

# **Game Design for Soft Skills Teaching: A Serious Game, "Vice-Chancellor" For Graduates**

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for the achievements I have recorded thus far. . . .*

# Abstract

Serious games have the potential to transform soft skill development in both educational and professional settings. This dissertation investigates the implementation of *Vice-Chancellor*, a 2D serious game created to teach identified key soft skills relevant to today's workplace: Teamwork and collaboration, time management, problem-solving and effective communication. The study provides a solution to the current need for a more innovative learning method to better equip graduates for the labour market.

A quasi-experiment was utilised through pre and post-intervention surveys to check the effectiveness of the game in enhancing the targeted skills. By grounding the game design in Experiential Learning Theory and Social Learning Theory, and game design frameworks like 4DF, MDA and LM-GM, *Vice Chancellor* provides players with relatable decision-making scenarios that simulate challenges faced by a university vice-chancellor. During the gameplay, participants engaged in tasks that involved prioritisation and strategic decision-making, after which feedback was provided for performance reflection.

These results of the study revealed that *Vice-Chancellor*, indeed successfully improved Student soft skills across multifarious dimensions. Based on the statements of the research subjects, they are more confident in believing that they can manage tasks by setting levels of priority. They even claimed that game mechanics helped them to more deeply realise how to solve problems and work as a team. These results were drawn from the survey questions before and after the intervention.

The study confirms that serious games can serve as effective educational tools for developing soft skills, offering an interactive and engaging alternative to traditional methods. The immersive experience provided by *Vice-Chancellor* supports the development of interpersonal skills that are critical for success in professional environments. Future research will focus on refining the game's feedback mechanisms and expanding its applicability to various professional fields, maximising its potential for enhancing soft skills development.

**Key Words:** Soft Skills, Serious Games, Experiential Learning Theory, Social Learning Theory, Teamwork and Collaboration, Communication Skills, Problem-Solving, Time Management, Game Mechanics, Decision-Making, Feedback Systems Higher Education, Educational Technology, 2D Game Design.



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# **Chapter 1**

## **Introduction**

### **1.1 Background and Context**

#### **1.1.1 Understanding Soft Skills**

Soft skills are a broad range of non-technical skills that promote communication and understanding between people. They can also be described as people skills, interpersonal skills, social skills, transferable skills, and behavioural skills, amongst others. These skills are vital in various aspects of life, including educational and professional aspects. These skills include qualities like teamwork, communication, problem-solving, critical thinking, and emotional intelligence and are sacrosanct for both personal and professional development[3]. In contrast to hard(technical) skills, which are measurable, soft skills are more challenging to quantify[4]. For instance, a developer's proficiency in a programming language like Python can be measured with certifications, tests or tasks; on the other hand, soft skills such as communication are harder to quantify as there are no standard methods of measurement.

The importance of soft skills in the present world cannot be overemphasised. Reports have it that employers rate soft skills at the same level as technical skills[5, 6]. Typical examples include how strong communication abilities could enhance collaboration and customer engagement in an establishment; critical thinking skills could also enable the creation of new ideas; emotional intelligence, which involves managing one's emotions and being empathetic, is important in leadership roles that involve interactions[7]. Soft skills are not only needed in workplaces; they also help people manage their relationships, which makes them important for everyday life. For this reason, they are viewed academically as highly contributing factors of success in various endeavours[8][3].

However, due to rapid industrial evolution and further complications of working environments, the traditional system of education can hardly keep pace with the demand for soft skills[9] Hence, the urgent need for educational tools that simulate real-life scenarios, offering students immersion in the practical acquisition of these skills[10].

### **1.1.2 Hard Skills Vs Soft Skills**

Hard skills and soft skills are classified based on their nature, how they are assessed how people learn them. Hard Skills are specific, teachable abilities that are easily defined and measured. They are technical in nature and include competencies such as proficiency in programming language and mathematical abilities, amongst others. To acquire hard skills, individuals could go through formal education, training programs, certifications and hands-on experience with specific tasks or technology[11, 12]. They are frequently listed as prerequisites in job descriptions due to their measurable nature and the fact that they can easily be tested.

On the Other hand, Soft Skills are less tangible and difficult to measure. They are skills like communication, teamwork, decision-making, problem-solving, time-management, and stress management, amongst others. Research has indicated that soft skills develop over time through experience, social interactions and reflective practice[13, 9]. Soft skills are not industry-specific, rather, they are applicable across various roles and context in both work settings and personal life. This universality makes them highly valuable in workplaces as they enable individuals to interact effectively with colleagues, manage situations, adapt to changes and increase productivity. This has been proven by sources that find that employers value these skills because they are needed to maintain harmony and enhance employee engagement[14]. As a result, employers and institutions recognise the need to prepare students and employees for success by having a balance of both soft skills and hard skills. By creating an enabling environment for soft skill development, educational programs can help individuals build a solid foundation for easy navigation of the complexities of the modern workplace and personal career development[3].

### **1.1.3 Using Games in Education**

Applying games to education, sometimes known as "gamification" or "serious games", has become a viable instrument for improving education in general(see chapter 2.3). Games, as opposed to traditional techniques, provide learners with interactive and captivating experiences that can enable students to have fun whilst learning effectively. Through immersive, practical experiences, educational games are made to impart specific knowledge or abilities. They frequently include components like challenges, prizes, feedback, and points, amongst others, which can motivate students and maintain their interest in the learning materials[15].

Games used in education have a big advantage in that they can model real-life within safe boundaries. Such a setting allows students to practice and apply knowledge within an environment that nearly precisely imitates a real-life scenario that they might eventually face. A suitable example is when games are designed to provide players with virtual offices, where they can make interactions like they would in real life[16]. Real Experiences like this have the potential to improve individual soft skills in ways that conventional methods don't. In the same fashion, games provide players with immediate feedback on things like scores, points, grades, and levels, which are vital ingredients for reflective learning. With this, learners can reflect on their actions and inaction, thereby helping them to master and gain a deeper understanding

of the targeted skills. When players enjoy the game, chances are, they lose track of time and replay as much as they can, giving them a continuous learning cycle[17]. Furthermore, games with features that enable multiplayer functions and virtual team play could increase a player's awareness of team spirit, which again proves vital for teaching soft skills.

From what has been said, we can deduce that games, due to their interesting nature, can be used to teach soft skills. Nevertheless, we must note that for them to be effective teaching tools, they must be designed and implemented carefully. This requires clearly laid-out learning objectives with certain game mechanics relevant to expected outcomes[18].

## 1.2 Problem Statement

The need for university students to possess soft skills, in addition to technical skills, is highly significant in today's competitive labour market[19]. However, traditional university education places excessive emphasis on hard skills, which creates a significant void in the development and assessment of soft skills[20]. Studies have indicated that traditional methods such as, *classroom instructions*[21], *workshop and seminars*[9] are insufficient to engage students adequately as well as capturing the dept of experiential learning necessary for soft skill development[22]. Although they are effective in terms of background knowledge, these traditional methods only end up providing students with a superficial understanding of these crucial skills, which does not effectively translate into real-world application[3].

The gaps we have pointed out pose a threat to the success of graduates who are transitioning into a workforce, where recently, more emphasis are being placed on soft skill acquisition[9]. Scholarly works have shown that graduates frequently lack the crucial soft skills needed to thrive in complex professional environments, impacting their employability negatively[23]. For this reason, it is safe to say there is an urgent need for better teaching methods in terms of soft skill development.

To remedy this challenge, *Serious Games* can be integrated into university programs. They provide players with platforms that look real and if tailored properly, they can be very useful as instructional materials. Serious games also present valuable opportunities for students to actively practice and internalise soft skills, closing the gap between theoretical knowledge and repetitive practices[10]. Despite how promising serious games are in education, they are not being used enough in higher education to meet the requirements of learning soft skills.

## 1.3 Research Aim and Objectives

The primary focus of this research is to implement a 2D serious game designed to teach identified soft skills in high professional demand(*chapter 2.1.1*). The game will be named *Vice-Chancellor* and will incorporate prominent Learning theories with game design frameworks to demonstrate how effective SG are when it comes to preparing graduates for their aspired workplaces.

To achieve this aim, some specific objectives have been set out;

## **1. Introduction**

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1. To develop a 2D Serious game through the incorporation of Learning theories and game design frameworks.
2. To implement game mechanics in the serious game with a focus on decision-making and to determine its impact on the targeted soft skills.
3. To evaluate the effectiveness of the Serious Game *vice-Chancellor* in Teaching Teamwork and Collaboration, Effective Communication, Problem-solving and Time Management.

### **1.4 Significance of the Study**

The significance of this study is strengthened by its focus on the pressing needs we have previously mentioned. It addresses the shortcomings of traditional teaching methods when it comes to soft skills development. Academic institutions are notable for using methods like classroom lectures, seminars, and mentorship programs, amongst others, which are not potent enough to impart non-technical skills. Unlike Serious games, these methods do not provide hands-on experience that enables students to practice what they have learned repeatedly. This study is indeed important at this time as it delves deep into multiple facets of learning, with comprehensive use of best practices to ensure that they are relevant to soft skill development. The outcomes of this research weigh heavily on higher education, where preparing students for the labour market is a primary focus and might be useful for professionals who are looking to refine their interpersonal skills.

The findings underscore SG's potential to create a multifaceted environment that encourages active engagement, deep reflection, and practical application of soft skills. As the game design replicates possible challenges faced in workplaces, it has the potential to offer students opportunities to develop their soft skills more efficiently. Further, the study provides a deep analysis of empirical evidence on SG effects, which makes it contribute to educational inquiries for more effective teaching methods. The results we get from this rich study could totally transform university curricula by encouraging institutions to integrate serious games into programs.

### **1.5 Research Questions**

1. How can a 2D serious game be designed to effectively teach soft skills among university students?(RQ1)
2. What game mechanics, educational theories and frameworks are most effective in fostering engagement within a 2D game environment?(RQ2)

### **1.6 Dissertation Structure**

Moving forward, this dissertation is structured as follows:

**Chapter 2** enriches this study with a critical review of how serious games are developed. It explores relevant learning theories and other evidence that supports the use of educational games for soft skill development.

**Chapter 3** gives a description of the design and implementation of the serious game *Vice-Chancellor*. It discusses the game structure, mechanics, advisor personalities, scoring systems and development challenges faced during its creation process.

**Chapter 4** details the research design, sampling methods, data collection techniques and frameworks that guide the development and evaluation of the game.

**Chapter 5** presents the results of the study, including statistical analysis of the intervention data. It highlights the changes observed in participants' soft skills and provides insight from their feedback on game engagement and mechanics.

**Chapter 6** discusses the findings in relation to the research questions and existing literature. It looks into how the game enhanced the development of soft skills and offer practical implications in a broader context.

**Chapter 7:** Concludes the dissertation by summarising key findings. It highlights the limitations of the study and gives recommendations for future research that aim to adopt this innovative method of soft skill development.

## 1.7 Conclusion

This research lies at the juncture of two strong demands: the growing need for soft skills in today's workplaces and the inability of traditional methods to satisfy the said demands. The study aims to add one more innovative solution to an ever-widening gap in higher education by developing a 2D serious game intended to enhance key interpersonal skills. Clear goals based on educational theory and game mechanics make this project not just an issue of trying to immediately address an educational problem but also have wider implications for how universities can better prepare the graduate for the complexities facing many professional environments today. The following chapters will now build on this foundation, offering an in-depth analysis with regard to theoretical perspectives, relevant previous research, and design considerations informing the creation of the *Vice-Chancellor* game.

# **Chapter 2**

## **Literature Review**

### **2.1 Evolution of Soft Skills**

The conceptualisation of soft skills have transformed significantly since the term was first introduced. The phrase "soft skills" was officially introduced by Paul G. Whitmore in the U.S. Army at the Continental Army Command (CONARC) Soft Skills Training Conference in December 1972[24]. This event, which took place at the U.S. Army Air Defence School in Fort Bliss, Texas, focused on distinguishing "soft" skills like leadership and interpersonal skills from "hard" technical skills that require the use of machines. This conference marked the start of the Organised examination and instruction of soft skills in military contexts, which later impacted wider educational and corporate training settings. Paul acknowledged Soft skills as essential non-technical abilities for effective leadership and teamwork, especially in military training. These skills were compared with hard skills e.g., operating military vehicles, which are specific and measurable technical skills for specific tasks[25].

With the passage of time, as the global workforce adjusted towards industries that are service-oriented and knowledge-based, the importance of soft skills have grown. This has resulted in the persistent emphasis on skills such as communication, adaptability and emotional intelligence, which are now seen as vital to both individual success and Organisational success.

The definition of soft skills continued to broaden to accommodate a wide range of competencies that stretched beyond regular interpersonal skills. Explicitly, emotional intelligence, once not taken seriously, has gained traction as a vital component of effective leadership and teamwork[26]. This concept by Coleman hits on the ability to recognise and manage emotions, both one's own and those of others. Emotional intelligence has been linked to higher job satisfaction in professional settings, making it a key focus in educational training. beyond emotional intelligence, the modern perspective also recognises soft skills traits such as adaptability, creativity, and problem-solving, in addition to traditional interpersonal skills[6]. These attributes are valued by individuals as they enable them to respond effectively to change and be innovative in their roles; they reflect the understanding that success in the workplace is not solely dependent on technical knowledge but also the ability to apply this knowledge. This broadened

recognition has highlighted notable challenges in how these skills are taught and accessed. Soft skills are innate in nature, and this makes learning them require an experiential-based learning approach[27][28]. This need underscores the limitation of conventional teaching methods and has sparked interest in more interactive and immersive training tools.

Additionally, despite the growing demand from employers for graduates with robust skills, educational institutions still prioritise technical skills, resulting in a skill gap in the labour market[23]. This gap is especially apparent in industries like engineering, technology, and finance, where having the necessary technical abilities is essential but insufficient without the corresponding interpersonal skills.

### 2.1.1 Identified Soft Skills Necessary for Career Success

There are several soft skills that have been identified by various research works and are deemed necessary for career success. However, for the purpose of this study we will be discussing some of the most crucial ones. These include *Effective communication, Teamwork and collaboration, Problem-Solving and Time-Management*.

**Effective Communication** is simply the ability to convey information clearly and effectively. It can be propagated by verbal, non-verbal or written means, ensuring that messages are understood as intended. In professional settings, effective communication is deemed as a top skill required by employers as it facilitates teamwork, relationship building and smooth operations[3]. In the context of leadership roles, it is also deemed vital for leaders to inspire and motivate their teams effectively[13].

Effective communication consists of various components including *active listening, clear articulation and adaptability*. Active listening involves concentrating on what is being said, understanding it and responding thoughtfully, which are crucial for building trust and collaboration. Clear articulation involves expressing ideas in a straightforward manner, which ensures messages are easily understood, whilst adaptability is the ability to adjust one's communication style based on audience. Applying these ingredients in communication makes it effective.

**Teamwork and Collaboration** as the words connote, involve working together to achieve common goals and involves sharing responsibilities, cooperating, and solving conflicts. It is another highly valued attribute by employers that increases productivity and innovation whilst boosting employee satisfaction[23]. In their paper, Alromari et al. [29] puts it that teams that collaborate effectively are more likely to realise their goals while maintaining high morale. Some key components of teamwork and collaboration include *cooperation, conflict resolution, and responsibility sharing*. Cooperation refers to the act of working jointly with others in cooperation toward common goals; this is very instrumental in building a positive work environment and ensuring all persons in the team have focused their eyes on achieving organisational goals. Conflict resolution describes the procedure of constructively managing disagreement. Harmony in a team is maintained without any bad influence on performance by disputes. Responsibility sharing involves delegation according to the strengths and competencies of

every member of the team, so work is spread around impartially, where all contribute to the successful completion of the task.

**Problem Solving:** is the act of identifying issues, analysing situations and finding solutions that are effective; a skill that one must possess to make informed decisions. This skill is one of the most important soft skills crucial to workplace as it affects the ability for organisations to operate efficiently. Studies emphasise that employees with good problem-solving abilities are to a great degree, better capable of handling unforeseen difficulties and thus, promoting the growth and resilience of the organisation.[28]. Effective problem-solving links with better decision-making, which is necessary for leadership and strategic planning[30]. There are key components that makeup problem-solving skills: *critical thinking, creativity, and decision-making*.

Critical thinking is "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action"[31]. On the other hand, *creativity* can be defined as the ability to generate ideas that are unique and appropriate within specific contexts[32]. In terms of decision-making, it typically involves "choosing between two or more courses of action"[33] when presented with challenges. It refers to the activity including the determination of alternatives and selecting one or more, based on the decision-maker's preferences, values, and beliefs. In all, these terms we have defined are ones to be honed effectively if an individual or organisation aims to solve problems in an efficient manner.

**Effective Time Management** Aeon et al. (2021)[34] in their meta-analysis, defined time management as a form of making decisions to "structure, protect and adapt individual time to changing condition". In order to keep up with deadlines and manage workload, people must possess these skills, especially in present times where activities are expected to be done on time. On the same note, studies prove that good time management results in being more productive with less stress and improvement of job satisfaction[35]. Additionally, being able to manage time is a serious consideration for advancing one's career[36]. The main ingredients that form time management techniques include *prioritisation, organisation, and goal setting*. Prioritisation involves determining most vital tasks, concentrating first on these so that they are completed on time while effectively managing available resources. *Organisation* is the process of structuring tasks and activities in such a way that maximum productivity is obtained. It consists of making schedules, breaking tasks down into manageable steps, and arranging resources to stay on track.

## 2.2 Theoretical Framework For Learning

To cultivate soft skills effectively, studies "must be intertwined"[37] in essential learning theories. Although there exists many applicable theories, among the most relevant are Experiential Learning Theory(ELT) and Social Learning Theory (SLT). These theories illuminate the processes through which individuals acquire soft skills and also lay the groundwork for designing effective educational tools.

### 2.2.1 Experiential Learning Theory(ELT)

ELT was introduced by David Kolb in 1984[38] and revised in 2014 and has been evidenced as a cornerstone in the study of how people learn and refine their skills through experience. The study proposes that learning is an iterative process that encompasses four stages: *concrete experience, reflective observation, abstract conceptualisation, and active experimentation*[38]. It suggests that individuals learn through real-world/concrete experience, reflect on their outcomes, and apply learned insight actively. Another study in 2012 illustrates the effectiveness of ELT in medical education, where students developed effective communication and teamwork skills by participating in a simulated clinical experience[39]. To apply concrete experience, students interacted with standardised patients in a simulate environment; after this, they engaged in reflective observation by reflecting on their experiences guided by instructors. Students then engaged in active experimentation by using the insight gained from reflection to develop new strategies for further application. The success of this approach, underscored the value of EI in medical education and can be translated to the context of soft skills.

### 2.2.2 Social Learning Theory(SLT)

Another important learning framework that can be useful to this study is SLT which was formulated in 1977 by Albert Bandura[40]. The components of SLT are *observation, imitation and modelling* as significant processes in learning. It suggests that individuals can learn effectively by observing others and replicating behaviours that lead to successful outcomes. A demonstration of SLT can be found in Bandura's Bobo Doll Experiment in 1961. In this experiment, children observed an adult model behaving aggressively towards a Bobo doll, and they found that children who engaged in this were more likely to imitate the behaviours they observed. SLT's components were further broken down into, *attention, retention, reproduction and motivation*. This means that individuals must pay attention to the behaviour being modelled. They must then remember what they have observed after which they are expected to reproduce these behaviours. Finally, with the influence of rewards or consequences, individuals must be motivated to perform these behaviours. This theory provides a concrete background for learning and can be transferred to include the components of a serious game.

## 2.3 Gamification and Serious Games as Education Tools

Before delving into the application of these theories in educational games, it is important to clearly define the relationship between games and gamification, and also connect them with educational tools.

The concept of serious games originated with Clark Abt in his 1970 book, who referred to serious games as games with "an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement"[41]. Over time, as the field of technology has evolved. In 2005, Michael and Chen in their exploration of game design, defined serious

games as those that "educate, train, and inform" in fields such as healthcare, military, education, and corporate training[42]. This broad definition, explains how versatile serious games are in addressing learning objectives in various fields. Notable examples of serious games include *Compete!*, *Minecraft*, *Global Manager*, and *Among the office criticality(AOC)*(See section 2.5.4). They go beyond pure entertainment and are recognized as "serious games that change the world"[43].

Slightly similar, the process of integrating game elements(e.g., points, score, rating, Dashboard) into non-game settings is known as *gamification*. According to Li et al.[44], gamification holds significant potential for enhancing teaching and learning, prompting the need for further exploration. An example of gamification in education could be a lecturer implementing a point system for assignments, offering additional points for early submissions or rewarding group members who contribute more[45]. This application of game elements encourages student engagement and aligns with the principles of gamification.

Overall, serious games empower users to actively participate in decision-making and problem-solving activities through immersing learners in virtual platforms that mirror real-world professional scenarios. This interactive process is aimed at increasing engagement and enhances the practical application in ways that traditional methods fall short of achieving[16].

### 2.3.1 Key Applications of Serious games as Educational tools

Serious games have been implemented successfully across various educational contexts, highlighting their potential to improve learning outcomes.

One notable example is *Foldit*, a game created by the University of Washington, which enables players to contribute to scientific research by solving intricate protein-folding puzzles[46]. Players interact with the protein models using tools that allow them to pull, twist, and tweak the protein chains, aiming to minimize energy levels and maximize stability. In addition to educating players in molecular biology, *Foldit* has led to substantial scientific discoveries, including the identification of new protein structures related to AIDS-like viruses. This is a remarkable work that highlights the need for the application of serious games in education.

Another more widely recognized example is *Minecraft: Education Edition*[47]. This modified version of the popular sandbox game specifically becomes an educational version in training. *Minecraft* nurtures collaboration and problem-solving techniques among students, who can now work in the same virtual space. After that, it gives the students the ability to create and later tests their creations so as to give the student feedback to which they can iteratively learn from. Above all, instructors are able to adjust *Minecraft* for various subjects, hence adapting it to a multitude of multiple educational objectives. Such kind of flexibility allows players to work with abstract concepts concretely, making it formidable in terms of developing soft skills[48].

One more example that fits into this category is *Duolingo*, a language-learning game that has been acknowledged academically for its ability to teach new languages through gamified lessons[49]. It utilises point scoring, levels, and rewards to incentivize learners as they are taken through exercises structured to deliver vocabulary, grammar, and pronunciation. Several studies

have demonstrated the feasibility of *Duolingo* to attain language proficiency. They came to a conclusion that 34hrs of study on average is the same as a whole semester of university course in language[49]. Others realize that a mix of point-scoring and rewards helps learners maintain their engagement[50][51]. In comparison to traditional methods lacking these components, Duolingo further strengthens the argument that serious games are effective in educational settings.

Overall these games further supports the claim that games are effective for skill development. Following, we will delve a little deeper into learning in serious games, highlighting useful theories that are relevant to this context.

## 2.4 Learning In Serious Games

It is well documented that Serious games can be conducive to greatly improve learning through the incorporation of Experiential Learning Theory (ELT) and Social Learning Theory into their design and application. By infusing direct experience and subsequent reflection, Serious games could leverage on ELT to improve learning outcomes[16]. In the context of medical simulations, players engage in hands-on experience and receive constructive feedback to enhance their learning. Similarly, SLT is evident in serious games through the encouragement of observation and limitation, which enables others to learn from others' actions in a collaborative setting[52]. Games that teach soft skills in a team-based setting, serve as an illustration of this, as players have to collaborate to solve problems. These applications collectively create a conducive learning environment that effectively nurtures the learning of soft skills.

*Experiential Learning in Serious Games* Using games for education with the use of ELT provides a deeply engaging way for learners to actively participate in realistic tasks and the application of new strategies. By guiding learners to foster reflection, serious games align with the experiential learning cycle and offer immediate consequences for in-game decisions, leading to deeper understanding and improved knowledge retention[53]. For example, a study demonstrated that medical students who engaged in a simulated patient interaction in serious games exhibited enhanced clinical skills through continuous feedback and practice[54]. The interactive nature of educational games ensures that players are not mere passive recipients but active participants in the learning process. By learning through concrete experience, reflective observation, abstract conceptualisation, and active experimentation, serious games can potentially facilitate deeper understanding and retention.

### *Social Learning Theory In Serious Games*

Employing SLT in serious games could be done by integrating challenges that require players to be collaborative and team players in order to develop good communication skills[55]. A Serious games designed for healthcare professionals, requiring teams to diagnose and treat virtual patients, have been found to enhance clinical competencies and promote the establishment of shared mental models, contributing to improved real-life performance[56]. The collaborative nature of this games create a friendly environment for sense of community and results in a high level of engagement required to develop interpersonal skills[57]. For example, a serious

game intended to teach team work could include a scenario challenge where the players will be involved in communities to work together to achieve a goal of sustainability. That is, all decisions made should be a collaborative effort to make sure that their decisions are sustainable to their environment. This is a feasible way of integrating SLT to serious games.

By integrating ELT and SLT into their mechanics, serious games offer a well-rounded and immersive approach to developing soft skills, creating opportunities for experiential learning and engagement. This holistic design not only enhances individual learning outcomes but also equips players with the practical tools needed for real-world problem-solving and interpersonal interactions.

## 2.5 Serious Game Design Frameworks

Although there are numerous frameworks(see table 2.1) that can be used in serious game design, we have selected a few that are particularly relevant to this study for detailed discussion. While taking Learning theories into consideration, it is also crucial to blend them with frameworks that have proven effective in the design of serious Games. By matching game play dynamics with learning objectives, this integration guarantees that games are not only entertaining but also educationally valuable, improving motivation and knowledge acquisition[58]. The Four-Dimensional Framework (4DF)[59], Mechanics-Dynamics-Aesthetics (MDA) Framework, Learning and Mechanics-Game Mechanics (LM-GM) are a few that I have found to be very important and helpful for this study. These frameworks provide thorough methods for developing serious games that skilfully combine educational goals with captivating game-play.

Table 2.1: Summary of SG Design Frameworks

SG Design Framework	Core Components	Framework Category	Academic Advantages	Citation
Four-Dimensional Framework (4DF)	Context, Learner Specification, Pedagogy, Representation	Contextual and Pedagogical Design	Ensures alignment of game elements with educational objectives, facilitating relevant and engaging learning experiences through context-specific designs.	[59]

Table 2.1: (continued)

SG Design Framework	Core Components	Framework Category	Academic References	Advantages	Citation
Mechanics-Dynamics-Aesthetics (MDA)	Mechanics, Dynamics, Aesthetics	Player-Centric Experience Design	Provides a systematic approach to designing engaging games by focusing on player experiences and emotional responses, enhancing engagement and motivation.	[1]	
Learning Mechanics-Game Mechanics (LM-GM)	Learning Mechanics, Game Mechanics	Integrated Learning Design	Embeds educational content directly within game mechanics, promoting active learning and knowledge retention through gameplay.	[60, 2]	
ADDIE Model	Analysis, Design, Development, Implementation, Evaluation	Instructional Design	Offers a structured, iterative process for educational game development, supporting continuous refinement and adaptation to learner needs.	[61]	
Human-Centered Design (HCD)	Empathize, Define, Ideate, Prototype, Test	User-Centered Design	Focuses on designing games based on user needs and feedback, enhancing accessibility, user satisfaction, and engagement.	[62]	

Table 2.1: (continued)

SG Design Framework	Core Components	Framework Category	Academic References	Advantages	Citation
Player-Game Interaction (PGI)	User Interface, Feedback Systems, Player Choices	Interaction-Focused Design	Enhances user engagement by optimizing interaction between players and the game, ensuring intuitive controls and meaningful feedback loops.	[63]	
Game Object Model (GOM)	Game Elements, Game Structure, Game Rules	Structural Design Framework	Provides a detailed blueprint for organizing game components, ensuring consistency, coherence, and educational effectiveness in game design.	[64]	

### 2.5.1 Four-Dimensional Framework(4DF)

The 4DF for SG was introduced by Freitas and Oliver in 2006[59] as a comprehensive model for educational games. In their study, they conducted a case study analysis as to how exploratory learning through games and simulation can be effectively integrated into educational curricula. They then concluded by emphasising on the importance of prioritising *contextual relevance, learner specifics, pedagogic consideration, and Mode of representation*. in educational game designs. The contextual relevance focuses on the environment in which learning takes place, including factors like historical, political and must consider resource availability and technical support. The dimension of Learner specifications suggests that SG designs should focus on characteristics like age, learning history, styles and preferences. In the mode of representation, emphasis is laid on how games present their content, considering aspects like fidelity, interaction, immersion, and realism. Lastly, pedagogic considerations of 4DF focus on integrating learning theories, frameworks and strategies in SG to support learning practices. Scholars have acknowledged the effectiveness 4DF in SG design and its broad implications. It has been recognised as a model to "inform game design considerations" by Freitas and Jarvis who noted that this framework is used to guide the design and evaluation of serious games by considering various educational and contextual factors relevant to the game's effectiveness[65]. Another Study by

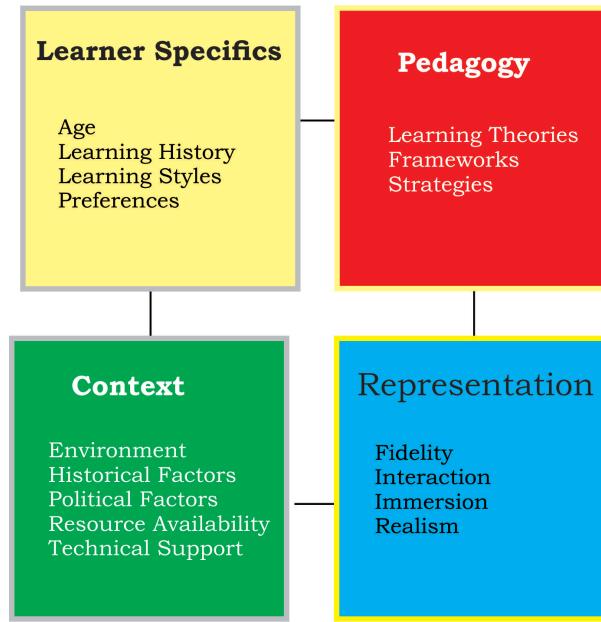


Figure 2.1: 4DF dimensions

Garris et al. that sought to explore "games, motivation and learning", laid the groundwork for the 4DF[66]. Although not exactly defined as in freitas and Olivers paper, they discussed a model that share similarities with the 4DF. They highlighted *game attributes such as fantasy, rules, goals, sensory stimuli and mystery*, an important SG component which is similar to *Mode of representation*. This model also addresses the influence of individual *learner characteristics* which can be likened to *Learner specification*.

Despite the fact that 4DF is a comprehensive model for SG designs, it is crucial to note that it is not a prescriptive methodology, rather, an initial consideration when designing educational games[65].

## 2.5.2 Mechanics-Dynamics-Aesthetics(MDA) Framework

Introduced by Hunicke et al., MDA serves as a formal approach for understanding games by connecting developers with player perspective[1]. To better analyse and design compelling gaming experiences, they offer a three-tiered approach in their seminal article that divides games into *mechanics*, *dynamics*, and *aesthetics*. The framework is designed to establish a universal terminology for designers and researchers, stressing the significance of evaluating how game components come together to create player experiences.



Figure 2.2: Mechanics-Dynamics-Aesthetics(MDA) Framework[1]

The *Mechanics* aspect pertains to the rules, formulas, and data formats that establish the fundamental framework of the game. It concentrates on the technical aspects that form the basis of the game, including scoring mechanisms, player interfaces, and game physics; The *Dynamics* component describes the run-time(System) behaviour of the game when the mechanics are in action, While The *Aesthetics* aspect focuses on the feelings and emotions that players experience, such as excitement, fun, or joy. This dimension underscores the significance of creating games that are not just practical but also evoke specific emotional responses. The effectiveness of MDA was acknowledged by Sailer et al. in designing educational games that enhance both learning outcomes and player enjoyment by balancing educational content with gameplay[67].

MDA can be utilised in diverse educational settings and for different learning goals, providing valuable insights into the complex connections among game mechanics, player interactions, and emotional responses[1].

### 2.5.3 Learning Mechanics-Game Mechanics (LM-GM) Framework

The LG-GM framework was introduced by Lim et al. in 2013 for the purpose of integrating educational concepts into enjoyable game experiences[60]. Before this introduction, Game Mechanics have been conceptually defined by numerous studies[68][69][1][70], though acceptable, these definitions in the LG-GM do not offer a primary approach that covers all of these elements[2]. This concept was then developed by Arnab et al. in 2015 as a model tailored specifically for blending learning objectives with game design. The framework addresses the alignment between *learning mechanics*-activities designed to explicitly foster educational outcomes-and *game mechanics*-the interactive parts of the games. Merging these two types of mechanics, LM-GM gives a systematic weight in the design of serious games that effectively merges gameplay and educational content.

The effectiveness of LG-Gm framework in serious game designs have been acknowledged particularly for its systematic approach to bridging educational contents with interactive game Elements. Arnab et al. describe it as a "mapping strategy" that aids in the analysis and development of serious games by ensuring that educational goals are directly supported by game mechanics [2].

Despite its strengths, the LM-GM framework is not a one-size-fits-all solution for serious game design, rather a descriptive one that guides game designs for best learning outcome.

### 2.5.4 Serious Games for Soft Skill Development

Integrating serious games into educational contexts have proven to be an effective strategy for soft skill development. Existing works have adopted common strategies to ensure their effectiveness in educating players on specific soft skills. Some of these strategies include, immersive story lines, realistic scenarios and interactions, making them entertaining whilst meeting educational objectives. These innovative solutions enable players to actively practice and refine their competencies, which has proven to be crucial for soft skills training and assessment.

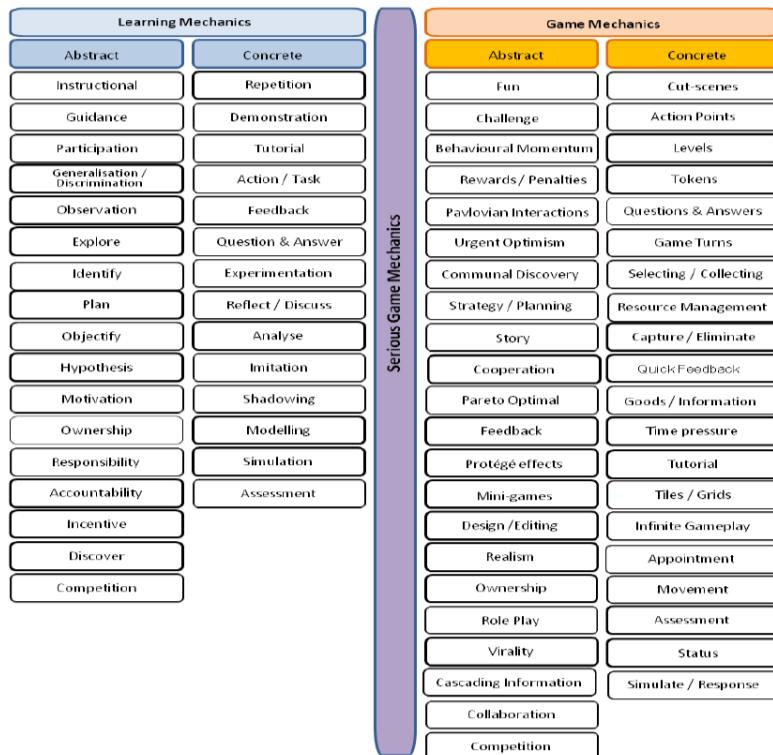


Figure 2.3: The LM-GM mapping framework[2]

### Compete![71][72]

An exemplary instance of a serious game for cultivating soft skills is *Compete!*. This 2D game video game was developed by Erasmus+ framework, a program dedicated to enriching education, training, and youth development throughout Europe[73]. The aim of compete is to instruct higher education students on the significance of soft skills in relation to employability, with focus on key competencies such as problem-solving, effective communication, stress management, and teamwork. *Compete!* is designed to captivate players in a series of decision-making tasks that reflect real-life situations. The player acts as a project manager confronted with scenarios where they must choose between two alternatives, each links with distinct outcomes. This serious game contains In-game characters that serve as counsellors that offer advice, steering players through a set of options evaluated for *sustainability* and *impact to society*. The mechanic is supported by the concept of evaluating decisions and guiding players to consider long-term consequences and ethical dimensions[74]. From there on, the players are to discuss advice given and make decisions based on their analysis regarding the given scenario. The overall underlying game design of *Compete!* shows just how decision-making and the application of soft skills matter when it comes to success in career and personal life. This project is a result of collaboration across multiple European institutions, which reflects a wide range of perspectives and its applicability in educational settings.

### Global Manager[75]

Global Manager is another serious game with capabilities to enhancing soft skills in the area of Global Software Development(GCS). This game was strategically designed to address some

challenges encountered in GSD, such as effective communication, Coordination and Control across culturally different teams. By getting players immersed in scenes that resemble the reality of GSD environment, Global manager is aimed at crucial managerial skills like conflict resolution, leadership, and adaptability – skills well known for effective management of global IT projects[76]. *Global Manager* presents the players with challenges where they must choose the right communication methods, deal with cultural differences, and handle job dependencies in several places. The game integrates challenges that are encountered in working globally in teams, which include time zone differences, cultural diversities and language barriers, providing players with a realistic learning environment. Just like in *Compete!*, the game incorporates educational feedback that helps players self-reflect and make more guided future decisions. 35 computer-science students and 12 project managers, after an evaluation, confirmed they experienced a stronger understanding of management of cultural diversity, which is particularly challenging in GSD[77]. Specifically, 25 out of 35 students, after engaging with the game, reported a heightened awareness of cultural differences, something that was previously underestimated[75].

These outcomes of *Global Manager*, Further justifies the effectiveness of serious games in development of soft skills. However, the single-player design might limit the teaching of collaborative skills as much as needed in the real global world. Also, the games focus on pre-arranged scenarios may restrict the dept of learning in areas such as adaptability.

#### *Among the Office Criticality(AOC)*[29].

This is a Serious game geared towards the development and assessment of 5 crucial soft skills needed in the labour market. Some of these include problem-solving, teamwork, time management, decision-making, and communication. AOC places the player in a virtual office setting where they are required to practically apply these soft skills. Similarly to *Compete!*, The Story line of the *Global Manager* is structured using a branching decision-making framework. In this technique, the decision of the player influences how the narrative is directed and helps develop specific skills. The game stresses decision-making and critical thinking, with players arriving at various outcomes depending on their decisions. Scenarios presented within a time frame of 6 months are used to determine whether the player's employment will be permanent, extended for another 6 months, or terminated. This structure not only evaluates the players' understanding but challenges them to consider the implications of their decisions. Finally, AOC clearly measures players' performance by providing feedback and scores that reflect how well their decisions align with the targeted soft skill. A pilot study carried out on 160 university students demonstrated how effective AOC is in enhancing these skills. When asked how the simulation effect affected their experience, they described them as Interesting, engaging, fun, and innovative, which further clarifies the true essence of serious games.

#### *ENACT*[78]

Enact is a project funded by the European Commission and designed to enhance negotiation skills. It is a 3D game that is combined with Intelligent Tutoring Systems(ITSs) to provide platforms for users to develop key negotiations skills. ITSs are computer systems

designed to provide immediate and customised instructions to learners, usually without human intervention.[79]. ENACT evaluates using a negotiating 2D model of interpersonal conflict management founded by Rahim and Bonoma in 1979. These five negotiating models include; integrating, obliging, dominating, avoiding, and compromising. During a Sci-Tech event in 2014 and British Science Week in 2015, ENACT was evaluated with a collection of user feedback. The results were highly positive with over 95% of players expressing their willingness to play the game again. What makes ENACT unique lies in its integration of a drama-based learning environment, which creates a robust environment for developing negotiation skills. Also, just like some other games we have previously discussed, this one simulates multiple negotiation styles grounded in comprehensive frameworks. It is important to note however, that as negotiation tactics may vary across cultures, ENACT lack the capturing of negotiation skills in multiple cultural context. Nevertheless, ENACT's success further sheds more light on the innovative approaches of interpersonal skills development.

### 2.5.5 Comparative Analysis and Application Serious Game design frameworks

The games discussed—Compete!, Global Manager, Among the Office Criticality (AOC), and ENACT—though varied in content and context, share several core design principles and educational strategies that contribute to their success in development of soft skills. These similarities are underpinned by established game design frameworks and supported by numerous studies. By examining the commonalities in design and strategy across these games, we can better understand the elements that make serious games powerful tools for education.

#### Use of Realistic Scenarios and Contexts

A prominent similarity across these serious games is the incorporation of realistic scenarios that emulate actual workplace situations. For example, *Compete!* and *Global Manager* puts players in project management and global software development environments respectively, which are actual workplace dilemmas. On the other hand, *AOC* simulates an office setting, while *ENACT* provides a platform for practising negotiation in a realistic setting.

This emphasis on realism closely aligns with The *Experiential Learning Theory* we discussed in previous sections, a theory that posits that learning is most effective when individuals can actively engage with real tasks and reflect on their experiences[38]. By making sure the scenarios presented to players are realistic, they provide players transferable experiences that ensures the targeted soft skills are learned effectively. Additionally, These game designs also draw insight from the *Four-Dimensional Framework (4DF)* for serious games. By focusing on contextual relevance, learner specifics, pedagogy, and representation, these games prove to be exemplary in the design of serious games.

Using realistic scenarios and being context-specific is a vital ingredient supported by Wouters et al.[16], who find that when serious games replicate career realities, they can be highly influential in enhancing skill-based learning outcomes.

#### Feedback Systems for Immediate Learning

## 2. Literature Review

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All games discussed incorporate robust feedback systems that provide players with immediate information on their actions, enabling players reflect on their actions and strategies. *Compete!* uses sustainability and ethical dimensions to measure players choices and provide them with feedback based on this. *ENACT* provides players with feedback based on their negotiation tactics. *ColcoMA* offers real-time analysis with cues and prompts during gameplay. *Global Manager*'s game feedback is based on players communication strategies and conflict resolution approaches. While *AOC* provides feedback through scores and outcomes.

Feedback is a critical component of learning in all contexts especially in the development of soft skills. The use of feedback systems is aligned with both the *Learning Mechanics-Game Mechanics (LM-GM) framework* and *Experiential Learning Theory (ELT)*. The LM-GM framework as discussed, focuses on blending educational contents with game mechanics to create a cohesive learning experience[2]. Feedback promote continuous improvement by making players aware of the impact of their actions and adjusting accordingly. This aligns with Kolb's study of reflection as a key part of the leaning cycle[38, 27]. Sitzman conducted a meta-analysis that showed that serious games with immediate feedback are more effective educational tools than those without[17]. As players engage in educational games, it is important for them to know what they are doing wrong so that they can learn rapidly.

### **Research and Data-Driven Design**

Clearly, in order to achieve a successful study design, it must be evidence-based and data-driven, which are common attributes of the games we are discussing. They are all relied on theoretical frameworks, empirical research findings and user data to refine game mechanics and ensure their effectiveness in teaching soft skills.

Research and data-driven design suggest a systematic collection and analysis of data to inform the iterative development of serious games. An example is *Compete!*, which was developed under Erasmus+ framework, a program known for its rigorous research-based approach of educational projects[73]. The game carefully makes use of data from pilot studies to fine tune its decision-making scenarios in order to meet educational goals of fostering problem-solving, communication, teamwork and Stress Management skills. Similarly, *Global Manager* and *AOC* were designed with extensive research into the needs of global software development industry and office dynamics, respectively. The development teams consulted with subject matter experts to identify the most relevant soft skills and create scenarios that reflect reality.

The importance of data-driven research is supported by the *ADDIE model*(Analysis, Design, Development, Implementation and evaluation), a widely accepted instructional design framework. The ADDIE model explains the need for continuous evaluation based on empirical data, to make educational tools responsive to learner needs[61]. *ColCoMa* and *ENACT* utilise real-time data from players interactions to provide personalised learning experience, which mirrors the effectiveness of ADDIE model.

### **Engagement through Interactive and Immersive Environments**

The MDA framework is one that is closely knit into the development of these games. As previously highlighted, this framework hits on creating experience that are emotionally engaging and does this by employing game aesthetics such as visual design, Story telling and User Interface[1]. They also adopted the EI theory that set that argues the necessity to manage emotions effectively to enhance learning[26]. Soft Skills like empathy, self-regulation, stress-management are easily developed through serious games when they take players emotions into consideration[26].

More studies have been carried out to prove the effectiveness of immersion and interaction in serious games, on learning outcomes. In their report, Johnson et al.[80] explored the impact of technology in education. One of those technologies include, immersive and interactive environments where they found that players who engaged in them had improved retention of material compared to those that used traditional teaching methods. The study concluded that immersive environments heightens sense of presence, and are more effective for skill acquisition.

In sum, serious games use an immersive and interactive environment to internally inspire emotional involvement, active participation, and the beliefs that maintain critical soft skills. It ensures this approach comes with not only more effective learning but also more enjoyable learning, which is a critical component in preserving the learners' motivation and dedication.

### User-Centred Design

Finally, another common characteristics among these games that is worthy of note-taking, is their user-centred design principles. The games are tailored to meet specific needs and preferences of the learning's, giving users a feeling of inclusion. In *Compete!*, In compete, their feedback mechanisms strongly focuses on users, making them reflect on their mistakes in ways relevant to their personal journey. Similarly, *Global Manager* incorporates feedback loops that adjust games difficulty based on the players performance. In the game, they also considered diversity in cultures that resonated with players from different background which makes the content more relatable[75]. AOC also uses branching narratives that gives players control over the story-line, helping them arrive at desired outcomes.

The concept of User-Centred Design is not new to the field of serious game development. It is rooted in the *Human-Centred Design*(HCD framework, which suggests that products should be designed, prioritising the needs and experience of the users[62]. This framework was directly applied to the games as they made substantial efforts to keep users engaged and active throughout the time of play. HCD framework has also been given a thumbs up by many studies. An example is a study by Gerling et al. where they reported that 93% of participants felt the instructing giving to them were sufficient, while 87% of them found the feedback on gesture performance helpful[81]. This was achieved through a full-body motion-based game that focuses on the importance of accessibility in game design, which further highlights the need for a serious game design that is Centred on the User.

These similarities we have found in these games, clearly explains that adopting serious design principles and learning theories in the serious games design is an efficient strategy to meet educational goals. Real scenarios, breaching decision-making mechanisms, stronger

feedback loops, immersing players and so on, make these serious games comprehensive for the development of soft skills. Based on the frameworks and theories we have recognised, these games add to the body of knowledge in academia when it comes to preparing individuals for success in today's workplace.

## 2.6 The Impact of Serious Games on Learning Outcomes

Serious games have been evidenced to improve learning outcomes substantially. They prove to be highly effective across various fields compared to the traditional methods of teaching. Due to its nature of combining pedagogical frameworks with game techniques, serious games provide environments that help learners develop a more profound understanding of subject matters.

### 2.6.1 Empirical Evidence

Clark et al. (2016)[82] carried out a meta-analysis on 57 studies, comparing digital games to non-game conditions, revealing that digital games significantly enhanced learning outcomes in cognitive and intrapersonal areas. The overall effect size for learning outcomes was moderate at  $g = 0.33$ , indicating that students in game-based learning environments outperformed those in traditional settings. Both cognitive competencies and intrapersonal competencies displayed similar effect sizes at  $g = 0.35$ , demonstrating the effectiveness of serious games in improving cognitive skills and personal development. The improved versions of educational games, which include more support or customise the gaming experience to suit the learner's requirements, demonstrated an even more significant impact ( $g = 0.41$ ). This result emphasises the significance of deliberate game design in optimising learning and memory retention. In a similar fashion, Papastergiou (2019)[83] in their research, discovered that a serious game created to instruct computer memory concepts in a high school computer science class was more successful and inspiring than a non-gaming application with the same learning aims and content. In using the game, the student's conceptual understanding in computer memory notably improved and was more engaging. The study also established that even though students have different prior gaming experience and computer knowledge, both male and female students still have equal learning improvement and find the game similarly motivating.

#### *Learning Transfer and Real-World Application*

Wouters and Van Oostendorp (2013)[16] carried out a meta-analysis and concluded that serious games could be effective in enhancing learning transfer, especially when combined with instructional support, namely, feedback and guidance. In this analysis, the estimated effect size was impressive for the skills learning outcome,  $d = .62$ , which signals serious games as highly effective for knowledge application. They concluded that supplementing serious games with instructional elements can further enhance their effectiveness in facilitating real-world transfer of learning, especially when the SGs themselves are developed to closely emulate real-world scenarios. This can also be likened to Ricci, Salas, and Cannon-Bowers[84] who

highlighted that individuals in the military who received instruction through SG demonstrated superior performance in real-life combat scenarios compared to those who received conventional training. The value of serious games is shown by this discovery in contexts where applying knowledge and skills practically is of great importance.

#### *Cognitive and Affective Outcomes*

Playing serious games has been shown to improve cognitive abilities like critical thinking, problem-solving, and strategic decision-making, going beyond just gaining knowledge. Adachi and Willoughby[85] discovered that engaging in strategic video games is positively associated to *cognitive outcomes*, specifically better problem-solving skills, among students. They conducted a long-term study following 1,492 high school students for four years and found that those who played strategic games, such as role-playing and strategy games, reported enhanced problem-solving skills over time. The research also revealed that these skills had a positive impact on academic performance, indicating that playing strategic games not only improved problem-solving abilities but also indirectly led to better grades. These findings suggest that engaging in strategic games, which involve planning and decision-making, helps in developing cognitive skills that can be applied in real-life situations.

In terms of *affective outcomes*, SG designed with cooperative mechanics(i.e multiplayer games) and themes that are socially supportive, enhance emotional intelligence and social awareness . An evidence can be found in a research by Greitemeyer and Osswald[86] where they examined the affective effects of prosocial video games. They placed players in two gaming conditions and found that Participants who engaged in playing prosocial video games were more inclined to offer help in different situations compared to those who played neutral or aggressive games. This help included aiding someone who dropped pencils, dedicating more time for additional experiments, and intervening to prevent harassment. It was then concluded that playing Prosocial video games, activates thoughts that are more inclined to foster empathy in addition to decreased aggressive tendencies amongst learners. In professions such as education and healthcare, emotional benefits are crucial as empathy and social abilities are necessary for successful performance.

The impact on serious games on emotions cannot be underrated. As they usually have gamified elements like, score, points, feedback, etc, they allow learners to experience challenges in a low-stakes environment, which can reduce anxiety associated with traditional assessments.

#### *Increased Motivation and Engagement*

The interactive nature of SG have been shown to significantly boost intrinsic(inward) motivation and engagement among students. This claim is supported by Arias-Calderón, Castro, and Gayol's study involving 108 second-year undergraduate nursing students showed that 87.9% of participants experienced increased motivation when serious games were integrated into their online physiology course during the COVID-19 pandemic[87]. It was also found that 90.8% of the students felt that these games improved their engagement in the learning process. The study

emphasized that the interactive features of serious games, such as immediate feedback and self-paced learning, were crucial in making the learning experience more engaging and enjoyable.

In a similar study, Riopel et al.(2019)[88] highlighted that serious games significantly enhance engagement levels. Their exploration on the serious game "Archipel," used for teaching probability, demonstrated that 95% of students actively participated in the game, leading to a 30% increase in the average time spent on learning tasks compared to traditional instructional methods. These findings show how serious games are effective in keeping the student's attention longer and intrinsically motivating them with features such as challenges and rewards, providing an interactive learning experience.

### 2.6.2 Challenges and Considerations

It is important to acknowledge various challenges and considerations associated with the utilisation of serious games for educational purposes. The efficacy of SGs in enhancing learning outcomes is contingent upon a multitude of factors such as the calibre of design, implementation, and their alignment with educational objectives. According to Ke (2011)[89], the success of serious games is heavily influenced by "learner characteristics, game-based pedagogy, and instructional game features". The implication of this is that SG, which either fails to engage learners or present complex subject matter in simplified terms, may result in superficial learning and thus, limits their educational effectiveness.

Furthermore, the integration of serious games into traditional educational settings is confronted with its own set of challenges. Young et al.[90] emphasized the criticality of aligning game content with curricular goals to facilitate the successful adoption of serious games in educational environments. Educators bear the responsibility of ensuring that the educational objectives of the games are congruent with the intended learning outcomes. Additionally, instructors must undergo specialised training to sensibly incorporate serious games into their pedagogical strategies. In the absence of adequate support and comprehension, educators may encounter difficulties integrating these games into their curricula, potentially impeding their efficacy.

Serious games substantially advance the learning outcomes by embedding academic content in a more engaging environment created through game mechanics. As we have seen, evidence proves that they indeed work in enhancing intellectual skills, transferring learning into real-life situations, and facilitating affective learning. They indeed outperform traditional pedagogues at higher levels of learning about subject matter.

## 2.7 Best Practices When Using Serious Games in Soft skills Teaching

Firstly, it is essential to create scenarios in SGs that replicate real-world challenges, allowing players to practice decision-making processes that mimic professional environments.[16]. Secondly, offering immediate and constructive feedback is paramount. Feedback that emphasises the ramifications of players' decisions enhances learning by promoting reflection and subsequent

improvement. Studies approve this practice, showing their significance in development and retention of soft skills[17]. Thirdly, a session of debrief lasting between 20-30 minutes after game play is recommended. This reflection period aids players in dissecting their decisions and draw connections between in-game experiences and real-world applications, thereby augmenting both learning and skill transfer[67]. Facilitators play a pivotal role in guiding participants towards the educational objectives, offering support as required, and maintaining focus. Adopting this approach goes a long way in challenging players without overwhelming them[91]. Lastly, adding in-game characters like those seen in *compete!*[72], serves to replicate real interpersonal dynamics. The players, through this approach, are opportune to consider multiple viewpoints, which allows players to learn through observation.

## 2.8 Chapter Summary

By reviewing relevant studies, we can conclude that several learning theories and SG design frameworks exists. Educational games have also utilised these background knowledge in ensuring SG meet learning outcomes. Since their adoption, serious games provide an immersive and interactive platform for learning, particularly in soft skill development, given its innate qualities that allows for experiential learning. Despite the existence of limitations, evidence shows massive capabilities of SG in improving interpersonal skills among students. While traditional approaches constrain themselves to technical training, serious games represent an interactive and playful way of teaching soft skills—often poorly recognized but increasingly important in work. Despite the many strengths, however, SG requires thoughtful design if harmony is to be achieved between it and educational objectives. Embedding an educational framework into research has shown that coherence between game play and learning objectives is a fundamental ingredient in attempting to maximize their potential. Although serious games are not a panacea for developing soft skills, when appropriately applied, it does indeed play an important role in complementing traditional approaches.

# Chapter 3

# Implementation

## 3.1 Game Design Process

The implementation of *Vice-Chancellor* is considered to replicate the kind of experience the head of a university would face day in and day out. The player is thrown into a virtual office, with multiple challenges he must overcome by applying several soft skills in order to make useful decisions for the future of a fictional university called "Success". In doing so, a series of factors need to be taken into account, including sustainability and the satisfaction of stakeholders. The selection of the vice-chancellor also reflects the complex nature of leadership in educational settings where choices have far-reaching effects on issues such as sustainability, organisational growth, and interpersonal dynamics. Indeed, the theme of sustainability is one that has been informed by a number of studies that indicate how the need for sustainability as a tool for decision-making in the 21st century is increasingly relevant. In this respect, sustainability has become a significant element of corporate strategy and leadership, as there are global challenges society is facing, like resource depletion, social inequity, and climate change[92][93]. We chose to do it this way to ensure that learners are provided with the dept of experiences that are realistic and applicable.

In the development process, we followed the agile approach. This approach is notorious for its emphasis on incremental improvement that relies on feedback[94]. We focused on the Scrum cycle which is a general Agile method that focuses on managing "iterative development rather than specific agile practices"[95](See figure 3.1).

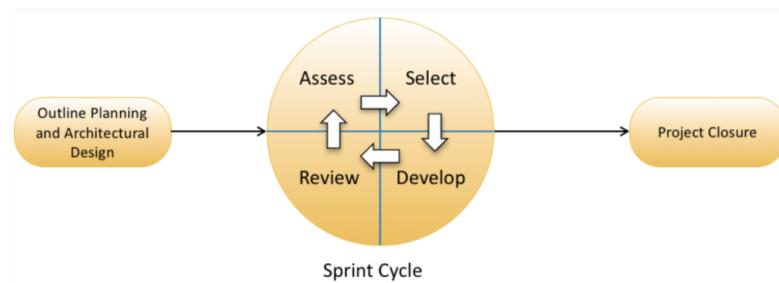


Figure 3.1: Agile Scrum Development Cycle

Initial play tests showed a lot of things to improve, including adjusting timing during drag-and-drop tasks and the feedback system. Through the Agile framework, it was possible to include these changes right away and immediately test if those changes would actually work to enhance user experience and acquisition of soft skills. For example, feedback on the complexity of decision-making tasks resulted in changing the scenarios in terms of difficulty balance in order to maintain player engagement. Agile's iterative sprints ensured that each stage of development was informed by real-time data from user testing, resulting in a final product that effectively addressed the learning objectives while remaining responsive to player needs [94].

### 3.1.1 Game Structure

The flow of the game was designed to mirror the journey of the player, starting with an introductory screen, followed by a number of decision-making scenarios. The early phases introduce players to the environment of the game through two priority tasks, after which the player is taken to the main scenarios of the game. Each challenge gives a university-based scenario that needs critical decision-making. The structure of the game is outlined below:

1. **Introduction**(Figure 3.2): In the beginning of the game, the player gets an introductory message about what has to be achieved and what one needs to do to get a certain amount of points. It contains introductory pages with a "next" button that appears after 8 seconds. This is due to the fact that the players may not read the introduction text properly, thus missing the opening and active involvement in this game from the beginning.

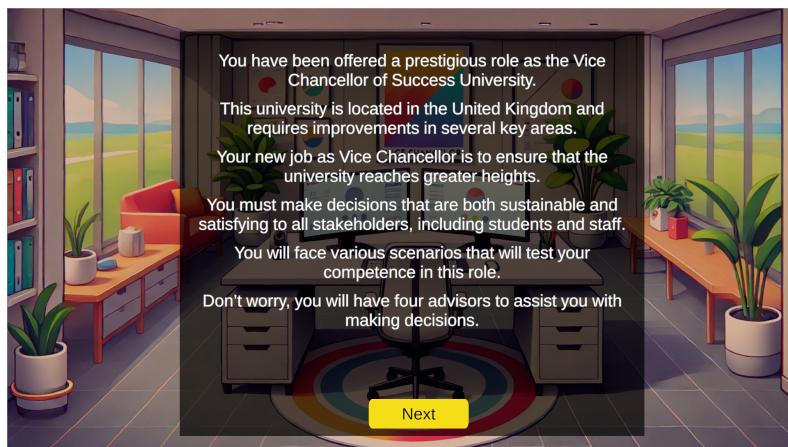


Figure 3.2: Game Introduction first page

2. **Priority Scene** (Figure 3.3, Figure B.4): This first interactive scene involves the player dragging and dropping task cards into different baskets that represent different levels of priority. Such a prioritisation exercise will introduce players to decision-making mechanics, which in turn will reinforce such soft skills as time management.
3. **Challenge Scenario Presentation**(Figure 3.4): Each scenario starts with identifying a specific, real-life problem that the university is facing, such as managing IT infrastructure

### 3. Implementation

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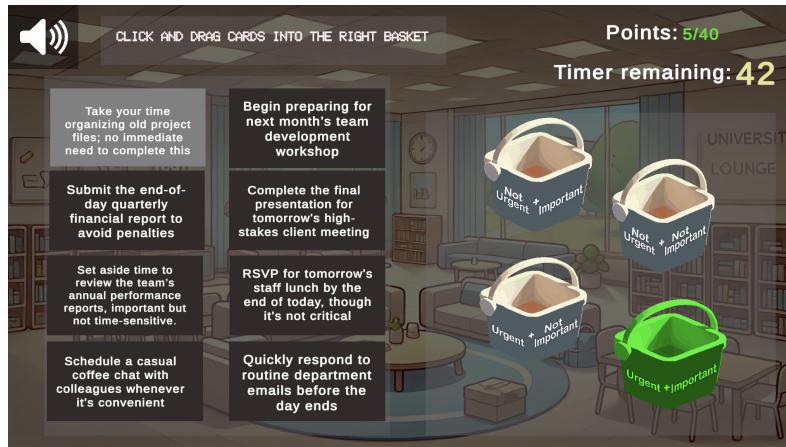


Figure 3.3: Second Priority Challenge

or increasing energy efficiency. These scenarios are introduced in the form of e-mails from different colleagues at the institution. The respondent has to click on an e-mail icon to enter the scenario, thus mimicking the kind of communication that a Vice Chancellor would normally receive. This method not only contains an element of interactivity but also represents complex, real-world problems that a university leader might face in carrying out his or her work.

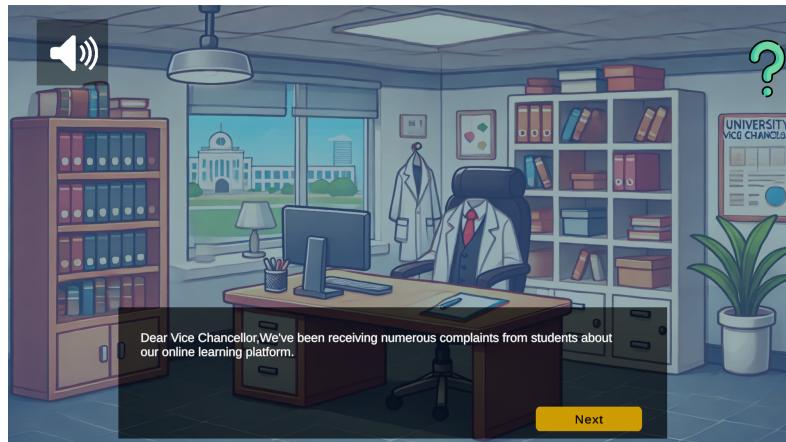


Figure 3.4: After clicking email button

4. **Decision-Making Task:** The player is provided with a task related to decision-making that addresses the challenge. The task is designed to measure specific soft skills like time management, problem-solving, teamwork, and effective communication.
5. **Advisors**(Figure 3.5): Four advisors, each representing distinct leadership styles, offer their perspectives on the best course of action. These advisors—Andrew, Zara, Smith, and Stacy—provide different viewpoints based on their personality types, which align with the Myers-Briggs Type Indicator (MBTI) framework[96]. This helps players assess decisions from multiple angles.



Figure 3.5: Advisors as Avatars

6. **Player Decision:** The player needs to decide which solution of the different advisors works best in their judgment for the situation. Every choice is assessed regarding its value on two critical dimensions: sustainability and satisfaction of key stakeholders. This enhances the real-world implications of decision-making in real work environment.
7. **Immediate Feedback (Table 3.6):** Immediately after each decision, the player receives direct feedback on how their choice affects sustainability and the satisfaction of the stakeholders involved. Consequently, points are allocated accordingly, stimulating reflection on the decision-making process.



Figure 3.6: Immediate feedback after decision-making scenario

8. **Final Report:** At the end of the game, players are presented with a final report that includes:
  - Total score and grade.

### 3. Implementation

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- A percentage breakdown of how well they applied soft skills such as time management, effective communication, teamwork, and problem-solving.
- A summary of their overall performance based on the percentages they achieved.
- Suggestions for further research or improvement based on their game-play performance.

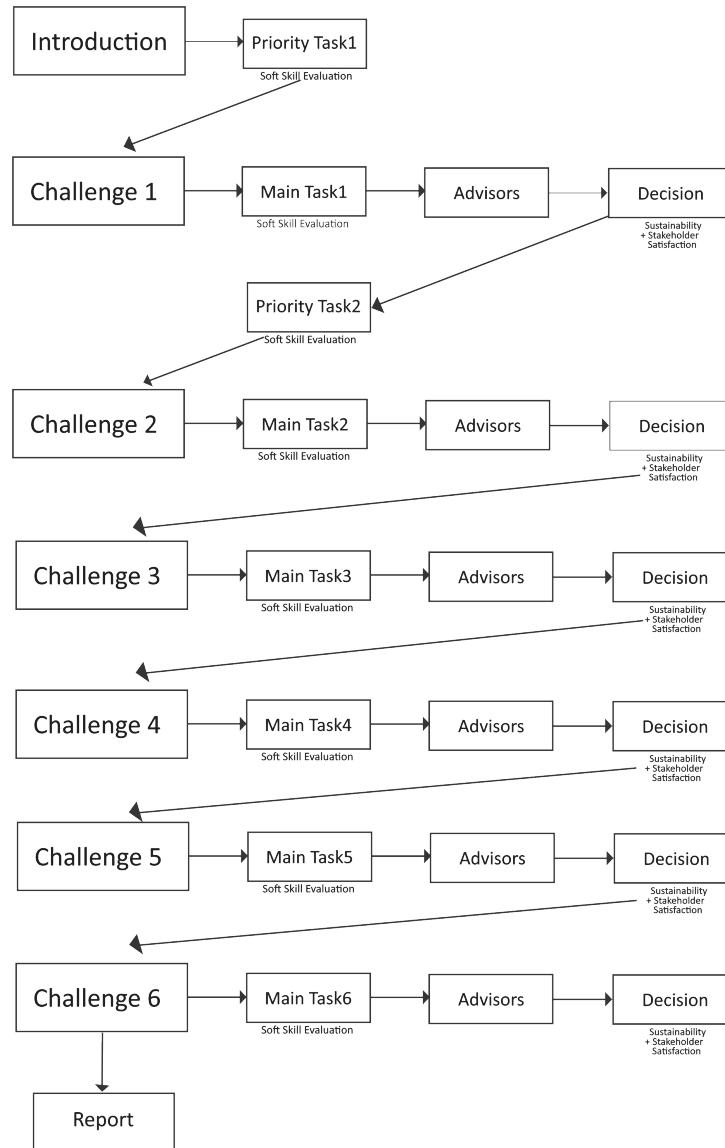


Figure 3.7: Game Structure

The design of each stage ensures that players are not only engaged in the task completion but are also prompted to reflect on the broader impact of their decisions, integrating educational value into an interactive experience.

#### 3.1.2 Advisor Personalities

A critical aspect of the design was integrating advisors, each with a distinct personality and style. MBTI[96] is one of the popular assessment tools when it comes to personality, on which

the basis of the four personality types used in the game design is derived. Each one of the types has been represented with a four-letter code showing different cognitive preferences.

1. Andrew (Extraverted, Intuitive, Thinking, Judging—ENTJ): "The Visionary" Andrew is a strategic leader who thrives on developing long-term goals and taking calculated risks. His assertive approach encourages players to think boldly about the future of the university.
2. Zara (Introverted, Sensing, Thinking, Judging—ISTJ): "The Pragmatist" Zara is detail-oriented and cautious, preferring methodical and logical approaches. Her advice tends to be grounded in practical solutions, helping players to consider risk-averse strategies.
3. (Extraverted, Intuitive, Feeling, Judging—ENFJ): "The Collaborator" Smith is charismatic and team-focused, emphasising the importance of collaboration and collective success. His advice often revolves around fostering positive relationships within the university community.
4. (Introverted, Intuitive, Thinking, Perceiving—INTP): "The Planner" Stacy is highly analytical and data-driven. She prefers to base decisions on research and careful analysis, making her advice particularly valuable in situations that require deep thought and planning.

These advisors give a host of perspectives that make players have to put themselves in many points of view to make decisions. This dynamic encourages deeper understandings of the decision-making process and reinforces the importance of diversity in the. Careful scripting and iterative testing made sure each advisor's advice was clear yet nuanced, to avoid overwhelming the player.

## 3.2 Scoring

The scoring system in the game is designed to provide clear feedback based on how well the player demonstrates soft skills in various decision-making scenarios. The scoring for each scene is broken down as follows:

- Priority Task 1 (40 points) + Scene 1 Decision-Making Task (60 points) = 100 points.
- Priority Task 2 (40 points) + Scene 2 Decision-Making Task (60 points) = 100 points.
- Scenes 3 to 6 are each worth 100 points, making a total of 600 points achievable.

### ***Priority Task (Drag and Drop System)***

The player can earn up to 40 points per priority task, with 5 points awarded for each correct match. The combined score from the priority tasks and the first two decision-making tasks provides a comprehensive evaluation of the player's time management and Effective-communication skill respectively.

### ***Scenario Scoring***

### *3. Implementation*

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Each scenario evaluates how well players balance sustainability and stakeholders satisfaction while applying the intended each of the intended soft skills.

#### *Decision-Making Scenarios 1 and 2*

Scoring of the first two decision-making scenarios: each out of 60 points, broken down into:

*Sustainability (30 points):* measures the player's ability to make decisions based on considering long-term environmental and operational impacts on the university.

*Stakeholder Satisfaction 30 points:* The degree to which player decisions serve stakeholder needs, such as students and staff.

After each decision, participants received immediate feedback that included:

*Total score:* A breakdown showing total points earned out of 60.

The score explanation should be a justification for how the player's decision impacted sustainability and/or stakeholder satisfaction.

*Praise or suggestion:* Feedback that may commend a player for choices or advise him in order for him to make better decisions in the future.

*Decision Making Scenarios 3 - 6* Scenarios 3 through 6 are scored out of 100 points per scenario, divided equally between:

*Sustainability (50 points):* Assesses the long-term effect of the decision.

and

*Stakeholder Satisfaction (50 points):* This assesses immediate and long-term satisfaction of the stakeholder.

The immediate feedback structure is the same as in Scenarios 1 and 2: immediate breakdowns of the score, along with explanations for the player's performance. This ensures consistency in learning outcomes and reflection on decision-making processes.

Table 3.1: Soft Skill Point Distribution per Challenge

<b>Challenge</b>	<b>Time Management</b>	<b>Effective Communication</b>	<b>Problem Solving</b>	<b>Teamwork and Collaboration</b>
Priority Task 1	40			
Priority Task 2	40			
Challenge 1		60		
Challenge 2		60		
Challenge 3				100
Challenge 4			100	
Challenge 5				100
Challenge 6			100	

#### *Advisor Point Distribution*

In each decision-making challenge, players choose from four advisors, each representing different decision making styles. The selected advisor influences the sustainability and stakeholder satisfaction score, which in turn impacts the overall evaluation.

#### *Final Feedback and Reflection*

Table 3.2: Distribution of Points and Advisors for Priority Tasks and Challenges 1 and 2

Challenge	40 (No Advisors)	Ad-	30s + 30sh	0s + 0sh	30s + 0sh	0s + 30sh
Priority Task 1	40					
Priority Task 2	40					
Challenge 1		Stacy		Andrew	Zara	Smith
Challenge 2		Andrew		Stacy	Zara	Smith

Table 3.3: Distribution of Points and Advisors for Challenges 3 to 6

Challenge	50s + 50sh	50s + 0sh	0s + 50sh	0s + 0sh
Challenge 3	Smith	Zara		Andrew
Challenge 4	Stacy	Zara	Andrew, Smith	
Challenge 5	Stacy	Andrew	Zara	Smith
Challenge 6	Stacy	Zara	Andrew, Smith	

At the end of the game, the player is given a detailed report that summarizes their performance in each soft skill category. The total grade is categorised into two performance levels:

- **Master Technician (51–100%)**: Players who score more than 50% demonstrate exceptional decision-making, balancing sustainability and stakeholder interests.
- **Novice Strategist (0–50%)**: Players with a score of 50% or below may struggle with decision-making, indicating areas for improvement in applying soft skills.

This grading system aligns with research that shows categorizing performance provides meaningful feedback and encourages learners to reflect on their strengths and weaknesses, thereby enhancing self-regulation and motivation [97].

As an analytical and data-driven consultant, Stacy has shown the ability to provide the best decisions through a structured analysis of situations and the application of sound reasoning. Her strategic mind resonates well with what is expected of a Vice Chancellor, where decisions often involve a thorough look at the long-range impact on sustainability and stakeholder satisfaction. While there is an element of this methodology that might make it predictable, the main purpose is that the participant refines specific soft skills through conscious feedback and self-reflection.

However, to maintain dynamism and not make the direction of the game too predictable, specific scenarios have been designed to better match the capabilities of the advisors in play, whether it be Andrew's strategic foresight or Smith's cooperative methodology. This makes sure the player stays quite active and experiences a wide range of decision making styles.

#### *Performance Reflection*

Players are provided with feedback tailored to their performance in each skill area, offering suggestions for how they can further improve their decision-making strategies. The

Table 3.4: Final Feedback Summary

Category	Total Achievable
Total Score	600
Total Grade	100%
Time Management	100%
Effective Communication	100%
Teamwork and Collaboration	100%
Problem Solving	100%

final report emphasises reflection and encourages players to engage in continued learning to refine their abilities.

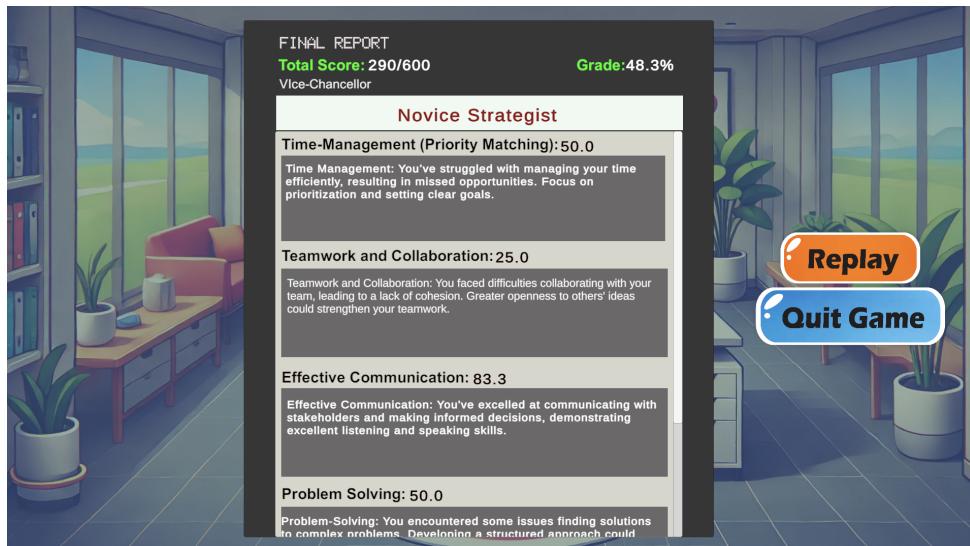


Figure 3.8: Final Report

### 3.2.1 Practical Design Challenges

In the design process, a major challenge was turning abstract ideas about developing soft skills into fun and practical game elements. It was tough to translate the emphasis on the intended soft skills into interactive tasks like prioritisation exercises and scenario-based challenges. Making sure that the player's decisions mirrored real-life consequences took a lot of trial and error. It was important nevertheless, to strike a balance between complexity and fun to keep the game educational and engaging.

These advisors provide different perspectives that would challenge players to think deeply about the decisions they made and appreciate the value of a perspective-driven process for in the application of soft skills. It required careful scripting and testing to ensure that their advice was unique yet did not confuse the player with conflicting advice.

### 3.2.2 Development Constraints

The timeline was a major constraint in the development since the game needed to be completed within a tight three-month timeline; every feature and scenario required careful prioritisation. Given the time constraint, a decision was made to develop six comprehensive scenarios rather than spreading resources on many thinly prepared challenges. In that respect, each scenario focused on the core soft skills, ensuring depth rather than breadth in learning outcomes.

Given that Unity[98] easily enables development concerning 2D games, and taking into consideration gameplay mechanics and interactions of greatest importance, the choice for this game engine is a piece of cake. Resource limitations, especially regarding graphical assets, created the need to implement at least minimalist 2D graphics. This allowed us to pull the focus of the game to decision-making, thus letting the player stay focused on the strategic choices rather than their elaborate appearance.

## 3.3 Development and Testing

### 3.3.1 Technical Stack

This game was created in Unity[98], one of the world's most used game development platforms that allows cross-platform deployment but also provides powerful tools in developing 2D games. The choice of Unity was because of the versatility provided by the engine in handling components with logic-based decision-making and drag-and-drop mechanics. Unity was chosen because of its large community and very powerful in support compared to other game engines such as Godot. The programming language used was C#, which integrates well with Unity.

We used several tools during this game's development.

1. **TextMesh Pro** was used for the rendering of dynamic text interfaces; this ensures that in-game instructions and feedback are clearly displayed in scalable text. This feature also benefited the design by enabling dynamic feedback based on players' choices. (Figure 3.9)
2. **Unity UI system** We used this built-in unity library that allowed to control active elements such as buttons, advisor selection panels, and scores.
3. **C# Coroutines** - This is a feature of Unity Editor that allows for delayed action of events. We used co-routine for a specific reason: to delay the appearance of the "next" button so that players do not hastily click next without reading the instructions. This is shown in Figure 2.9, where the wait time of "8" is highlighted. As seen, we can directly adjust the wait time from the editor without modifying the code. This feature added value to the game by making sure players stay engaged through the game play.
4. **SerializedField Attribute** is a C# attribute in Unity and was employed to expose private fields in the Unity Editor. This allowed for greater control over variable assignments and

made it easier to adjust settings in UI elements directly in the Editor without modifying the code.

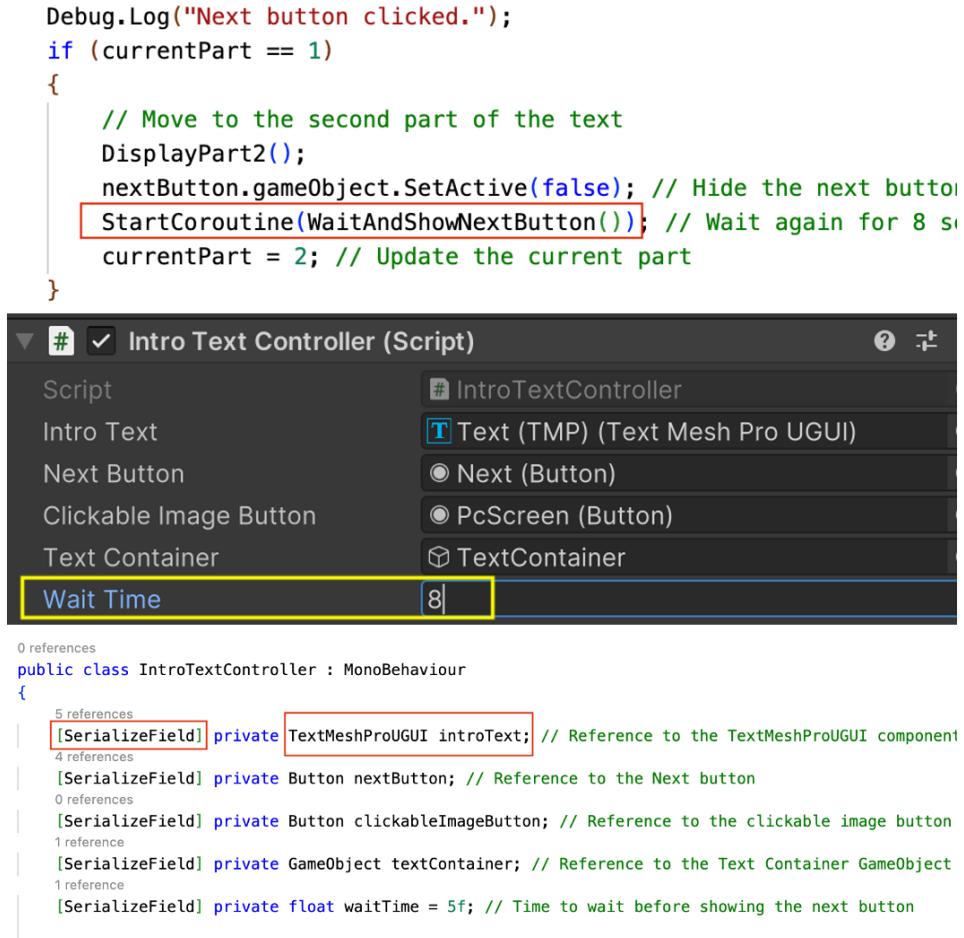


Figure 3.9: Code Snippet for TextMesh Pro, SerializedField and Coroutine with the hierarchy panel area showing the adjustable time without code altering

### 3.3.2 Performance Optimisations

Much effort was concentrated on the optimization of the use of system resources by the game to ensure smooth gameplay on Windows systems. As a 2D game, efficient memory management was critical, especially regarding the processing of text and advisor panels. Objects that had fulfilled their purpose were immediately destroyed to prevent unnecessary usage of memory, and object pooling techniques were utilized to reduce delay times when switching between scenes.

### 3.3.3 Security Features

While the game does not collect user data, basic security to block cheating methods that rely on tampering with in-game objects—such as the score—to maintain the integrity of the user's experience has been put in place.

### 3.3.4 Testing

The development of *Vice Chancellor* took eight weeks, with testing integrated throughout.

- **Unit Testing:** Individual components, such as the drag-and-drop system and scoring mechanics, were tested to ensure they functioned as expected.
- **Integration Testing:** This phase ensured that all game elements—scenarios, advisors, and scoring—worked together seamlessly, with a focus on transitions and overall game flow.
- **Playtesting:** A small group of users tested the game's performance and responsiveness. This helped identify bugs, such as minor delays and scoring discrepancies, which were fixed in later iterations.
- **Bug Fixing:** Issues identified through play testing were fixed, edits for clarity made, which included refining adviser feedback and fine-tuning the visual cues..

## 3.4 User Experience

There are three important features implemented in this game to enhance the experience of the user:

- **Audio Mute Button:** This feature was added in the game intentionally so that players could control the sound if they wanted to. Further, by allowing them to mute audio, the player was able to focus on the given tasks. It adheres to the HCI principle, which stipulates that users are to be provided with **control and freedom**[99] over the game experience.
- **Give Up Button:** Let players give up on the task if they become overwhelmed akin to HCI principle *reducing user frustration and mental strain*[99]. It aims to benefit players when approached with challenging scenarios, helping them prevent cognitive overload and keeping the experience positive without feeling forced to complete a task[99].
- **Next Button:** Helps the user to be in control of their reading experience by making sure that they view the texts only at their own pace. We had added this with the aim of avoiding feelings of being rushed and ensuring its alignment with HCI principles of user *Control and freedom*.

The design of the user interface aimed to keep things simple and easy to understand to avoid cognitive overload[100]. We accomplished this by using intuitive drag-and-drop actions, and providing clear, bold instructions to smoothly guide players through the game.

## 3.5 Technical Implementation

### 3.5.1 Back-End and Front-End Design

The game was developed as a standalone application intended for offline use, which eliminated the need for server-side integration. All game-related calculations, such as decision outcomes,

advisor remarks, and point tracking, were performed locally within the Unity environment. This eased the whole development process and ensured that the game could run seamlessly without relying on any external databases or internet services.

Due to the time available, Vice Chancellor was optimised only for Windows, making sure performance and functionality were woven inside the system. This was one of those very critical decisions-one which not only allowed the game itself to reach the entirety of its core mechanics and educational objectives within a project timeline but also one in which cross-platform compatibility would extend the accessibility of the game. The time did not allow for cross-platform compatibility.

### **3.6 Player Feedback and Iteration Process**

For play testing, three colleagues were invited to play from the Department of Mathematics and Computer Science. In their feedback, there were comments related to improvements that are very important. Firstly, in the introductory message, participants had to wait until 15 seconds until the next button appeared; it was too much for them since they read everything in less than 15 seconds. They also pointed out that lengthy inactivity may provoke diversions. In return, wait time was reduced to increase activity and retain focus among the players.

Similarly, the timing of the drag-and-drop game needed some adjustment. What was to be 1 minute had to extend to 2 minutes-to give them ample time to read the cards, decide on the thoughts, and keep off pressure. In that way, the gameplay can be more reflective without undue stress. We also received feedback that the advice given by advisors were too similar to each other. To change this, we refined their personalities more in a way that makes their advice more reflective of their personalities. By doing this players are guaranteed more depth in strategies especially when making decisions and exploring the contrasting views presented to them.

Also, the feedback was that the advisors were too similar. Their personalities were fleshed out more so that their advice immediately reflected the type of leadership they had. This allowed a player to enjoy more depth in strategy when making decisions and exploring the contrasting views of the advisors.

# **Chapter 4**

## **Methodology**

This chapter explains the methodological decisions of this research. It also includes participants and sample, data collection method, analysis of result and explains the steps taken to ensure safety of participants data.

### **4.1 Study Background**

We adopted a quasi-experimental design to test the *Vice-Chancellor* game's effectiveness in teaching soft skills among graduates. As recommended by Crasswell[101], this approach is more suitable for interventions where random assignment may not be feasible. This type of design enables the collection of pre- and post-test data, that enabled the comparison of participants' skills before and after game participation. Through the use of questionnaires, we aimed to capture changes in soft skills before and after the intervention of *Vice-Chancellor* coupled with self-reported experience of the game mechanics.

A notable strength of this design lies in its capacity to evaluate the causal link between game-based learning and improvements in specific soft skills[102]. By conducting a pre-test, the study establishes a baseline for each targeted soft skills, which are then re-evaluated after engaging with the game, enabling the identification of any changes attributable to the intervention. While the absence of random assignment may restrict the generalizability of the findings, this limitation is mitigated by the study's focus on a specific participant group(University graduates) chosen for their relevance to the study's context.

This study was guided by the research questions,

1. How can a 2D serious game be designed to effectively teach soft skills among university students?(RQ1)
2. What game mechanics, educational theories and frameworks are most effective in fostering engagement within a 2D game environment?(RQ2)

### 4.1.1 Theoretical Frameworks

The educational game "Vice-Chancellor" is built upon two main theories of learning: Experiential Learning Theory (ELT) and Social Learning Theory (SLT). These theories are integral to the game's design, ensuring that players engage with realistic scenarios, reflect on their decisions, and learn through modelled behaviours. Each theory is incorporated into the game in a way that aligns with its fundamental principles.

#### *Integrating Experiential Learning Theory (ELT) to the game.*

Proposed by Kolb[38], Experiential Learning Theory postulates that learning is a cyclical process involving the conversion of experience into knowledge. The decision-making scenarios provided by *Vice-Chancellor* was intentional for learners to have a concrete experience that aligns closely with ELT. When introduced to these scenarios, players are made aware that their decisions must be considerate of the sustainability of *Success University* coupled with the satisfaction of stakeholders involved. This idea provides them with an experience that mirrors the learning cycle of ELT, as sustainability, in particular, is a factor that modern organisations consider when making decisions. After passing through these experiences, the game then outputs a pop-up screen in the form of feedback, which explains the impact of their decisions, helping them reflect on it for improvements to be made. By passing through these learning stages, the principle of ELT which suggests experience, reflection, and application, is enforced.

The priority task in this game is also another angle where ELT was adopted. The tasks were designed to have 8 task cards with weekly plans written on them. One of the tasks is "Quickly respond to routine departmental emails," which is required to be dragged and dropped in a priority basket tagged "Not Urgent + Important." A repetition of this activity gives the players a clear picture of how to plan their intended activities for specific periods of time, enforcing time management, thus creating an internalised/practical environment.

*Integrating Social Learning Theory (SLT)* As explained in the previous chapter, ELT posits that learning is achieved by observation, imitation and modelling of behaviours. For *Vice-Chancellor* to integrate this, it was structured to have in-game characters in the form of avatars that serve as models with varied styles of making decisions.

In the game instructions, players are advised to carefully observe the advisor' behaviours, evaluate the consequences of their suggestions, and model their own decisions accordingly. For instance, Andrew (the Visionary) provides strategic, high-risk advice, while Zara (the Pragmatist) advocates for cautious, detail-oriented approaches. By presenting these diverse perspectives, the game mirrors the SLT emphasis on learning through exposure to multiple role models. This interaction simulates real-world leadership situations, where decision-makers must often weigh the input of different advisor before making informed choices.

The feedback provided in the game also reinforces the principles of SLT by demonstrating the consequences of the player's decisions in relation to the advice received. Players are able to see how their decisions, informed by the advisor, influence the university's success, thereby encouraging the imitation of effective strategies and the avoidance of less successful

ones. Through this model-observation-feedback cycle, the game enhances the player's ability to develop the targeted soft skills.

### 4.1.2 Game Design Frameworks

The design of *Vice-Chancellor* incorporated multiple SG design frameworks to seamlessly integrate educational content into the game play. The 4DF, MDA and LM-GM frameworks were implored with the goal of creating an immersive and engaging experience to learners. These frameworks guide the game mechanics and user interactions to ensure that the player is not only engaged but also learning in a structured and purposeful way.

#### *Integrating the Four-Dimensional Framework into the game*

The **Vice-Chancellor** game incorporates the Four-Dimensional Framework (4DF) to ensure that the gameplay is relevant to the context, tailored to the learner, pedagogically effective, and well-represented in terms of educational content. By placing players in the position of a university Vice Chancellor, the game provides a realistic context for the skills being taught, aligning with the 4DF's focus on contextual relevance. It is designed to cater to university graduates who are likely to encounter similar decision-making challenges in their professional lives, highlighting the learner specifics dimension of the 4DF. This aims to test and enhance their ability to manage time, communicate effectively, work in teams, and solve complex problems.

The pedagogical aspect of 4DF is evident through the structured feedback system implemented in the game. The reflection that happens when feedback is given to players re-enforces the learning objectives that align with 4DF. For instance, in the drag and drop tasks, learning is enforced through the image transformation that happens when the correct match is achieved. The priority basket transforms to green when a task is matched correctly, otherwise it stays the same; players are then made aware that "Scheduling a casual coffee chat with colleagues whenever it's convenient", is neither urgent nor important. This instant feedback gives the core of pedagogical enforcement of time management.

In terms of representation, the *Vice-chancellor* ensured to take some necessary measures. It used a minimal graphics(2D) to make sure that players are focused on the gameplay and block out unnecessary distractions. Coupled with that, the game adopts a sound according to the atmosphere of the day and plays this thgameplay the scene. By taking these steps, the game fulfills the dimension of representation proposed by 4DF.

**Mechanics-Dynamics-Aesthetics (MDA) Framework** In a similar fashion, MDA framework was reflected in the game's design. As the 4DF and MDA are somewhat similar, the efforts design took in integrating 4DF into *Vice-Chancellor* can be likened to those taken to integrate MDA. Players feedback are tailored according to their performance, aligning with the mechanics-dynamics of the game. Also as discussed, the minimal graphics and game sound are components of the game that reflects the Ascetics of the game, to create an enjoyable learning experience.

#### *Learning Mechanics-Game Mechanics (LM-GM) Framework*

#### **4. Methodology**

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Finally, *Vice-Chancellor* integrates the LG-GM frameworks by aligning soft skills teaching directly into the game mechanics. Each decision of the players is scored based on two core principles: Sustainability and stakeholder satisfaction. These principles are guided by several scholarly works that suggest the need to base decisions around sustainability and social considerations in different contexts[103],[104], [105], making it effective to scale best decisions. The scores are immediately reflected back to the players, allowing them to see how their decisions affect the overall state of the university. The scoring system not only aims to provide feedback but also to provide a summary of the skills being taught. An example from the game includes when a player makes decisions that balance short-term and long-term gains, whilst the others consider perspectives from both students and staff. This is a mechanic that comprehensively lets players practice what is experienced in real life, further enhancing the strength of the game in soft skills teaching.

In summary, it can be said that the creation of the "Vice-Chancellor" game is closely linked to both theoretical and practical game design principles, ensuring that the game is not only entertaining but also effective in promoting the development of interpersonal skills. By combining ELT and SLT with 4DF, MDA, and LM-GM, a strong foundation is laid for the educational goals of the game, ensuring that every choice, interaction, and feedback mechanism significantly contributes to the player's learning journey.

## **4.2 Participants and Sampling**

This study targeted a population that consists of university graduates in the United Kingdom (UK), with participants specifically selected from Swansea University. Swansea University is one of the leading institutions in the UK[106] and offers many postgraduate programs, which qualifies it as an ideal setting to examine soft skill development. The selection of the UK and Swansea is important due to their reputation of nurturing critical thinking and employability among graduates[107], aligning with the goals of the 3rd objective of this study. To evaluate the effectiveness of SG in enhancing soft skills. The criteria for participants included being over 18 years old, enrolled as postgraduate students, and having completed at least one semester of their program. These criteria were chosen to ensure that participants had a certain level of academic maturity, which is relevant to the study of teamwork and collaboration, effective communication, time management, and problem-solving. We exempted individuals who had prior experience with serious games, and SG specifically focused on developing soft skills. This exclusion was necessary to avoid bias and ensure that participants encountered games like *Vice-Chancellor* for the first time, a necessity for providing a better reflection of its effectiveness in real-world educational settings.

We targeted university graduates because particularly, because they are in transition to professional workforce, making the development of soft skills essential for their career success. As discussed in Chapter 1, these intended skills are increasingly valued by employers[16].

Focusing on graduates from Swansea University leverages a sample relevant to the study objectives of enhancing real-world employability.

### 4.2.1 Sampling Method

We used a purposeful sample strategy for this study, which means we selected participants based on specific characteristics relevant to the research objectives as suggested by Palinkas et al.[108]. We chose postgraduates from Swansea University because they are academically mature and ready to engage with complex scenarios such as those presented in *Vice-Chancellor*. Initially, we reached out to Swansea University's postgraduate students through university email lists and social media platforms, inviting them to participate. In addition to the outreach, we circulated a pre-screening form to determine their eligibility to participate based on their academic background, previous exposure to serious games, and willingness to engage in the study. A total of 10 students expressed interest, but after reviewing pre-screening responses, 8 participants were ultimately selected for the study.

The decision to use a sample size of 8 participants was influenced by the focus on specific learning outcomes, making this group size sufficient to generate meaningful insights into how the game affects soft skills development across a range of individuals. Although a relatively small sample, the diversity of academic backgrounds and career aspirations among participants helps ensure the findings are reflective of postgraduate students' experiences at large. In addition, power analysis indicates that even with this sample, reliable insights can be gained into the game's effectiveness in teaching skills[109].

### 4.2.2 Participants Characteristics

Participants were selected based on their academic backgrounds in terms of gender and age. We had a wide variety of participants from different academic backgrounds, which made the leadership and soft skills training relevant to a broad range of fields. The mix of genders and academic disciplines helped us gain insights into how individuals from diverse backgrounds approach the same soft skills training. A breakdown is provided in *Table 4.1*.

Participant	Age	Academic Background	Gender
Participant 1	24	Computer Science	Male
Participant 2	26	Renewable Energy (Engineering)	Female
Participant 3	28	Communications	Male
Participant 4	25	Mass Communication	Female
Participant 5	27	Computer Science	Male
Participant 6	23	Business Management	Female
Participant 7	29	Law	Female
Participant 8	24	Psychology	Male

Table 4.1: Demographic characteristics

### 4.2.3 Participation Setting

Participants were able to take part in the game from a distance. Each participant received a zip file that included the *Vice-Chancellor* game and a README.txt file containing easy-to-follow steps for accessing and playing the game, ensuring that participants could play independently. Since the game was digital, participants could complete it at their own pace, giving them flexibility and reducing the influence of external factors like time and location. Prior to participation, each individual received a participant information sheet detailing the purpose of the study, expectations, potential risks and benefits, confidentiality, and their right to withdraw at any time. It is also necessary to note that even though instructions were provided none of the participants had any previous experience with serious games that teach soft skills. This choice was because the primary aims of the study focus on teaching soft skills and not comparing SGs that teach soft skills.

## 4.3 Data Collection

In this research, pre- and post-questionnaires were adopted to serve the dual purpose of eliciting data on the development of participants' soft skills in this study and assessing the effectiveness of the *Vice-Chancellor* game mechanics to evoke engagement (RQ1 and RQ2). The questionnaires focused on the self-reporting of information concerning time management, effective communication, teamwork, and problem-solving. Participants were also asked for their opinions on how well the game taught these skills. The post-questionnaire also addressed how certain in-game mechanics and methods affected players' engagement in playing the game.

Likert scale was used in collecting the responses for the questionnaires. This scale was chosen because it is user-friendly and it allows measurement for agreement and disagreement. It is also well-established in behavioural and educational research for its reliability[110]. It is noted as a "*technique suitable for the measurement of attitudes*" [41], in addition to being a method that makes data easier to analyse.[111]. By using the Likert scale, we are able to quantitatively assess participants' views and self-assessments, which provides detailed insight that facilitated the analysis of the results.

### *Pre-and Post-Questionnaires*

The surveys were thoughtfully created to match the main research questions and lay emphasis on the soft skills addressed by the *Vice-Chancellor* game. Participants were provided with a 5-point scale, where 1 represents *Strongly Disagree*, 2-*Disagree*, 3-*Neutral* 4-*Agree*, 5-*Strongly Agree*. Figure ... details the content of the questionnaire.

These questions were designed to measure how confident participants are in their soft skills, particularly the ones being emphasised in the game, before and after they engaged with *Vice-Chancellor*. The questions on game mechanics and engagement were used to gather information on how effective the game's task and feedback were in encouraging engagement and reflection. Comparing these responses before and after the game adds to the insight we got from this study.

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**Survey Question**

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**Time Management**

1. I am confident in my ability to prioritise tasks based on their urgency and importance.
  2. I often complete my work within the deadlines I set for myself.
  3. I regularly review and adjust my schedule based on changes in priorities.
  4. I am effective in managing my time to balance multiple responsibilities.
  5. I am capable of breaking down larger tasks into manageable steps to stay on track.
- 

**Effective Communication**

6. I am comfortable expressing my ideas clearly in both written and verbal forms.
  7. I actively listen and respond appropriately during conversations with others.
  8. I feel confident in my ability to convey complex information in a way that others can understand.
  9. I am able to adjust my communication style to suit different audiences (e.g., peers, supervisors).
  10. I handle conflicts or misunderstandings effectively through open communication.
- 

**Teamwork and Collaboration**

11. I am effective in working as part of a team to achieve common goals.
  12. I often take the initiative to collaborate with others when problem-solving.
  13. I am comfortable giving and receiving feedback during group projects.
  14. I effectively divide tasks and responsibilities when working with others.
  15. I adapt well to different roles in a team, whether leading or following.
- 

**Problem-Solving**

16. I approach challenges with confidence and find solutions in a timely manner.
  17. I am able to adapt my decision-making approach based on the situation's demands.
  18. I feel confident in making decisions when presented with complex problems.
  19. I approach unfamiliar problems with confidence and curiosity.
  20. I regularly evaluate multiple solutions before deciding on the best course of action.
- 

**Game Mechanics and Engagement**

21. Interactive tasks, such as drag-and-drop or decision-making mechanics, help me stay engaged in the learning activities.
  22. I am confident that feedback provided after completing tasks improves my understanding of how to make better decisions.
  23. I feel that clear guidance and advice during tasks help me perform better in collaborative or decision-making activities.
  24. Which specific game mechanics (e.g., drag-and-drop tasks, feedback systems, rewards) did you find most engaging, and how did they impact your ability to focus on the tasks?
- 

25. How did the real-time feedback or in-game guidance (e.g., hints, instructions) influence your learning process or decision-making during gameplay?
  26. Was there a particular game feature (e.g., character interaction, task-based challenges) that made the learning experience more enjoyable or effective for you? Please explain how it helped.
- 

Figure 4.1: Pre- and Post-Study Questionnaire

## 4.4 Data Analysis

We used a combination of descriptive and inferential statistics to access the impact of the *Vice-Chancellor* game on soft skills development. The descriptive statistics included means and standard deviations for each category of soft skills before and after the intervention. These provide an overview of changes in participants' self-reported skill levels.

The study used paired t tests to determine the significance of the changes. It was chosen because it compares the means of two related groups, which in this case are the pre-and post-intervention. We did this aiming to determine whether the changes after intervention were significant in soft skill development. Consistent with academic practice, a p-value of less than 0.05 was considered statistically significant[109]. To understand the magnitude of improvement in each skill area, we calculated the effect size with Cohen's d. This facilitated a better understanding of its practical significance. Finally, we did a thematic analysis using qualitative feedback from the open-ended questions. This was done to provide additional information on how the game mechanics influenced engagement and learning. By displaying these elements with context, it was easy to see how participants reveal cues of learning.

## 4.5 Validity and Reliability

To ensure the study is valid, we aligned the research design, instruments and data collection methods with the study objectives and academic frameworks. using pre and post intervention surveys helped us to measure participants soft skill development and increase internal validity of the findings[101]. Additionally, applying well established theories such as, Experiential Learning and Social Learning, ensured the game was relevant to soft skill teaching.

We achieved reliability by using standardised questionnaire. The use of Likert scale, which is commonly used in behavioural research, contributed to the data reliability[110]. We went further to employ reliability by making sure instructions were clear and participant worked at their own pace, reducing the influence of external variables. while limited, the sample size of 8 was enough to depict changes in participants' skills after intervention.

## 4.6 Ethical Considerations

Strict ethical guidelines were followed during the entire research process in this investigation. A comprehensive participant information sheet outlining the goals of the study, the methods, and the participants' ability to withdraw at any time. Prior to participation, informed consent was sought, and participants signed consent forms that contained their identities. To stay anonymous, these names were kept stored aliases Participant 1, 2, etc., and were not revealed throughout the study. The questionnaire collects the email addresses of participants in order to track their responses both before and after the intervention of "Vice-Chancellor" and were not linked to any personal identifiers. To ensure anonymity, all data were safely stored and only the researcher

had access to them. The study followed the ethical guidelines of Swansea University's ethics committee, with no incentives offered to participants, who volunteered freely.

## **4.7 Limitations**

The most key limitation of this study is the small sample size of 8 participants. With this, it is difficult to generalize our findings to a broader population. The small sample may not reflect the range of skill development across different student demographics or disciplines. We therefore suggest that future studies recruit larger, more diverse groups to better represent the variability on skill acquisition, for external validity to be increased.

The exclusive use of self reported measures to evaluate reported improvements presents another limitation. Even though Likert scaled surveys provided useful insights, they are prone to bias such as over- or underestimation of abilities[112]. More objective measures, such as peer evaluations[113] or scenario-based assessment, should be incorporated in the future to verify and complement self-reported data[114].

In addition, focusing on Swansea University postgraduate students alone introduces limitations in terms of diversity educational backgrounds in this study. How people interacted with the decision-making mechanics of the game, might have been impacted by the homogeneity of the participant pool. In the future, studies could include participants from various institutions and professional sectors, to have a full grasp of its applicability in different contexts.

## **4.8 Conclusion**

Eight participants engaged with the serious game Vice-Chancellor over two weeks. They were introduced to the game's rules and objectives through a digital guide and information sheet. The game featured decision-making scenarios, real-time feedback, and interactions with four advisors representing different leadership styles. Pre- and post-game surveys assessed skill development, with additional post-game questions focusing on engagement and game mechanics. The feedback we received from participants, provided insights into the impact of game mechanics on learning and engagement. A quasi-experimental design compared skill levels before and after the intervention, following ethical standards and maintaining confidentiality and informed consent.

# **Chapter 5**

## **Results**

The current chapter is devoted to our research results concerning how well the *Vice-Chancellor* game allows the development of key soft skills and permits the assessment of players' experiences in regard to game play mechanics. Indeed, in-depth data analysis of participants revealed impressive improvements on all targeted skills, especially time management and teamwork.

We used IBM spss statistics[115] as the main tool for analysing data. This tool is widely accepted for its wide coverage of several statistical techniques like inferential, descriptives, among others. It fits into our study design as it is recognised for handling complex data set that include pre- and post-tests[116][117].

In preparation for the actual testing, variables were renamed in SPSS to ensure clarity and coherence. For instance the first pre question that involved, "Ability to prioritise task" was renamed as "Time\_Manage1"; the question that involve "expressing ideas clearly", was renamed as "Comm\_1" and same style was applied to all variables. This helped us make the interpretation flow more easily during the analysis process.

We also combined related variables into logical groups to add meaning to the comparison. For example, the pre and post questions for "Time-Management" was divided into two groups and named as "Pre\_Time\_Management" and "Post\_Time\_Management" respectively. It was reasonable to do this for all groups in order to assess the overall improvement of each group instead of analysing them separately.

These steps taken helped us ensure that we structured the data in a meaningful way, making it easier to analyse and arrive at clear interpretations.

### **5.1 Descriptive Statistics**

To answer RQ1 we used descriptive statistics to get an overview of the data, including mean scores and standard deviations for each soft skill category before and after the intervention. Recall:

RQ1: *How can a 2D serious game be designed to effectively teach soft skills among university students?*

To calculate the mean for each soft skill category, we summed all participant's score on the particular skill and divided the total by the number of participants, reflecting the central tendencies.

The formula used for calculating the mean(average) score was:

$$\mu = \frac{\sum X_i}{n}$$

where:

$X_i$  represents individual participant scores for a specific soft skill.

$n$  represents the total number of participants.

Additionally, we calculated the standard deviation to measure the spread of participants' scores from the mean. A lower SD indicates that the scores were closely clustered around the mean, while a higher one suggests more variability in the responses of participants.

The formula used for Standard Deviation was:

$$SD = \sqrt{\frac{\sum(X_i - \mu)^2}{n - 1}}$$

where:

$X_i$  represents individual participant scores.

$\mu$  is the mean score.

$n$  is the total number of participants.

### 5.1.1 Pre- and Post-Intervention Analysis

The line graphs used in this section show the Average score (Mean) of each soft skill group before and after intervention. Also, for summary purposes, we have highlighted the most interesting changes that occurred in each targeted skill.

In **Time Management**, the ability to prioritise tasks based on urgency rose from 2.75 ( $SD = 1.28$ ) before the game intervention to 4.50 ( $SD = 0.54$ ) after the intervention. Additionally, participants ability to complete tasks before deadlines improved from 2.25 ( $SD = 0.89$ ) to 4.63 ( $SD = 0.52$ ). (*see figure 5.1 for improvements*)

**Effective communication** also showed significant improvement, with the average score for expressing ideas clearly increasing from 2.75 ( $SD = 1.28$ ) to 4.75 ( $SD = 0.46$ ). There were smaller improvements in adjusting communication style, with scores increasing from 2.63 ( $SD = 1.06$ ) to 4.38 ( $SD = 0.52$ ). (*see figure 5.2 for improvements*).

**Teamwork and collaboration** also demonstrated positive changes. The ability to work effectively as part of a team improved from 3.13 ( $SD = 1.13$ ) to 4.75 ( $SD = 0.46$ ), while dividing tasks showed a smaller increase, from 2.25 ( $SD = 0.89$ ) to 4.50 ( $SD = 0.54$ ). (*see figure 5.3 for improvements*)

In **problem-solving**, confidence in approaching challenges increased from 2.88 ( $SD = 1.13$ ) to 4.75 ( $SD = 0.46$ ), while adaptability in decision-making showed moderate changes, improving from 3.25 ( $SD = 1.17$ ) to 4.50 ( $SD = 0.76$ ). (*see figure 5.4 for improvements*)

In summary, There was improvement in all areas, with some soft skills showing more significant gains than others.

## 5. Results

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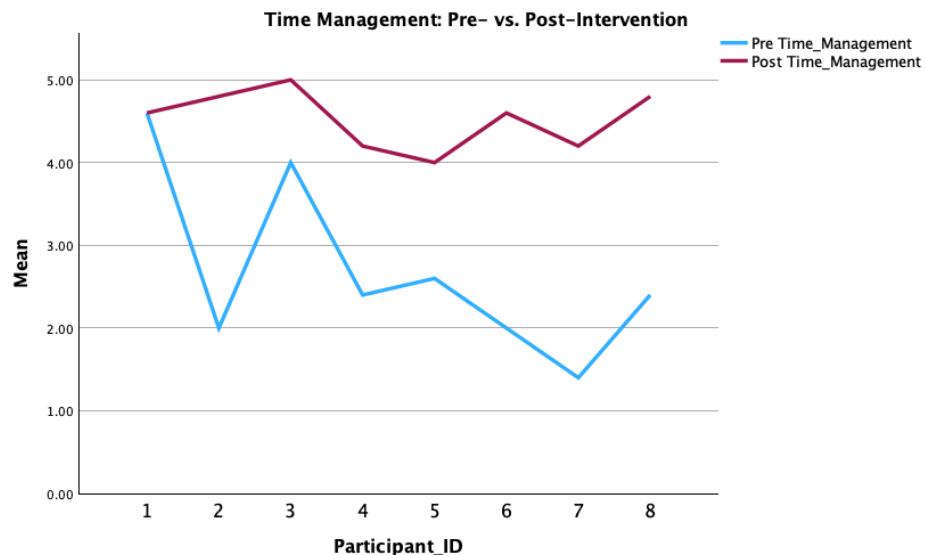


Figure 5.1: Improvement In Time-Management Skills

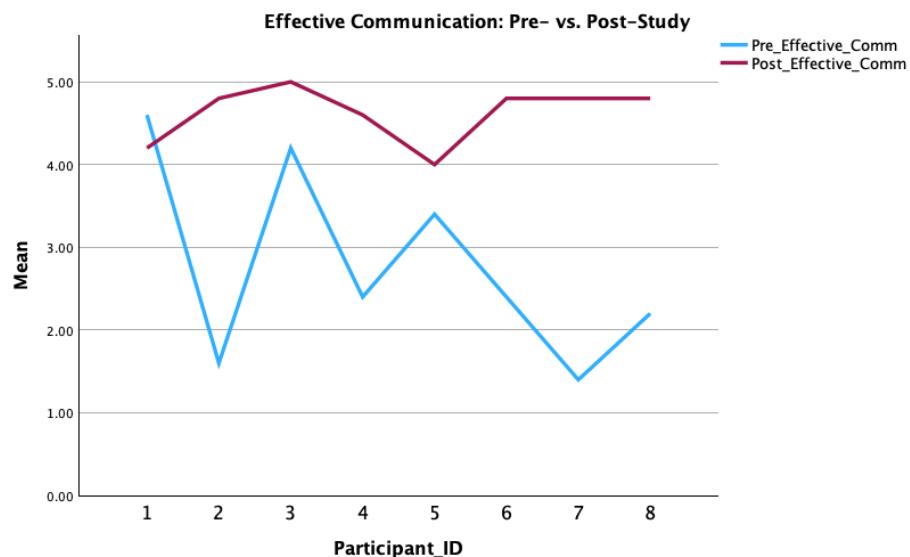


Figure 5.2: Improvement In Effective-Communication Skills

Table 5.1: Most Interesting Pre- and Post-Intervention Mean Scores for Soft Skills

Soft Skill	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)
Time Management - Prioritize tasks	2.75 (1.28)	4.50 (0.54)
Time Management - Complete tasks	2.25 (0.89)	4.63 (0.52)
Communication - Express ideas clearly	2.75 (1.28)	4.75 (0.46)
Teamwork - Work effectively in a team	3.13 (1.13)	4.75 (0.46)
Problem Solving - Approach challenges	2.88 (1.13)	4.75 (0.46)

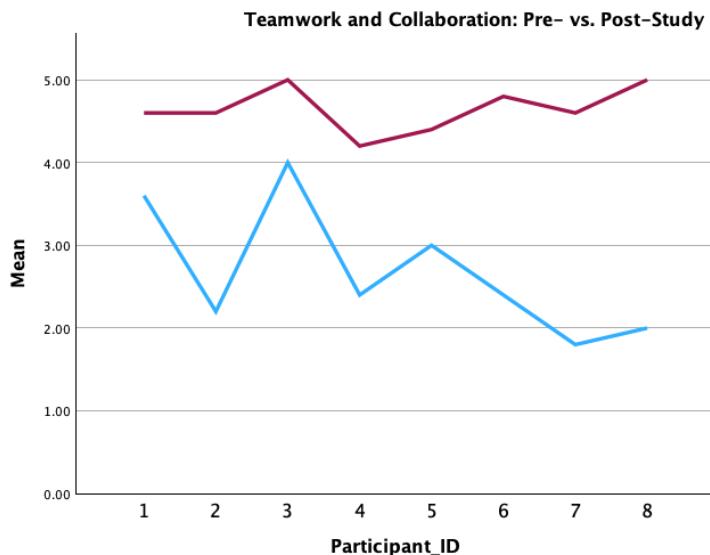


Figure 5.3: Improvement In Teamwork and Collaboration Skills

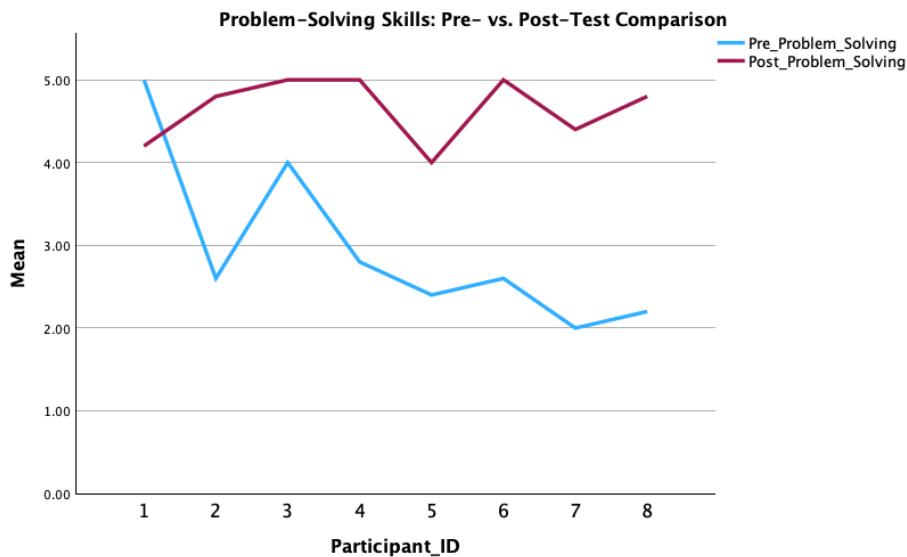


Figure 5.4: Improvement In Problem-Solving Skills

### 5.1.2 Inferential Statistics

Still on RQ1, we conducted paired t-tests to compare the scores before and after the intervention for different soft skill categories. As shown in Table X, all four categories displayed significant improvements with p-values less than 0.05.

To measure the extent of these differences, we calculated Cohen's d and Hedges' correction to determine the effect sizes. The results indicated substantial impacts across all skills, with the most significant effect observed in teamwork and collaboration (Cohen's d = -2.504), indicating a considerable improvement in participants' ability to work in teams. Time management also exhibited a strong effect (Cohen's d = -1.847), while effective communication and problem-solving showed moderate to large effects (Cohen's d = -1.361 and -1.496, respectively).

## 5. Results

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In summary, the intervention resulted in statistically significant and practically meaningful improvements in soft skills, as demonstrated by the t-test findings and the substantial effect sizes (refer to Table X for specific values).

Paired Samples Test										
	Mean	Std. Deviation	Paired Differences			t	df	Significance		
			Std. Error Mean	95% Confidence Interval of the Difference	Lower			One-Sided p	Two-Sided p	
Pair 1	Pre_Time_Management - Post_Time_Management	-1.85000	1.00143	.35406	-2.68721	-1.01279	-5.225	7	<.001	.001
Pair 2	Pre_Effective_Comm - Post_Effective_Comm	-1.85000	1.35962	.48070	-2.98667	-.71333	-3.849	7	.003	.006
Pair 3	Pre_Teamwork_Collaboration - Post_Teamwork_Collaboration	-1.97500	.78876	.27887	-2.63442	-1.31558	-7.082	7	<.001	<.001
Pair 4	Pre_Problem_Solving - Post_Problem_Solving	-1.70000	1.13641	.40178	-2.65006	-.74994	-4.231	7	.002	.004

Paired Samples Effect Sizes						
		Standardizer <sup>a</sup>	Point Estimate	95% Confidence Interval		
				Lower	Upper	
Pair 1	Pre_Time_Management - Post_Time_Management	Cohen's d	1.00143	-1.847	-3.000	-.654
		Hedges' correction	1.12748	-1.641	-2.665	-.581
Pair 2	Pre_Effective_Comm - Post_Effective_Comm	Cohen's d	1.35962	-1.361	-2.322	-.354
		Hedges' correction	1.53076	-1.209	-2.062	-.315
Pair 3	Pre_Teamwork_Collaboration - Post_Teamwork_Collaboration	Cohen's d	.78876	-2.504	-3.945	-1.031
		Hedges' correction	.88804	-2.224	-3.504	-.915
Pair 4	Pre_Problem_Solving - Post_Problem_Solving	Cohen's d	1.13641	-1.496	-2.508	-.440
		Hedges' correction	1.27945	-1.329	-2.227	-.391

a. The denominator used in estimating the effect sizes.  
Cohen's d uses the sample standard deviation of the mean difference.  
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Figure 5.5: Improvement In each soft skill category

### 5.1.3 Comparison by Soft Skills

There was a significant improvement in participants' time management competencies after the intervention, as shown by the average increase in all items measured. The biggest increase concerned the task prioritisation items, represented by an average difference of -1.85 ( $p < 0.001$ ). The effect size calculated (Cohen's d = -1.847) presents a strong and significant development of time management competencies. These advances could also be graphically presented using bar charts to indicate the tendency for upward score movement after treatment.

The participants demonstrated noteworthy advancements in their communication abilities, especially in articulating their thoughts with clarity. The average enhancement measured -1.85 ( $p = 0.006$ ) and was associated with a moderate effect size (Cohen's d = -1.361), indicating that the participants experienced increased confidence in both their verbal and written communication following the intervention. Importantly, the capability to adapt communication styles to various audiences also saw improvement, albeit to a lesser extent.

The teamwork and collaboration improvement was the most significant, as expressed through the mean difference of -1.98,  $p < 0.001$ , and the largest effect size: Cohen's d = -2.504. Thus, this points to participants reaching a significantly higher level of ability in collaborating effectively, showing initiative, and distributing tasks within a team. Improvements in this area underpin

the beneficial effect of the intervention on collaborative skills and point to the central role of group dynamics and division of labour.

Problem-solving skills increased significantly, with a mean difference of -1.70 ( $p = 0.004$ ), indicating a large effect size (Cohen's  $d = -1.496$ ). In fact, the respondents showed increased confidence to handle problems, revise ways of making decisions, and solve complicated problems, which implies that the intervention enhanced their problem-solving skills in handling situations that were either new or complicated.

## 5.2 Game Mechanics and Skill Development

Recall:

**RQ2:** *What game mechanics, educational theories and frameworks, are most effective in fostering engagement within a 2D game environment?*

Clear insights into the game mechanics and how these created both engagement and learning were pulled from the analysis of participant feedback. The interactivity portion came from the drag-and-drop tasks that were included. Participant 3 described how these tasks required them to pay attention:

*"The drag and drop tasks helped me focus on associating the correct answers with the correct basket."*

For Participant 8, they were "*engaging*" and a core part of decision-making.

Another important observation was **feedback and real-time guidance**. Participant 2 identified immediate feedback as very helpful since it

*"kept me informed about my progress"* and helped to maintain focus through rewards. The same participant added, *"Real-time feedback and in-game guidance enhanced my learning process by making clear what went wrong and by making immediate correction suggestions,"* thus arriving at better thoughtfulness of decisions.

The *character interactions* was also one of the aspects of the game that gave meaning to it. For Participant 1, this interaction with the characters and listening to different opinions was "*fun and reflective-thought-provoking*"; indeed, they said,

*"Hearing differing opinions contributed to my decision making."*

Such interactivity also made this learning experience deeper and more reflective, whereby participants were urged to think over their decisions.

These findings show that game mechanics like in-game interactive tasks and feedback systems, along with character engagement, were great tools to promote enjoyment and effectiveness in serious games.

## 5.3 Insight on Game Mechanics and Engagement

Still on **RQ2**, The result from the Likert scale suggests that the participants found the game mechanics highly engaging, with clear overviews given in figures of descriptive statistics. For instance, the mean rating for interactive tasks was very high, at 4.75. This agrees with

## 5. Results

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Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Game Engagement – Interactive tasks kept me engaged in learning	8	1	4	5	4.75	.463	.214
Game Engagement – Feedback improved decision-making understanding	8	2	3	5	4.63	.744	.554
Game Engagement – Guidance helped teamwork and collaboration	8	1	4	5	4.88	.354	.125
Valid N (listwise)	8						

Figure 5.6: Descriptive Statistics for open-ended questions

the qualitative responses, whereby participants noted that features like the drag-and-drop interactive tasks helped them remain focused on the subject. These activities, according to Participant 3, helped "me focus on associating the correct answers," accentuating how the game mechanics supported active engagement.

Similarly, the feedback mechanism was efficient in achieving what was required with an average score of 4.63. The responses established that immediate feedback guided them in their choices to enhance their performance. For example, Participant 2 commented that "the immediate feedback kept me informed about my progress," therefore making it easy for him to stay on course and make better choices in the game.

One of the highest-rated items concerned guidance about teamwork and collaboration, with a rating average of 4.88. The open-ended questions allowed us to capture participants' responses on how the in-game instructions and guidance helped them understand the tasks they were presented with. Participant 6's response reads, "The instructions were clear and helped me understand what I needed to do", demonstrating the positive effects the instructions to enhance their learning outcomes.

## 5.4 Summary

The data we derived from the study's survey fully demonstrates that participants' soft skills improved, with time management and teamwork making the most significant improvements. We discovered that their ability to prioritise tasks and work effectively with others saw a significant rise, as demonstrated by the increases in average scores. Communication skills and problem-solving also saw positive changes, albeit to a slightly lesser degree.

Participants consistently emphasised the importance of the game's mechanics in driving these improvements. Interactive features like dragging and dropping tasks were frequently cited as crucial for maintaining focus and aiding decision-making. Real-time feedback, particularly in guiding participants through mistakes, was another key aspect that supported learning. Overall,

considering both the statistical data and participant feedback, it's evident that the serious game was highly successful in enhancing various soft skills.

# **Chapter 6**

## **Discussion**

The results we have analyzed show that the serious game *Vice-Chancellor* effectively addressed the research questions accordingly. In fact, the SG enhanced participants' soft skills, directly linking to RQ1, which seeks to understand how an effective 2D SG can be used to each soft skills. The improvements in the Soft skills taught reflects the ability of the game to fulfill this goal.

key to this development was the structure of the game, which embedded components of experiential and social learning. The prioritisation task for instance, where players were required to order task based on urgency and importance, were vital in improving Time-management. This activity enabled players to develop skills of time estimation in a virtual environment, as posited by ELT by Kolb(2014)[38]. The immediate feedback for decisions within the game fostered reflection and refinement, which is at the core of the ELT learning cycle.

Similarly, RQ2 which focused on identifying the most effective game mechanics for fostering cooperation and engagement was addressed with the use of advisors that embodied diverse styles of approaching problems. Through the lens of Social Learning Theory[40], participants were exposed to problem solving approaches, allowing them to observe, imitate, and adapt these behaviors. The interaction with advisors compelled players to consider multiple view points that contributed to the development of their soft skills. The noticeable improvement in this areas, especially in teamwork and collaboration(with a mean increase from 3.13 to 4.75), underlines that this is an effective mechanic for fostering cooperation and thus answers RQ2.

Therefore, the game's design, particularly the decision-making scenarios and interactions guided by the advisors, was directly in line with both the research questions and the theoretical frameworks, confirming the Vice-Chancellor's effectiveness in enhancing soft skills development.

### **6.1 Comparison with previous research.**

The study's results are in line with previous research on game-based learning. Scholars have stressed the importance of experiential learning in acquiring skills that are difficult to teach using traditional means[118][38].The decision-making tasks in Vice-Chancellor, which simulate

real-world challenges, support Wouters et al.'s [16] findings that immersive game environments enhance learning outcomes through active engagement and reflection.

In terms of effective communication, this study reflects Backlund and Hendrix [119] argument that interactive learning methods are more effective than theoretical instructions, especially for the acquisition of soft skills. The improvement we noticed in participants' confidence in working collaboratively in teams aligns with research showing that serious games promote collaboration and shared responsibility [120]. As *Vice-Chancellor* made participants decide from different advisor perspectives, the dynamics of real-life teamwork is reflected. This clearly demonstrates that game-based learning can replicate interpersonal interactions in a controlled environment.

We observed minimal improvement in working effectively as a team (from 3.13 to 4.75). However, these gains are mainly linked to the difficulties of developing more intricate aspects of teamwork, such as assigning tasks and handling group interactions. While the game helped enhance general collaboration, mastering these deeper skills might need more targeted approaches. The findings suggest that even though *Vice-Chancellor* improved teamwork, integrating more specific situations involving task distribution and managing team roles could further enhance participants' capacity to handle complex group dynamics, resulting in more substantial improvements in collaborative effectiveness.

## 6.2 Practical Implications

### 6.2.1 Higher Education

The findings of this study indicate that serious games are an essential tool for effectively bridging the gap between theoretical learning and the practical application of soft skills. The significant improvement we observed in the skills taught by *Vice-Chancellor* shows that soft skill-teaching games provide a more immersive way to engage in development of soft skills when compared to conventional teaching methods. Universities could leverage such games to mirror the complexities of workplaces, thereby preparing students adequately for the labour market. The mechanism of decision making can be used to serious games that can effectively enhance their softskills as they look to transition into the labor market.

By integrating SG into curricula, higher education institutions could address gaps in soft skill development, which are increasingly being demanded by employers. Games provide a safe as well as engaging space for students to develop, time-management, effective communication, teamwork and collaboration, and problem-solving, where student can practice without the fear of failure.

### 6.2.2 Professional Training

In profession settings, SG like *Vice-Chancellor* offer a valuable tool for training employees, particularly in environments that require the application of soft skills in making decisions. The game's structure allows employees to simulate workplace challenges, such as managing multiple stakeholder interests and navigating through complex problems. This type of experiential

## *6. Discussion*

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learning provides encouragements for employees to take calculated risks and learn from their mistakes without real-world consequences. In addition, the various leadership styles included in *Vice-Chancellor*, through advisors, helps players develop adaptability which is essential for effective leadership in a dynamic environment. For organizations, this approach provides a flexible yet scalable method for employees, promoting engagement, and fostering continuous career development.

## Chapter 7

# Conclusions and Future Work

In the introduction chapter, we defined the objectives of this study:

1. To develop a 2D Serious game through the incorporation of Learning theories and game design frameworks.
2. To implement game mechanics in the serious game with a focus on decision-making and to determine its impact on the targeted soft skills.
3. To evaluate the effectiveness of the Serious Game *vice-Chancellor* in Teaching Teamwork and Collaboration, Effective Communication, Problem-solving and Time Management.

The study was also guided by the following research questions:

1. How can a 2D serious game be designed to effectively teach soft skills among university students?
2. What game mechanics, educational theories and frameworks, are most effective in fostering engagement within a 2D game environment?

To bring these objectives to life, we designed a serious game called *Vice-Chancellor* which was informed by prominent educational theories and game design frameworks. Insights were drawn particularly from Experiential Learning Theory and Social Learning Theory in addition to game mechanics supported by Mechanics-Dynamics-Aesthetics(MDA), Four-dimensional framework(4DF) and Learning-Mechanics Game-Mechanics(LM-GM) framework. These theories and frameworks have one thing in common: "Providing an intuitive learning structure that can enhance skill development". The game-making was centred around the role of a university vice-chancellor, where players take on the position and navigate challenges related to it. We then proceeded to evaluate the game design by carrying out a quasi-experiment on 8 participants. Although not a very large participant pool, it was enough to capture enough data for effective evaluation.

The findings from the research suggest that *vice-chancellor* effectively achieved these Objectives as notable changes were observed in all targeted soft skill areas. Firstly, in the area of time

management, we noticed that participants were more confident on their ability to prioritise tasks. This was achieved after their encounter with the game, especially with the game mechanics of Dragging and dropping task cards into their level of priority. Other changes improvements observed was participants' ability to work in teams and solve complex problems by applying effective-communication, teamwork and problem-solving skills. In the game, this was facilitated by embedding a series of scenarios that required the players to make decisions with the best decision rated for considering sustainability and the satisfaction of stakeholders.

Further, in our experiment, we aimed to capture what game mechanics participants enabled participants' engagement. We did this with open-ended questions and received interesting responses from participants. The data we received suggested that the game mechanics we employed were effective in fostering engagement. Participants reported that the instructions enabled them to have a clear picture of the tasks at hand. Other responses demonstrated that the in-game characters that were used to offer players diverse decision-making perspectives, improved their knowledge on problem-solving. Some also acknowledge the feedback systems of the game, claiming it helped them reflect on their decisions and improve them in subsequent challenges.

The game mechanics and learning theories applied gave the game an edge in teaching soft skills relevant to workplaces. It also fostered engagement and made sure students were immersed in the gaming experience. In all, this approach we have taken further supports the argument that serious games are more effective tools that teach soft skills in ways that traditional methods fall short.

## 7.1 Limitations

Though the results we gathered are promising it is difficult to generalise our findings as the sample size of 8 was rather small. The small group of 8 made it difficult to capture a more nuanced range of individual differences in how participants engaged with the game. As participants were new to serious games, the data was not sufficient to practically compare the game mechanics with those used in other similar games. Although this was not our focus, the study could be enhanced in the future to capture features that could be improved for experienced gamers. This limits the ability to assess how the game's performance may be in an audience familiar with game-based learning environments.

Secondly, the game focuses on the role of a university vice-chancellor, which may not be relevant to everyone. Individuals who do not occupy academic or managerial positions might feel out of place when engaged with such a storyline. This may restrict the generalisation of practised skills outside of the game, particularly for those professionals who are working in industries with very different challenges, such as an industry dealing directly with customers or hands-on teamwork.

In terms of the feedback systems we also found some limitations in the serious game. Although the immediate feedback was valuable in promoting reflection, the binary success-or-failure outcomes oversimplify complex decision-making processes. In reality, there are many more decision-making approaches that could be used, depending on the specific situation.

Participants were restricted to choosing from the advisors' predefined strategies, which might not fully encompass alternative approaches such as consensus-building or risk-sharing strategies. This limitation may have constrained the participants' ability to explore a wider range of decision-making styles, potentially hindering the development of more nuanced problem-solving skills.

Additionally, the fact that the game can only be played offline could be seen as a drawback. The game missed the opportunity in this area to reach a wider audience and provide a flexible environment for an asynchronous gaming experience. Closing this gap may also benefit the study by allowing for more inclusion across the globe.

## 7.2 Recommendations

This work could be extended to an even broader population, including a wide range of students and professionals from different fields and industries in order to draw further conclusions on how different kinds of learners are impacted by the in-game mechanics, and at what level the skills learned within the game can be transferred into other, non-academic settings. It would also be interesting to discuss how the game might be used in other contexts, such as in corporate or healthcare settings, for the presentation of the topic relevant to various professionals.

Longitudinal research will also be an interesting area to explore whether the soft skills acquired from the game are retained over time. We suggest that future studies create an experimental design that tracks participants' engagement for a longer time frame so as to find out if the targeted soft skills were improved over time. Additionally, enhancing the game's feedback system to provide more detailed insights into decision-making processes could make the game better at simulating real-world problem solving.

## 7.3 Final remarks

This research contributes to the growing body of work on using serious games to develop soft skills. By integrating game mechanics with established educational theories like Experiential Learning Theory and Social Learning Theory, the Vice-Chancellor provided participants with an engaging and introspective environment that effectively enhanced skill development in areas such as teamwork, communication, time management, and problem-solving. Despite some limitations in the study, the results emphasize the promising role of serious games in connecting theoretical knowledge with practical skill application, especially in educational and professional environments. Future research can expand on these findings by examining broader contexts and refining game design to tackle more diverse and intricate decision-making processes, ultimately maximizing the potential of serious games as effective tools for comprehensive skill enhancement.

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## **Appendix A**

### **Participants Forms**

# Screening Form for Participation in "Vice-Chancellor" Serious Game Study

Thank you for expressing interest in participating in this study. The study's Focus:

1. How can a 2D serious game be designed to effectively teach soft skills among university students?
2. What game mechanics, educational theories and frameworks are most effective in fostering engagement within a 2D game environment?

Please complete the form below to determine your eligibility to participate in this research. Your responses will be kept confidential.

## Researcher Contact Details:

**Name:** Emmanuel Nwokoro

**Email:** 2245430@swansea.ac.uk

**Institution:** Swansea University

---

\* Indicates required question

## Participants Information.

1. **Name \***

---

2. **Age \***

---

3. **Gender \***

---

4. **Academic Program \***

---

5. Have you previously participated in any serious games designed to develop soft skills (e.g., teamwork, communication, time management, problem-solving, etc)? \*

*Tick all that apply.*

Yes

No

6. How familiar are you with serious games or educational games? \*

*Tick all that apply.*

- Very Familiar
- Somewhat familiar
- Unfamiliar

7. Do you feel comfortable engaging with tasks that involve decision-making scenarios and time management? \*

*Tick all that apply.*

- Yes
- No

8. Do you have the necessary tools (Computer(windows OS), internet access) to participate in this digital game study? \*

*Tick all that apply.*

- Yes
- No

### Willingness to Participate

9. Are you willing to participate in a study where you will engage with a 2D serious game for learning soft skills? \*

*Tick all that apply.*

- Yes
- No

10. Are you willing to provide feedback after completing the game through a post-questionnaire? \*

*Tick all that apply.*

- Yes
- No

11. By submitting this form, you confirm that the information provided is accurate to the best of your knowledge, and you are willing to participate in this study if selected \*

*Tick all that apply.*

- Yes

*A. Participants Forms*

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# Vice-Chancellor Game: Pre-Study Survey on Soft Skills

This survey aims to help us understand and improve how individuals develop essential soft skills such as time management, communication, teamwork and collaboration, and problem-solving. There are 20 questions in this questionnaire, rated on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). It should take less than 10 minutes to complete. Your responses are anonymous and confidential, and the data collected will be used solely to evaluate the effectiveness of the serious game in enhancing these skills.

\* Indicates required question

---

1. Email \*

---

## Time-Management

2. I am confident in my ability to prioritise tasks based on their urgency and importance. \*

*Mark only one oval.*

1    2    3    4    5

---

Stro      Strongly Agree

---

3. I often complete my work within the deadlines I set for myself. \*

*Mark only one oval.*

1    2    3    4    5

---

Stro      Strongly Agree

---

4. I am effective in managing my time to balance multiple responsibilities. \*

*Mark only one oval.*

1    2    3    4    5

---

Stro      Strongly Agree

---

5. I am capable of breaking down larger tasks into manageable steps to stay on track. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

6. I regularly review and adjust my schedule based on changes in priorities. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

### Effective - Communication

7. I am comfortable expressing my ideas clearly in both written and verbal forms. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

8. I actively listen and respond appropriately during conversations with others. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

9. I feel confident in my ability to convey complex information in a way that others can understand. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

10. I am able to adjust my communication style to suit different audiences (e.g., peers, supervisors). \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

11. I handle conflicts or misunderstandings effectively through open communication. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

### Teamwork and Collaboration

12. I am effective in working as part of a team to achieve common goals. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

13. I often take the initiative to collaborate with others when problem-solving. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

14. I am comfortable giving and receiving feedback during group projects. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

15. I effectively divide tasks and responsibilities when working with others. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

16. I adapt well to different roles in a team, whether leading or following. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

### Problem - Solving

17. I approach challenges with confidence and find solutions in a timely manner. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

18. I am able to adapt my decision-making approach based on the situation's demands. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

19. I feel confident in making decisions when presented with complex problems. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

20. I approach unfamiliar problems with confidence and curiosity. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

21. I regularly evaluate multiple solutions before deciding on the best course of action. \*

*Mark only one oval.*

1    2    3    4    5

Stro      Strongly Agree

---

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Google Forms

## A. Participants Forms

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### PARTICIPANT INFORMATION SHEET (Version 1.0, Date: 26/08/2024)

#### Project Title:

Game Design For Soft Skill Teaching

#### Contact Details:

Name: Emmanuel Nwokoro  
Email: 2245430@swansea.ac.uk  
Institution: Swansea University

#### 1. Invitation Paragraph

You are being invited to participate in a study exploring the effectiveness of a 2D serious game called Vice-Chancellor in teaching key soft skills such as time management, teamwork, communication, and problem-solving. Before deciding whether or not to take part, please take the time to carefully read the following information, which explains the purpose of the study, what your involvement will entail, and your rights as a participant. Your participation is entirely voluntary, and you are free to withdraw at any time without any consequences.

#### 2. What is the purpose of the study?

The overall aim of this study is to evaluate how well a serious game can help in the development of soft skills among university graduates. We are particularly interested in assessing how gameplay fosters skills such as time management, effective communication, teamwork, and problem-solving. By doing so, we hope to understand how educational games can complement traditional learning methods to better prepare students for real-world challenges.

#### 3. Why have I been chosen?

You have been chosen because you are a postgraduate student at Swansea University, and your academic experience makes you an ideal participant for this study. Participation is entirely voluntary, and you can withdraw from the study at any point without providing a reason. Your involvement is appreciated but not mandatory.

#### 4. What will happen to me if I take part?

If you decide to participate, you will be asked to play the Vice-Chancellor game, which simulates decision-making scenarios typically faced by a university leader. The game involves drag-and-drop tasks, scenario-based decisions, and feedback from virtual advisors. You will also complete a pre-study and post-study questionnaire, which will assess your confidence in key soft skills before and after the game. The entire study, including gameplay and questionnaires, will take approximately 1 hour. All tasks can be completed remotely.

#### 5. What are the possible disadvantages of taking part?

There are no significant risks associated with this study. However, you may experience some mild discomfort if you find decision-making scenarios challenging or if the game requires you to reflect on your skills. If at any point you feel overwhelmed, you are free to withdraw from the study.

#### 6. What are the possible benefits of taking part?

By taking part in this study, you may gain deeper insights into your own soft skills, including time management, communication, teamwork, and problem-solving. Additionally, you will be contributing to research that could improve the design and effectiveness of educational games aimed at enhancing workplace readiness among students and professionals.

#### 7. Will my taking part in the study be kept confidential?

Yes, your participation in this study will be kept confidential. All data collected from the questionnaires will be anonymized, and your identity will not be disclosed in any part of the study or its results. Only the researcher will have access to the raw data, and it will be stored securely. The findings of the study may be published or presented at conferences, but no personally identifiable information will be shared.

#### 8. What if I have any questions?

If you have any questions or require more information about the study, please do not hesitate to contact me on the information provided at the top-left of this document.

Figure A.1: Participants' Information Fact Sheet

How to Run Vice-Chancellor in 1 minute on windows OS.

**Step1**

-Download the zip file

**Step 2: Unzip the File**

- a. Locate the downloaded ViceChancellor.zip file on your computer.
- b. Right-click on the ViceChancellor.zip file.
- c. Select "Extract All..." and choose a destination folder, then click "Extract".

**Step 3: Open the Extracted Folder**

- a. Once extracted, open the ViceChancellor folder.
- b. You will see two items: \_MACOSX (ignore this) and another folder named ViceChancellor.
- c. Double-click on the ViceChancellor folder.

**Step 4: Run the Game**

- a. Inside the ViceChancellor folder, you will see a file with a black-and-white icon named Latest.
- b. Double-click on the Latest file to launch the game.
- c. The game will start, and you are ready to play!

**NOTE:**

- You may see a message from Windows Defender saying "Windows protected your PC." If this happens:
  - Click on the More info link.
  - Then click "Run anyway".

Your game should now launch and play smoothly.

**Minimum System Requirements for Windows PC:**

To run Vice Chancellor smoothly on your PC, your machine should meet the following minimum specifications:

Operating System: Windows 10 (64-bit)

Processor: Intel Core i3 (or equivalent) dual-core processor

Memory: 4 GB RAM

Graphics: Integrated graphics (e.g., Intel HD Graphics 4000) or dedicated graphics with at least 1 GB VRAM (e.g., NVIDIA GeForce GTX 600 series or AMD Radeon equivalent)

DIRECTX: Version 11

Storage: 500 MB of free space

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**PARTICIPANT CONSENT FORM**  
(Version 1.0, Date: 26/08/2024)

**Project Title:**

*Game Design For Soft Skill Teaching*

**Contact Details:**

**Name:** Emmanuel Nwokoro  
**Email:** 2245430@swansea.ac.uk  
**Institution:** Swansea University

**Please initial box**

1. I confirm that I have read and understood the information sheet dated ...../...../..... (version number ..... ) for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
3. I understand that sections of any of data obtained may be looked at by responsible individuals from Swansea University or from regulatory authorities where it is relevant to my taking part in research. I give permission for these individuals to have access to these records.
4. I agree to take part in the above study.

Name of Participant	Date	Signature
Name of Person taking consent	Date	Signature
Researcher	Date	Signature

Personal data collected on this form will be processed in line with the General Data Protection Regulation 2016 and the Data Protection Act 2018. Further information about how your data is managed is available on the [University Research Privacy Notice](#).

<https://www.swansea.ac.uk/about-us/compliance/data-protection/privacy-notice-index/research-privacy-notice/>

Figure A.2: Participants Consent Form

## Appendix B

# Other Game User Interface Not included in the Implementation Chapter



Figure B.1: First Game Screen - Options Buttons

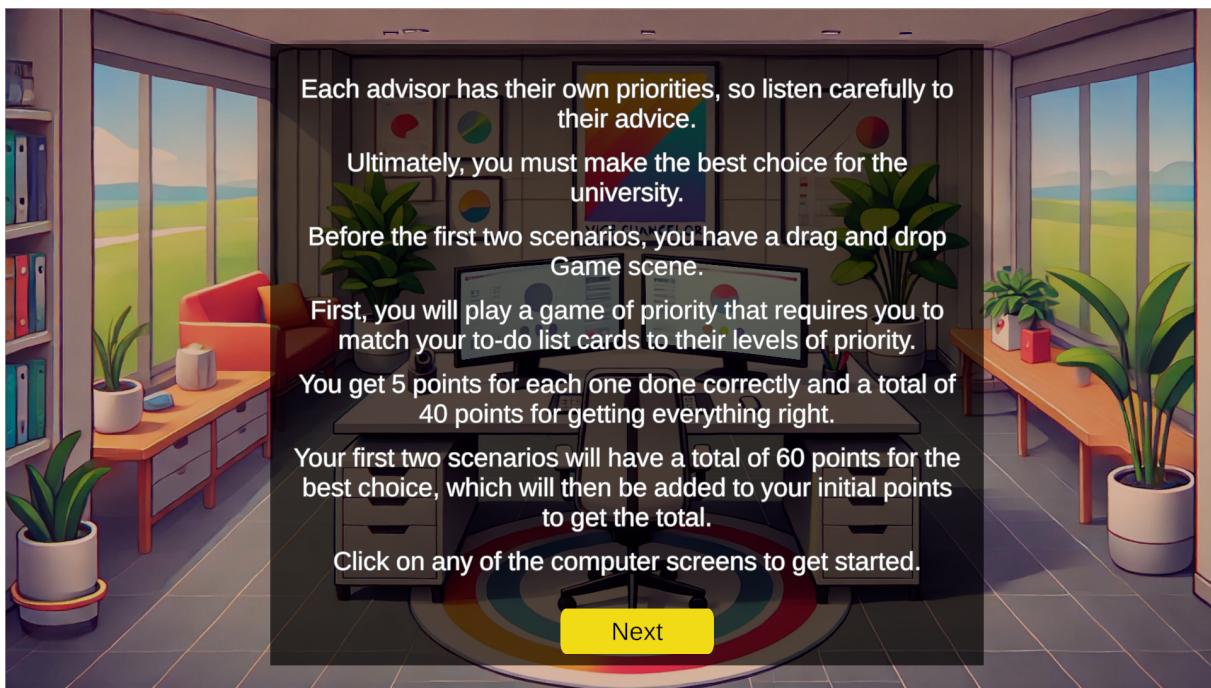


Figure B.2: Second Page of game Introduction



Figure B.3: Clickable Images of Computer Screen

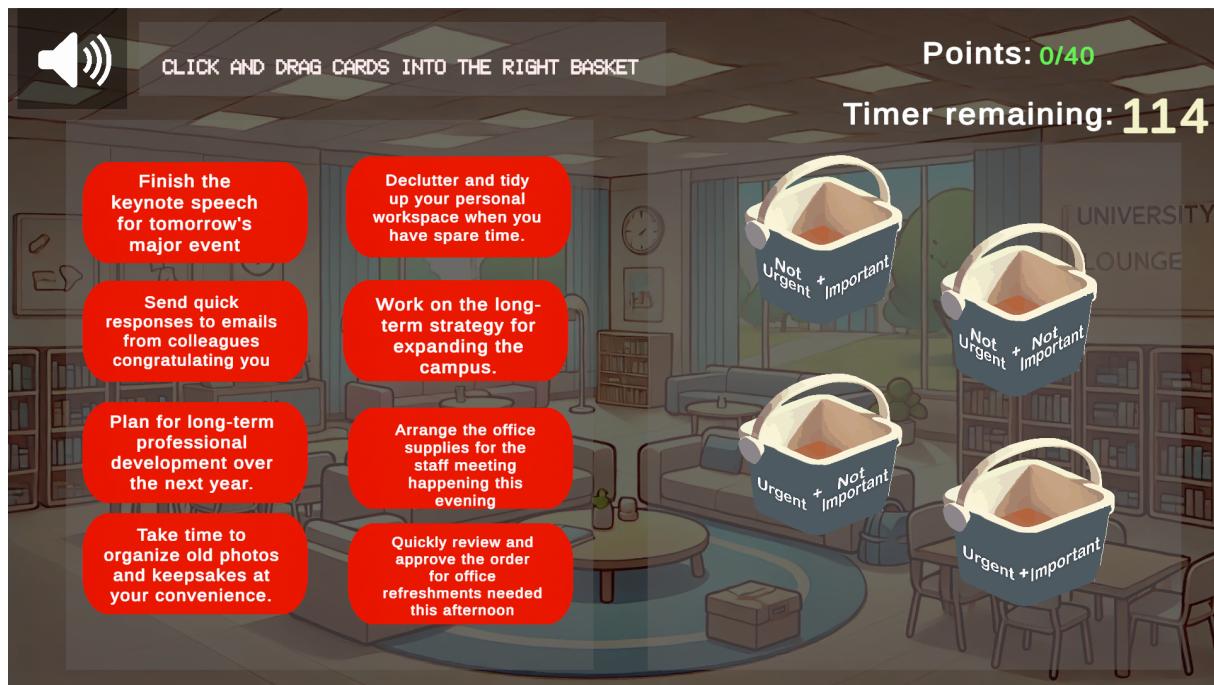


Figure B.4: First Priority Challenge

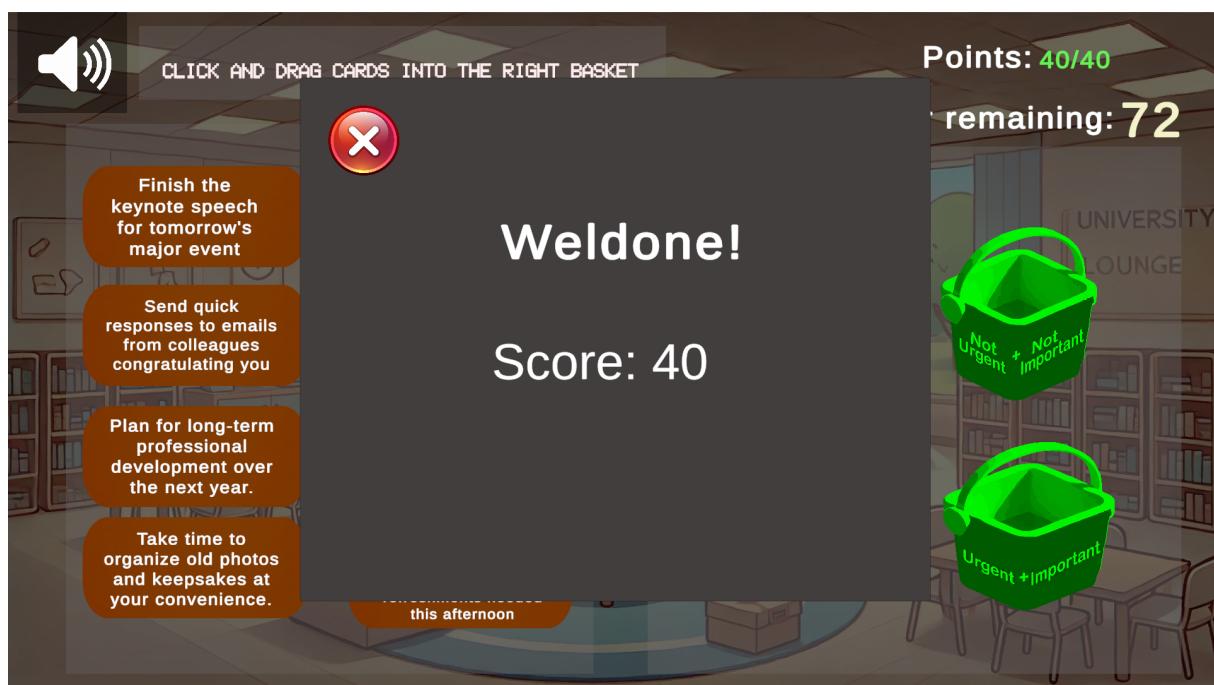


Figure B.5: Instant score feedback after Priority Screen

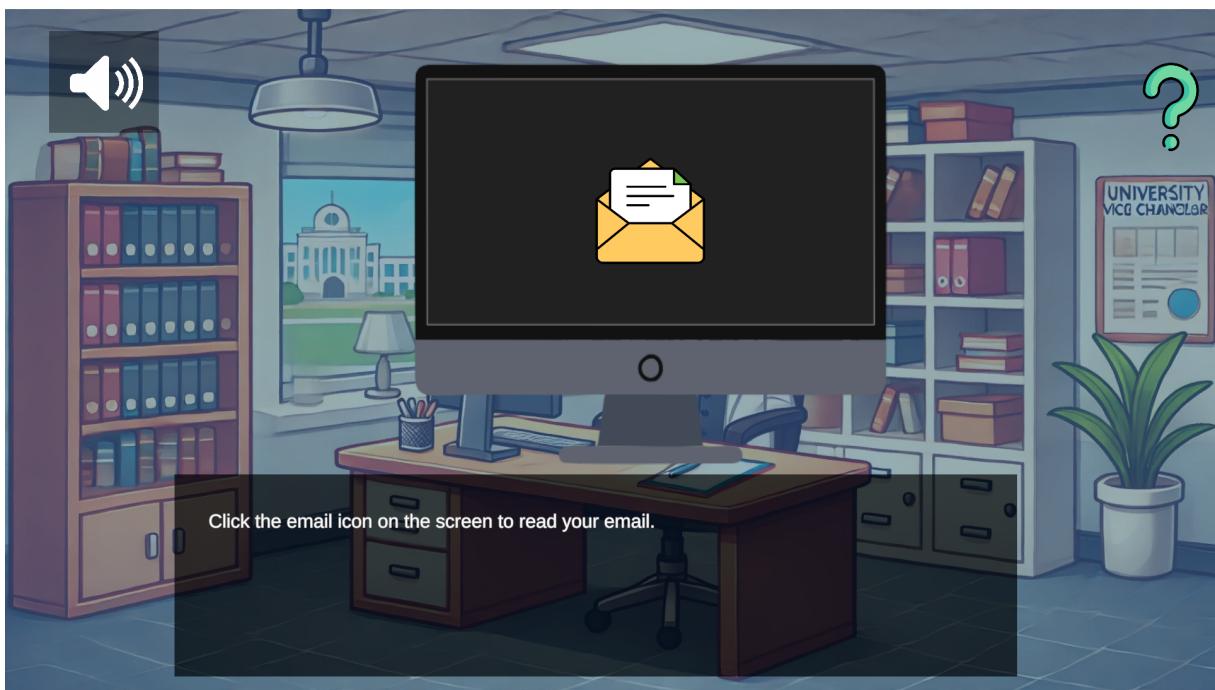


Figure B.6: Email button in computer screen that reveals decision-making challenges when clicked

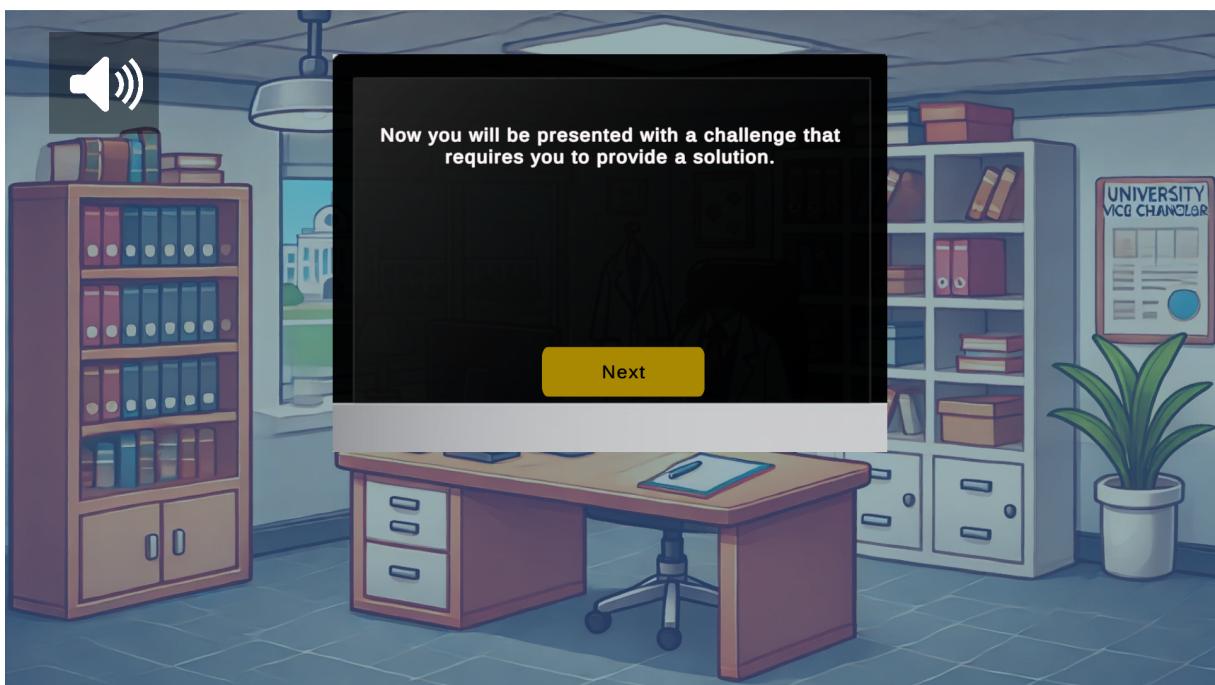


Figure B.7: In game instructions before each decision-making challenges is presented. This happens again repeatedly when the Question mark is clicked, reminding players of the tasks at hand