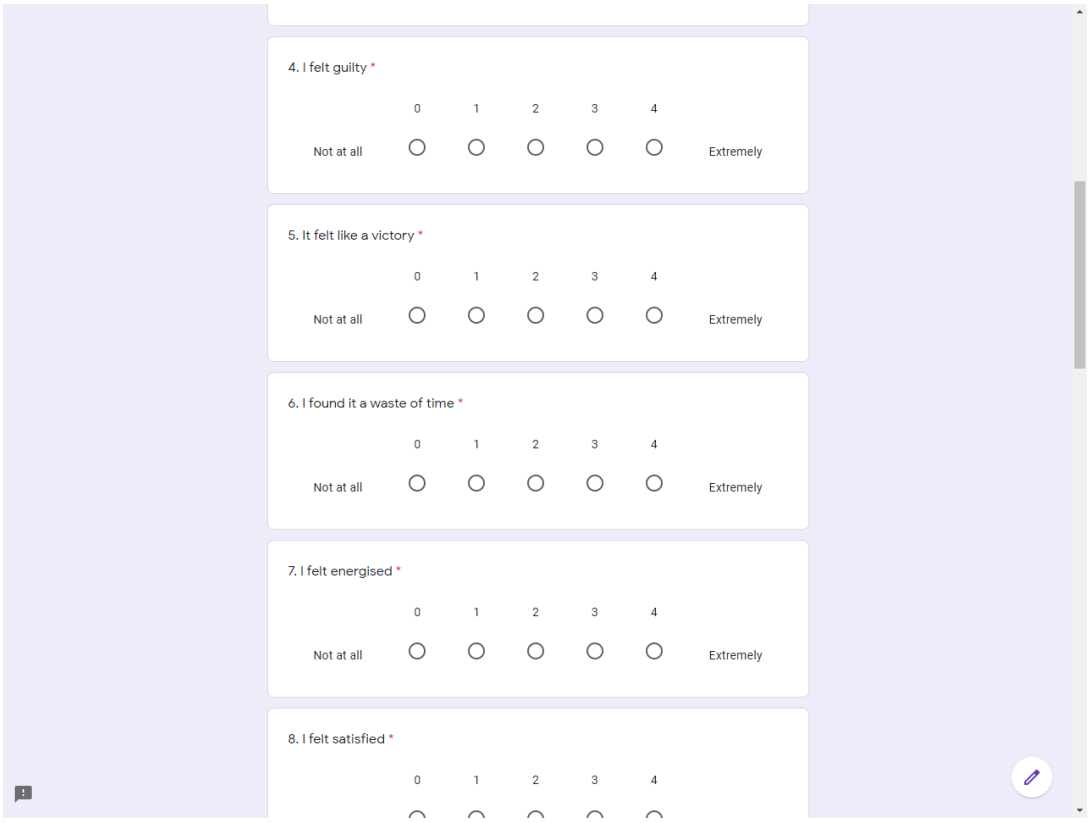
	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

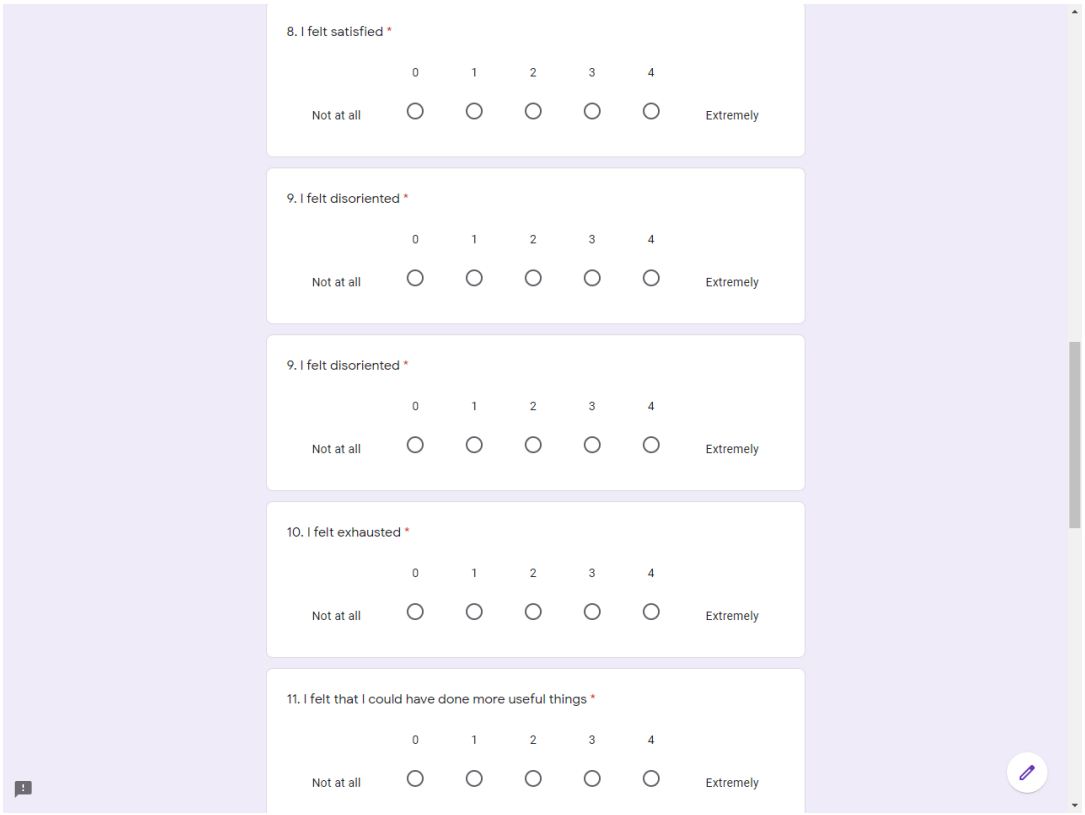
3. I found it hard to get back to reality *

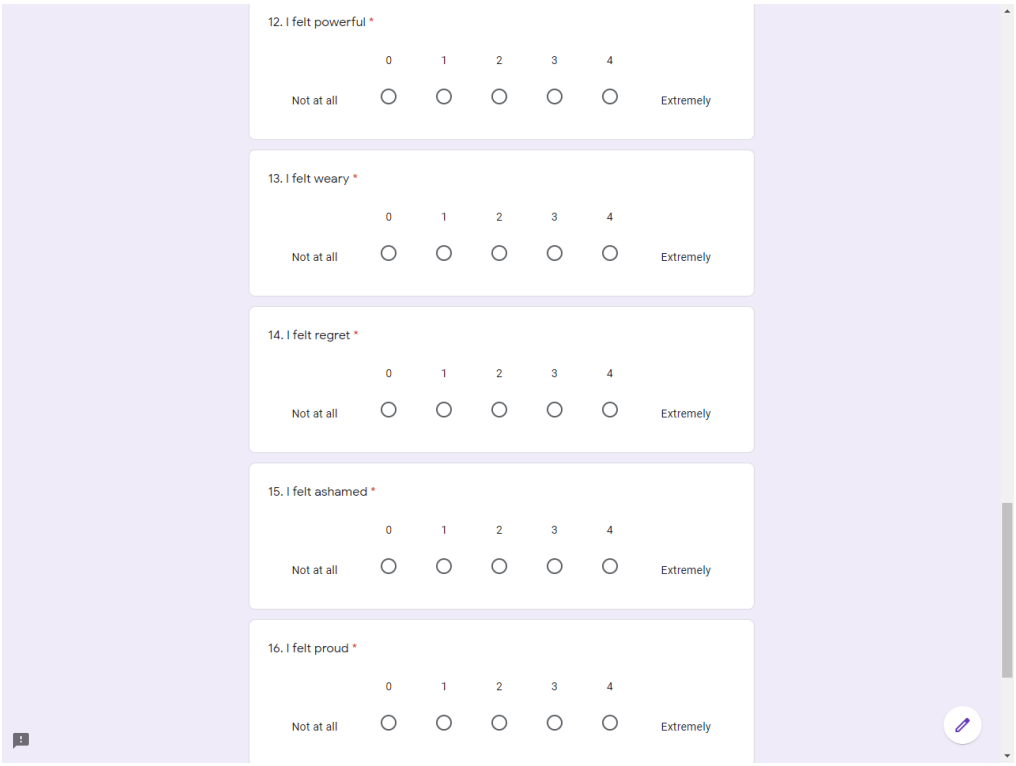
	0	1	2	3	4	
Not at all	○	○	○	○	○	Extremely

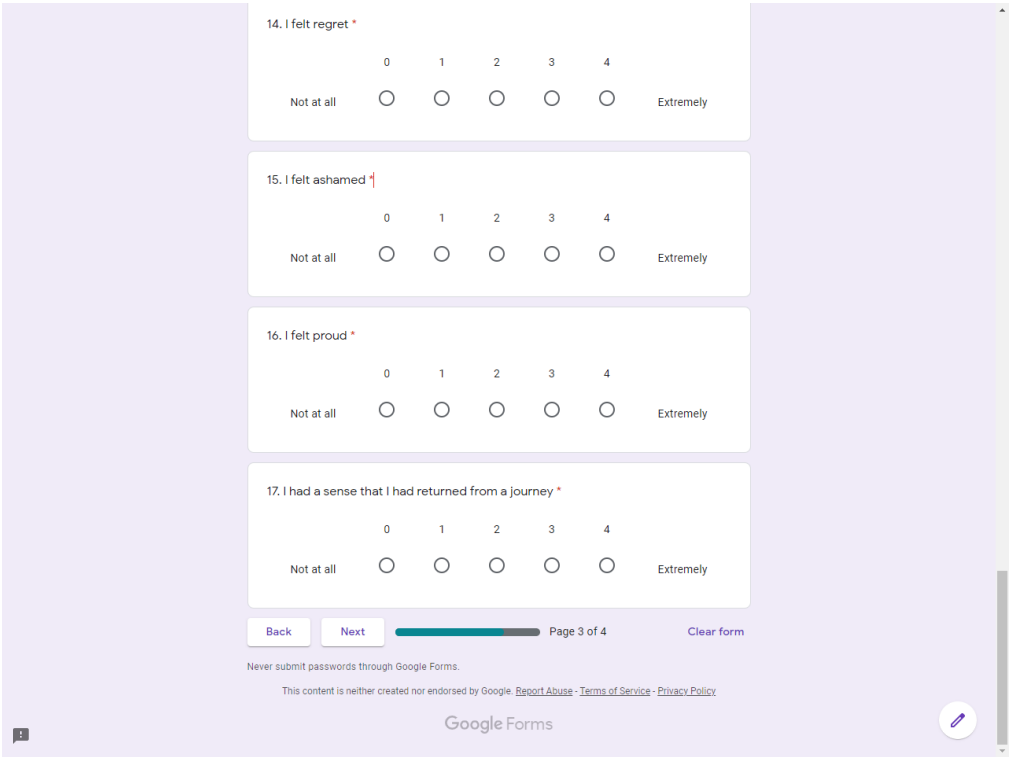
4. I felt guilty *

0 1 2 3 4


4. I felt guilty *
0 1 2 3 4
Not at all
Extremely
5. It felt like a victory *
0 1 2 3 4
Not at all
Extremely
6. I found it a waste of time *
0 1 2 3 4
Not at all
Extremely
7. I felt energised *
0 1 2 3 4
Not at all
Extremely
8. I felt satisfied *
0 1 2 3 4


8. I felt satisfied *
0 1 2 3 4
Not at all
Extremely
9. I felt disoriented *
0 1 2 3 4
Not at all
Extremely
9. I felt disoriented *
0 1 2 3 4
Not at all
Extremely
10. I felt exhausted *
0 1 2 3 4
Not at all
Extremely
11. I felt that I could have done more useful things *
0 1 2 3 4
Not at all
Extremely


12. I felt powerful *
0 1 2 3 4
Not at all
Extremely
13. I felt weary *
0 1 2 3 4
Not at all
Extremely
14. I felt regret *
0 1 2 3 4
Not at all
Extremely
15. I felt ashamed *
0 1 2 3 4
Not at all
Extremely
16. I felt proud *
0 1 2 3 4
Not at all
Extremely


14. I felt regret *
0 1 2 3 4
Not at all
Extremely
15. I felt ashamed *
0 1 2 3 4
Not at all
Extremely
16. I felt proud *
0 1 2 3 4
Not at all
Extremely
17. I had a sense that I had returned from a journey *
0 1 2 3 4
Not at all
Extremely
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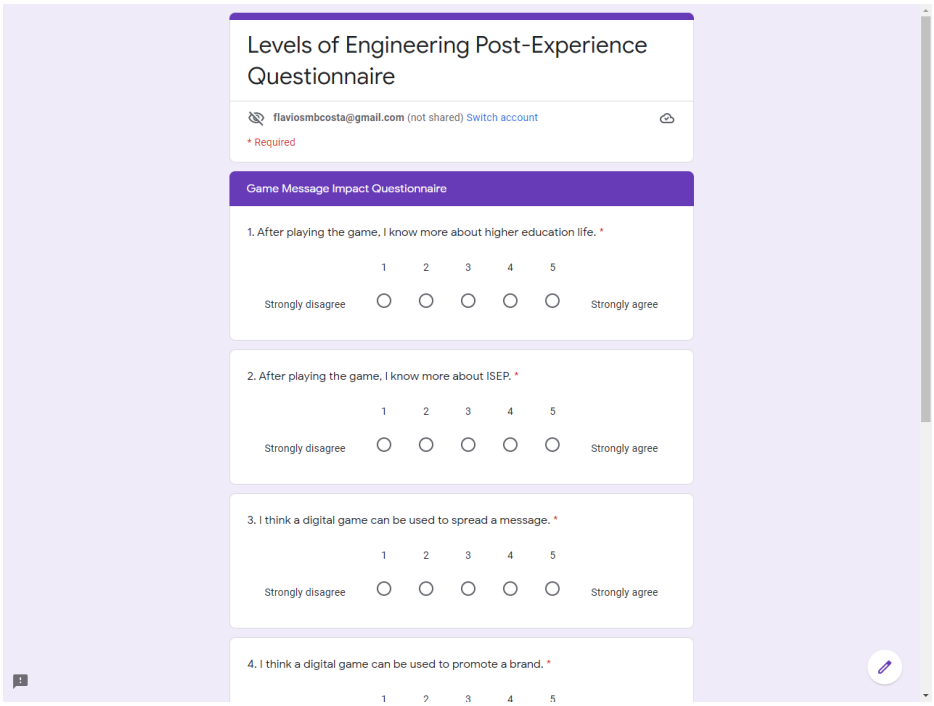
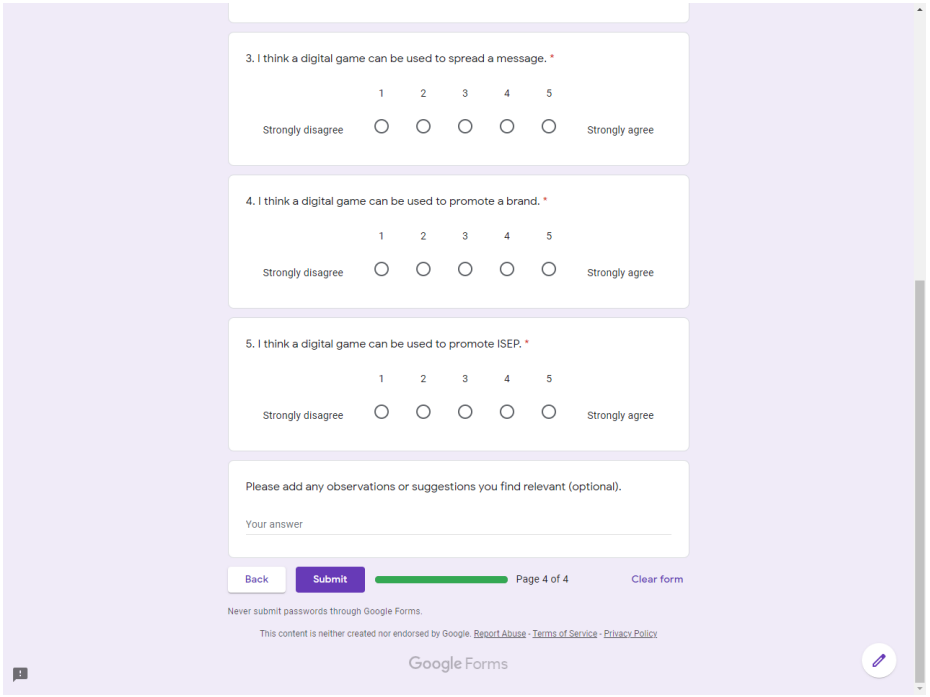

Levels of Engineering Post-Experience Questionnaire
flaviosmbcosta@gmail.com (not shared) Switch account
* Required
Game Message Impact Questionnaire
1. After playing the game, I know more about higher education life. *
1 2 3 4 5
Strongly disagree
Strongly agree
2. After playing the game, I know more about ISEP. *
1 2 3 4 5
Strongly disagree
Strongly agree
3. I think a digital game can be used to spread a message. *
1 2 3 4 5
Strongly disagree
Strongly agree
4. I think a digital game can be used to promote a brand. *


3. I think a digital game can be used to spread a message. *
1 2 3 4 5
Strongly disagree
Strongly agree
4. I think a digital game can be used to promote a brand. *
1 2 3 4 5
Strongly disagree
Strongly agree
5. I think a digital game can be used to promote ISEP. *
1 2 3 4 5
Strongly disagree
Strongly agree
Please add any observations or suggestions you find relevant (optional).
Your answer
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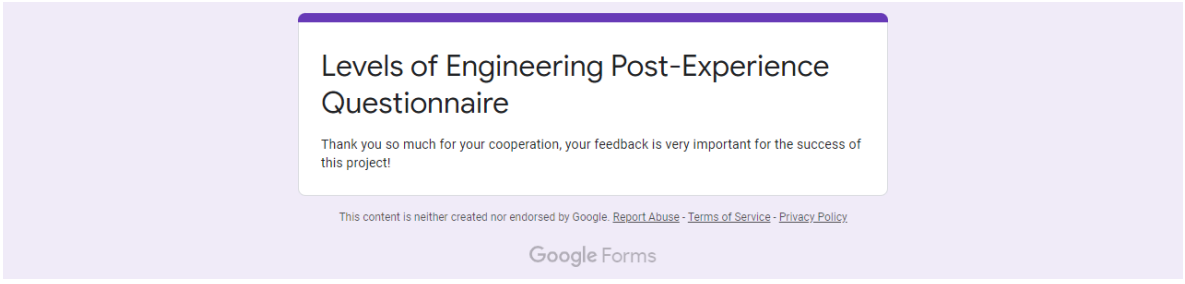
Levels of Engineering Post-Experience Questionnaire
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1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4	5
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13 Annex 5 – Analytics Results

Damage Source	Amount of Damage Inflicted
enemy1.1	36
enemy1.2	3
enemy1.3	6
deathzone1.1	14
deathzone1.2	17
deathzone1.3	18
deathzone1.4	10

Interactable	Number of times interacted
aeISEP	25
Lab	23
Library	18
Office	11
Focus Group	26
TeacherAE	24
TeacherME	14

Damage Source	Amount of Damage Inflicted
enemy2.1	5
enemy2.2	8
enemy2.3	7
enemy2.4	2
enemy2.5	4
enemy2.6	8
enemy2.7	2
enemy2.8	1
enemy2.9	3
enemy2.10	4
enemy2.11	6
enemy2.12	11
enemy2.13	3
enemy2.14	1
enemy2.15	6
enemy2.16	3
enemy2.17	3
enemy2.18	5
enemy2.19	3
enemy2.20	0
enemy2.21	5
enemy2.22	1
deathzone2.1	8
deathzone2.2	3
deathzone2.3	0

Interactable	Number of times interacted
aeISEP	21
Lab	27
Library	22
Office	9
Focus Group	25
TeacherCE	15
TeacherIME	17
ISEP|GO	13

Damage Source	Amount of Damage Inflicted
enemy3.1	19
enemy3.2	24
enemy3.3	18
enemy3.4	13
enemy3.5	3
enemy3.6	13
enemy3.7	12
enemy3.8	2
enemy3.9	11
enemy3.10	0
enemy3.11	4
enemy3.12	1
deathzone3.1	2
deathzone3.2	15
deathzone3.3	10
deathzone3.4	4
deathzone3.5	11
deathzone3.6	5

Interactable	Number of times interacted
aeISEP	12
Lab	45
Library	47
Office	3
Focus Group	39
TeacherB	14
TeacherChem	32