Game Design for Soft Skills Teaching: A Serious Game for Undergraduate Students

Cephard Kipkemboi
2324276

Project Dissertation submitted to Swansea University in Partial Fulfilment for the Degree of Master of Science

Department of Computer Science
Swansea University

30th September 2024

Declaration

This work has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed *Cephard Kipkemboi* (candidate)

Date 28th September 2024

Statement 1

This work is the result of my own independent study/investigations, except where otherwise stated. Other sources are clearly acknowledged by giving explicit references. I understand that failure to do this amounts to plagiarism and will be considered grounds for failure of this work and the degree examination as a whole.

Signed *Cephard Kipkemboi* (candidate)

Date 28th September 2024

Statement 2

I hereby give my consent for my work, if accepted, to be archived and available for reference use, and for the title and summary to be made available to outside organisations.

Signed *Cephard Kipkemboi* (candidate)

Date 28th September 2024

Abstract

This dissertation presents TAG TEAM, the serious game developed within a competency-based learning and cognitive load framework that aspires to teach soft skills to undergraduate students in the UK in order to enhance their employability. While soft skills have gained traction in the 21st century, they are yet to be embraced by higher education institutions. Thus, a mixed-method approach based on game-based learning has been employed for this purpose. The game entails a series of real-world business scenarios that necessitate the application of soft skills to be solved. It further entails cognitive tasks in the form of mini-games that must be completed to commence within the game. This game's essential skills are decision-making and self-efficacy; with the additional integration of collaboration, communication and emotional intelligence, the game aims to achieve a well-rounded business-oriented simulation. As a case study, this research tested TAG TEAM's ability to teach soft skills through self-reported Likert questionnaires, open-ended questions and in-game analytics. While the game did not offer engagement through fun and entertainment, the students found the learning material to be the primary motivation for their engagement. The study shows that students are generally willing to use serious games, especially if they are intuitive. In conclusion, this dissertation describes a possible framework that allows students to self-learn soft skills while focusing on the areas that best suit their needs, thus alleviating the burden that employers face in the form of post-hire training.
Keywords: serious games, soft skills, cognitive load theory, competency-based learning, undergraduate education, game-based learning.

Acknowledgements

I take this opportunity to appreciate everyone who supported me throughout this research. First and foremost, I thank Almighty God for giving me mental resilience and good health, His divine guidance has been my pillar of strength. Profound gratitude goes to my supervisor, Dr. Tom Owen, for his valuable help and guidance. Module lecturers for providing fundamental knowledge; Special thanks to Prof Arnold Beckmann for his mentorship and Dr Trang Doan for her tireless programming practical tutoring. Heartfelt thanks to my parents, Elisha Busienei and Janet Busienei, and my wife, Staicy Wangui Kamau, for their unfailing support—financially, emotionally, and spiritually. My classmates for a healthy competition and constructive criticism through lectures and revision sessions. Lastly, I would like to honour the memory of my late grandmother, Joan Busienei, who, in many ways, believed and encouraged me to pursue this course. To everyone who played a part, may the Lord bless you abundantly.

I would like to dedicate this research to my beautiful daughter
Candice Chelimo Busienei

Contents

List of Tables **vi**

List of Figures **vii**

1 Introduction **1**

1.1 Background 2
1.2 Significance of the study. 4
1.3 Objectives 4
1.4 Research Questions 5
1.5 Summary 5

2 Literature review **6**

2.1 Definition of soft skills 6
2.2 Importance of Soft Skills 6
2.3 How to Teach Soft Skills 7
2.4 Serious Games Design principles 9
2.5 Conceptual Framework 15
2.6 Summary 15

3 METHODOLOGY **17**

3.1 Research Philosophy 17
3.2 Participants 17
3.3 Data Collection Instruments 19
3.4 Reliability and validity 21
3.5 Ethical Considerations 22
3.6 Summary 23

4 Implementation **24**

4.1 Tools and Technologies Used 24
4.2 Game Design and Development 27
4.3 Challenges and Solutions 32
4.4 Summary 33

5 EVALUATION AND RESULTS **34**
5.1 Survey Feedback 34
5.2 Data Presentation 34
5.3 General Sample Descriptive statistics 36
5.4 Findings on the research questions 37
5.5 In-Game Analytics 43
5.6 Summary 44

6 DISCUSSION **46**
6.1 Learning outcomes 46
6.2 Willingness to Use Serious Games for Learning 47
6.3 Edutainment in Serious Games 48
6.4 Game Design Principles on Engagement 49
6.5 Summary 51

7 Conclusions and Future Work **52**
7.1 Discussion of Overall Findings 52
7.2 Delimitations and Limitations 53
7.3 Recommendations and Future Work 55
7.4 Contributions 55
7.5 Summary 56

Bibliography **57**

Appendices **66**

A Survey Questionnaire **67**

B Ethics Forms **81**

C Game User Interface **86**

D In-Game Full analytics **88**

List of Tables

3.1 Diversity of the Participants in the Sample 18
3.2 Pre-Game Questionnaire Summary 20
3.3 Post-Game Questionnaire Summary 20

4.1 Chapter Summary 30
4.2 Chapter and Soft Skills Mapping 30
4.3 Character Roles and Behavioral Traits in TAG TEAM 31

5.1 Variable Reliability Statistics 35
5.2 Descriptive Statistics Summary of Variables 36
5.3 Themes Associated to Learning Outcomes 39

List of Figures

2.1 Conceptual framework 16

3.1 Age of higher education students in the UK [1] 18

4.1 Agile Model Iteration Process [2]. 28
4.2 TAG TEAM Data Flow Diagram. 29
4.3 Simplistic user interface showcasing consistent design for easy navigation 32

5.1 Bar chart of the perceived importance of soft skills. 35
5.2 Importance of soft skills clustered by field of study. 35
5.3 Histogram of willingness to learn 37
5.4 Anova model Summary 38
5.5 Box Plot of willingness to learn soft skills using serious games. 40
5.6 Paired Samples t-Test 40
5.7 Paired Samples Effect Sizes 41
5.8 Pearson Correlation Table Between Usability and Engagement 42
5.9 Engagement and Usability Regression Model Summary 43
5.10 Engagement and Usability Regression Coefficients 43
5.11 Extraction Method Principal Component Analysis 44
5.12 TAG TEAM Engagement Analytics 44

C.1 TAG TEAM pause menu 86
C.2 TAG TEAM feedback screen 87

D.1 Tag Team Full In-game Analytics 88

Chapter 1

Introduction

The sets of skills that are required for professional success in this fast-paced and ever-changing global economy need to be substantially updated. Of course technical expertise is still being vastly adored, but today, employers are more interested in soft skills. Soft skills are, in fact, the embodiment of one's ability to communicate, collaborate, adapt to situations, solve problems, and make the right decisions. While students have often undervalued them, soft skills have proven to be irreplaceable in trying to navigate the complexities which emanate from the work environment. While soft skills are imperative, they usually fall behind in the higher education curriculum in comparison with the development of technical knowledge. The disconnect between university graduates' preparedness and the needs of workplaces has engendered formidable challenges from expensive post-hire training programs to develop such competencies on both fronts.

A promising remedy for filling this gap comes through Game-Based Learning; it is a pedagogy in which complex issues are playfully taught to students in the form of educational games. Serious games within the domain of GBL have shown promising strides wherein the cognitive load imposed by educational content decreases, and a self-paced learning environment is given to the students. Their implementation has been well executed in sciences and mathematics, but in teaching soft skills, they are largely unexplored. Therefore, GBL has the potential to bring change in the way we learn and teach soft skills that can be a silver lining in the changing professional landscape.

This study aims to identify, evaluate and propose game design principles that enhance fun and engagement in serious games while focusing on the learning objectives. The goal is to develop an effective framework that incorporates these techniques to improve the educational experience of undergraduate students in the UK, thereby better equipping them to meet employers' expectations.

This chapter will introduce the study by exploring the background on a global scale, and the problem statement centered on soft skills. Then, it will offer the solution to the problem through serious games by highlighting their advantages. The rest of the chapter will further highlight the significance of the study, its objectives, and the research questions.

1.1 Background

Employers have realised that hiring employees based solely on their academic prowess and prestigious certifications is no longer sufficient to prove that an employee is fit to join their organisation[3]. Thanks to technological advancement and automation, soft skills have become the over-arching game changer in hiring and firing employees [4]. However, soft skills are not popular among educational institutions as recent undergraduate students have fallen short of impressing their future employers with just technical skills [5]. In an era when education is becoming more accessibly remote and affordable through micro-credentials, Massive Open Online Courses (MOOCs), and distance learning [6], traditional methods of teaching soft skills have consequently become less effective. These neglected skills had been found to contribute to 85% towards employability and career progression [7].

Today, higher education institutions in the UK are being scrutinised for how well they adapt to society's dynamic sociocultural diversity. They are now expected to ensure that students meet the employability threshold standards by the end of their studies. Thus, students are required to display knowledge and understanding of technical skills and possess skills that will enable them to communicate, collaborate, and make sound decisions with ease. A recent survey in 2023 in the UK indicates inadequate exposure to practice soft skills, highlighting a lack of critical soft skills among undergraduate students [8]. Therefore, there is an apparent mismatch between what Higher Education providers teach and what employers require at the expense of the students' careers. Thus, this study aims to bridge this gap by creating a 2D serious game that focuses on teaching and assessing undergraduate students' soft skills through a self-paced competency-based learning approach that reduces cognitive load through the learning experience.

1.1.1 Problem Statement

As technology advances, society advances with it, shaping how interactions between employers, employees, and customers evolve to accommodate the nuances of the new interventions at work. Artificial intelligence and robotics have been integrated into daily tasks, wherein they provide essential assistance in various roles and duties. Whereas these advancements have been celebrated and have made work easy, they also have resulted in job displacement through automated routine tasks [9]. Consequently, the demand for jobs that machines and artificial intelligence cannot replace has increased by 40% [10]. Subsequently, technical roles are no longer constricted in the bounds of specialised tasks but have also moved into accommodating interdisciplinary relationships. Fields like healthcare and human resource management, supply chain and information systems expect graduates to be up-to-date with soft skills now more than ever.

In the United Kingdom (UK), employers struggle to find qualified engineering recruits due to their lack of interpersonal traits, leading to costly and time-consuming post-hire training [11]. A survey conducted by YouGov and MathWorks on education institutions and businesses [11] shows that 59% of education institutions and 79% of businesses agree that students in

STEM subjects are less prepared for work environments. Although [11] presents a harmonious agreement between these stakeholders on the urgency to fill this gap, it is imperative to acknowledge that existing approaches, such as industrial placements, have not been fully utilized to countermeasure this problem. The UK should put long-term effort into enforcing soft skills teaching in schools rather than during the employee onboarding process.

In a technologically savvy country where having a mobile phone seems to gradually become a necessity rather than a luxury, the social disconnect among the younger generations has widened. 97% of high school pupils in the UK own a mobile phone by 12 years according to the "UK government's guidance on mobile phones in schools" [12]. These students will be well acquainted with technology when they join higher education institutions but with poor personal and interpersonal behaviours. To solve this problem, this study intends to create a novel, serious game that teaches and assesses soft skills in undergraduate students in the UK. In doing so, instead of fighting against technology, the study focuses on encouraging education providers to use it to teach these skills. This is a crucial approach for these institutions to consider mainly because previous research suggests that "Generation Z (GEN Z)," who are the current undergraduate students and graduate recruits, do not possess the required traits in project management [13].

Addressing this gap becomes timely and imperative because of the importance of soft skills in managerial tasks, decision-making, working under pressure, and building healthy relationships among work colleagues. Evidence of the drift between "what employers expect" and "what educators provide" from surveys held in the UK provides an undeniable call for improvements within the education sector. New teaching methods should be adopted by educational institutions to Mechanisms which fortify soft skills without compromising their goals and objectives.

1.1.2 Solution To The Problem

In a generally "tech-savvy" world, the number of "gamers" keeps growing steadily and quickly, with one in three people considering themselves as gamers in the 21's century era [14]. Digital games have proven successful, especially with the accessibility of various digital platforms that enable gameplay [14]. Currently, most students own a digital device, with 60% to 80% having smartphones and 20% with tablets [15]. Furthermore, these numbers are expected to rise with technological advancements. Serious games, in particular, share most characteristics with traditional digital games but primarily focus on a specific education goal. With the enhancements in "Human-Computer Interactions" (HCI), offering motivation and engagement through different modalities, better experiences can be achieved for soft skill acquisition [16, 17].

Serious games are ideal for teaching soft skills, especially due to their adjustable nature, which offers repeated attempts [18], which can foster a good understanding of soft skills affordably and efficiently. The protagonists can learn from their mistakes in the game, which would have caused a tremendous loss in real-world scenarios, hence eliminating the risk factor during the learning phase[19]. This learning technique, as opposed to the traditional pen and paper [20] pedagogy of memorizing concepts [18], takes the approach that enables the players to search

and discover information seamlessly without mental strain. The students can learn without relying on the instructors since the game allows them the freedom to self-learn [15, 19]. This independent approach to learning enables the students to set achievable targets and goals that they can complete at their own pace [15], thus enabling students to explore advanced scenarios in the virtual world without being constricted to the tutor's syllabus.

These games can also provide an affordable bridging mechanism between theory and practice, similar to internships and work placements [21]. Since not all students get the chance to secure these opportunities, the use of serious games can ensure that soft skills can be practised even in the comfort of their homes. Furthermore, the instant feedback on decisions made in the game environment tends to be unbiased, unlike face-to-face interactions where students might fail to receive constructive criticism from their peers, mainly due to emerging social implications. This can occur in terms of withholding or softening the criticism to avoid confrontation, hurting other's feelings, and preserving relationships.

1.2 Significance of the study.

Business organisations thrive when employees portray "professional maturity" when dealing with customers and stakeholders. A strong rapport builds trust and confidence, thus enabling more sales and signing better contracts on behalf of the business. When a company aims to hire in a managerial role, these behaviours dominate over technical skills, thus proving the need for a deeper acuity of soft skills. However, teaching these skills theoretically in 2-hour lecture halls begs the question of getting acquainted with them versus harnessing them. STEM subjects such as nursing and programming eventually require hands-on training, and so does self-efficacy, decision-making and collaboration.

The findings of this study will be of significance in enabling undergraduate students to get a glimpse of how managerial tasks are performed and the tough decisions they will be required to make when they are in a real-life setting. When and if education institutions embrace the suggestions from this study, they will alleviate the burden of teaching recruits from the employers.

1.3 Objectives

With this in mind, this study will be driven towards meeting these objectives :

1. To determine how game design principles impact fun and motivation in serious games for higher education students.

2. To evaluate the efficacy of serious games in improving soft skills among higher education students.

3. To propose game design principles that can enhance the learning outcomes of soft skills in serious games.

4. To develop and test a novel serious game designed for teaching and assessing soft skills in undergraduate students.

1.4 Research Questions

The focus of this study will also revolve around answering these research questions.

RQ_1 : Can a serious game effectively teach and assess soft skills in undergraduate students without prioritizing fun over learning?

RQ_2 : Are undergraduate students willing to use serious games to learn soft skills?

RQ_3 : Do serious game design elements improve player engagement and motivation for learning soft skills?

1.5 Summary

Chapter 1 sets the stage for the study by focusing on the broad significance of the study. The remainder of the chapter outlines the dissertation's structure in the order in which subsequent chapters appear. The next chapter presents a thematic literature review, followed by the methodology chapter. Subsequently, the implementation chapter will be followed by the evaluation and Results chapter. The dissertation will conclude the study with a discussion chapter and a conclusion chapter. The rest of the document will contain vital building blocks of the study, which will be presented in the appendix.

Chapter 2

Literature review

This chapter presents a thematic literature review that underpins the rationale behind conducting this research. It organizes the key themes from diverse backgrounds and then converges them into the context of this study; in doing so, the review embraces strengths while critiquing weaknesses in the existing literature.

2.1 Definition of soft skills

"Soft Skills" is a term that lacks a universally accepted definition [22, 23, 24]. While [23] points out the frequent confusion between these skills and individual competencies, it is worth noting that individual competencies engulf cognitive, soft, and technical skills. The numerous definitions of soft skills prompt for a universal definition [7] in order to avoid confusion when categorising them.

Since the 1970s, these skills have been expressed in different ways, such as "how-to-be" traits [7], and "21st-century skills" in the past decade [25, 26]. The first definition appeared in 1972 in the United States military's training manuals that described roles relating to managing manpower [27, 22]. They have also been referred to as specific human behaviours, personal qualities and attributes [4] and personal traits [28]. The term has also received different titles in various geographical locations, such as "employability skills" in Australia, "generic skills", and "life skills" by the World Health Organization [29], "lifelong learning" in the European Union, and "workplace know-how" or "vital competencies" in the United States [23].

While there is no agreed definition, it is apparent that soft skills concern attributes manifested through a person's behavior. This study, therefore adopts this perspective and defines soft skills as *the personal behavioral attributes that facilitate career success by fostering good relations between colleagues at work, irrespective of their technical proficiency or academic training.*

2.2 Importance of Soft Skills

The peculiarity of soft skills is in their ability to transcend departments. For example, teaching [30], supply chain [31], and information technology [32, 33] have highlighted the overwhelming

importance of these skills over the past decade. However, it usually takes some time for students to realize how such skills positively influence their careers. For example, a study conducted by [30] in the Bani Kenana District established that experienced teachers were found to exemplify soft skills better than those at the medium and least experienced levels by about 11.73% and 14.48%, respectively. This not only shows how students perceive the importance of soft skills but also points to a deeper issue of how and whether they have been taught these skills before. Furthermore, if the students only gained these skills in the field, what pedagogy is best suited to transfer these skills to them while still in school?

This gap explains the rift in soft skills education and practice, which almost seems apparent during recruitment. A survey conducted by [32] shows that there is more student focus on showcasing technical capabilities than anything else to the recruiters in interviews and resumes. While some students may portray intermediate ability in some competencies, the skills they portray sometimes are not deemed as important by the recruiters. In that case, the gap arises in determining the most essential soft skills and what higher education institutions can do to make their students meet the expectations of recruiters.

The VUCA ("volatile, uncertain, changing, and ambiguous") [3, 7] Work environments require different natures of tasks and interactions for successful transactions. For example, While teaching [3] and technology [32] have upheld communication, time management, teamwork, and leadership [30], the supply chain industry has emphasized on management and conduct [31] at the expense of emotional intelligence. While emotional intelligence is yet to appeal to employers at large, its importance has been vastly embraced in the United Kingdom [34, 35]. This inconsistency in employer preferences dictates that just like technical skills, some soft skills dominate others. Thus, it puts more strain on educators' shoulders in the case of how they are expected to teach soft skills to students while considering their field of study. Failure to do so will result in graduate job seekers whose skills are not aligned with their respective employer needs.

While it is apparent that soft skills are more essential for career progression [7]; this is not to say that technical skills should be abandoned. A good blend of both will ensure job seekers are the desired candidates for the most sought-after role [36]. Previous literature has proved the enthusiasm for the importance of soft skills among recruiters, which should be adopted in educational institutions. There is also a big issue arising in the categorisation of soft skills based on the work dimensions, which has also contributed to the neglect of various soft skills.

2.3 How to Teach Soft Skills

Teaching soft skills is most effective when it integrates both educational and industry training, a form of learning that occurs through experience. With the unanswered questions from the "Importance of soft skills section," it is worth noting and critiquing the efforts that have been taken to mitigate this problem before commencing into this study's preferred pedagogical framework.

2.3.1 Competency Based Learning (CBL) and Serious Games

Previous studies like [30, 32, 33] agree that teaching soft skills is not a straightforward task, especially with decision-making, emotional intelligence, communication, teamwork, and self-efficacy. Newer techniques have emerged with the innovations of technology, hence the emergence of this study that incorporated CBL [37] and Cognitive Load Theory (CLT) [38] in the design of a serious game that teaches soft skills without making them a peripheral learning objective [37].

Levine [37] proposes learning through experience to gain specific competencies, which promises to address the gap in teaching soft skills. CBL focuses on mastery [15, 39] and personalised learning, a common characteristic of serious games. This is done by emphasising real-world problems and ensuring collaborative and self-directed learning, offering flexibility to the student's learning experience. This approach helps students acquire better problem-solving knowledge through in-game contextual decision-making. In contrast to the traditional teaching approaches, which do not emphasise building these skills.

Levine proffers that learning through experience could be a means by which to acquire certain competencies that can bridge the gap in teaching soft skills. CBL focuses on mastery of standards [15, 39], as well as personalized learning, a common characteristic of serious games. CBL does this by emphasizing on real-life problems while ensuring that learning is collaborative and self-directed, thus giving flexibility to the students. It helps the students to gain better problem-solving skills through in-game contextual decision-making, as opposed to traditional approaches in teaching that do not emphasize such skills.

With CBL, serious games can rigorously transfer soft skills to undergraduate students without putting emphasis on group learning like PBL; in that case, the advantages over PBL can be two-fold. First, students who struggle with learning cannot be overshadowed by others since they have an opportunity to choose to learn alone or as part of a group. Secondly, the more active students don't have to revise the material that they have already gained mastery in but rather focus on the ones they don't feel comfortable with.

2.3.2 Serious Games

Serious games are software created for the sole purpose of learning a specific set of skills, for example, health, ethical awareness, soft skills, and cognitive skills in various fields [40]. These games in nature are more similar to traditional video because their intensive, interactive nature focuses mainly on results [40], engagement [7], and fun [41]. Players can make their own decisions in the storyline by experimenting with new things and exploring the digital world [42]; hence, the student becomes the story's protagonist. These games give instant feedback in the form of in-game rewards and punishments on decisions and actions undertaken by the player. The simulation of the real-world experiences incorporated concurs with Levines [37] CBL approach, where the serious game maintains similar functional activities as it would have been in the real world.

The emergence of serious games dates back to the 1970s when they were related to activities that can be performed inside and outside the classroom while maintaining an educational

purpose through simulation and play [43]. Fast forward to the recent decade, these games have gained much traction and favour in higher education, evident from the previous research highlighted in the theoretical review conducted by [43]. Due to their diversity, serious games have maintained this favour among educators and researchers alike. Eliminating the need for physical contact has also aided serious games in improving learning outcomes efficiently.

2.4 Serious Games Design principles

2.4.1 Narrative Design

Visual novels are a gaming genre that originated in Japan with the emergence of *"The Portopia Serial Murder Case"* [44], a game developed in the 1980s designed with a compelling storyline and minimalist graphics. This groundbreaking work laid the foundation for future innovations, which have resulted in subcategories such as kinetic novels, branching novels, and "Otome" games. These artistic novels are well confined within the boundaries of good Human-Computer Interaction (HCI) software, utilising modalities such as visuals and audio to maintain engagement and immersive experience.

Mainstream video games have been successful in adopting this technique; it is evident with famous titles such as *The Wolf Among Us* [45] by Telltale games and *Catherine* by Atlus [46] having the ability to immerse players into play for long periods of hours. Given that serious games are more similar to traditional video games, recent research has explored integrating these narrative-oriented techniques in developing serious games to teach soft skills. Such games include *Compete* [41], *Strong Together* [47], *Citizen Quest* [48] and *Galaxy Solutions* [49]. Although video games cannot promote learning, serious games can still be designed around the same mechanics in an educational approach; in so doing, this study intends to develop TAG TEAM as an educational visual novel. Other than the narrative design of the storyline and avatar formulation, it also aims to be process-oriented in nature.

Process-oriented serious games offer students a great opportunity to be exposed to the virtual environment and develop their skills via decision-making and parasocial interactions. These games do not focus on achieving outcomes but on the student's learning journey; with CBL, these games can enable students to focus on the competencies at hand while the learning process acts as scaffolding for attaining mastery. F-EMS [2] is an example of such a kind of game where simulation of the various activities that take place in the real-world business environment, and the students are in a position to learn skills like critical thinking and problem-solving in a more experimental way. Just like in F-EMS, TAG TEAM's design aims to incorporate the everyday business tasks that are typical for the sphere in which undergraduate students will operate when entering the work environment. Thus, it helps to enhance the soft skills of the learners.

2.4.2 Feedback

The design of a serious game is a well-orchestrated process that needs proper planning and in-depth study. To achieve a successful game design framework, the best practices that have proven efficient from previous work must be adopted. For example, Haely et al. [47] suggest conducting a research assessment of a serious game named *Strong Together* in order to examine the effect of game mechanics on the level of players' engagement. In terms of learnability and engagement of the students, the research stresses the value of feedback mechanisms. The study suggested using a research protocol called "Sequential Multiple Assignment Randomized Trial" (SMART) to examine the self-advocacy skills of female cancer survivors based on the game's effectiveness.

This protocol challenges the parameters deployed in designing the game, specifically the mechanics [47]. The study also suggests that future researchers should employ mixed-method research, where the quantitative data could be obtained from Likert questionnaires and real-time game analytics, while qualitative data could be obtained from semi-structured interviews with the participants. Nevertheless, the proposed approach by Healy et al. [47] has some drawbacks in data collection, such as its generalizability, flexibility, and participants' involvement. Regarding the three-month data collection period, some participants will eventually drop out of the study throughout the research process. Furthermore, the participants will require an internet connection for the game to capture the in-game analytical data during play successfully. Finally, since the study aims to focus solely on female participants, its findings might not be generalisable to represent all the cancer survivors, including the ones of the opposite sex.

The kind of feedback mechanism that is implemented in a game determines the manner in which students engage with and develop soft skills from it [40, 47, 50]. These two mechanisms include aesthetic and explicit feedback, which are useful if applied correctly. Mood and environment changes are part of aesthetic feedback, which means changes taking place in the virtual world in relation to and as a reaction to the players' actions [47]. These changes include different colour pellets, light shades, background music, and even weather, depending on the mechanics of the game, so as to induce the perception of emotions and feelings.

In contrast, explicit feedback involves direct updates on numerically centred and in-game metrics such as currency, health bars, armour, gems, and scores. These feedback forms enhance competition through leaderboards, ranks, badges, and high scores [47]. Unlike aesthetic feedback, which offers a subtle form of interaction that deepens player engagement [40], the competition aspect of explicit feedback increases motivation in students [47]. Although the literature does not explicitly favour one mechanism over the other, previous research suggests that both approaches have a beneficial impact on creating serious games for teaching soft skills.

Ávila-Pesántez, Rivera, and Alban [50] conducted a systematic literature review on 51 studies between 2008 and 2016 to analyse the frameworks, methodologies and models previously used for serious game design. [50]findings also support the conclusions made by [47], suggesting that while both feedback mechanisms are beneficial, the focus is on the context of the game. Furthermore, feedback must enhance fun and engagement in order to boost pedagogical

requirements and meet psychological goals [50].[50]. Explicit feedback is more effective for tasks with measurable outcomes, such as technical skills and short-term motivation. On the other hand, aesthetic feedback is more emotionally engaging and sustains interest; hence, it is effective in scenarios focused on teaching soft skills [40].

In conclussion, regardless of the feedback mechanism, students should always receive immediate feedback.While aesthetic feedback can intensify the novelty of a game, the scope upon which TAG TEAM is defined embraces explicit feedback. Mainly to achieve simplicity, in order to avoid over-emphasis on fun over learning and reduce the amount of confusing visuals that can intensify intrinsic load.

2.4.3 Failure and Fail States

Bouchillon and Stewart [48] conducted a study to evaluate the effectiveness of role-playing game-based design in teaching soft skills in the context of immigration stereotyping in America. The online role-playing game required the students to create an online avatar whose in-game performance affected their school final grades. This shared fate failure mechanic transcends the bonds of the game into the real world, with the students facing adverse repercussions if their avatar's trust is not achieved. Although the game aimed to create parasocial connections between the participants and the avatar [48], the participant's soft skills, such as communication and good decision-making, played a big role in enabling their avatar to attain trust through the citizenship application process.

Unlike academics and sports, which frown at failure due to the negative impact on people's psychology [39], challenge orientation and pursuit for mastery in serious games enforce failure as an integral building block for a good serious game. When fail states are correctly incorporated into serious games, the expected learning outcomes are achieved while also upholding engagement, as presented in the qualitative findings of Bouchillon and Stewart [48]. The study's findings show that more than 50% of the participants perceived the failure mechanism incorporated in the game as fair, with 42% finding it mostly fair and 23% finding it extremely fair [48]. However, one-third of participants who did not see the approach favourable to them might have lost interest in engagement due to the fear accompanied by the high stakes of failing to perform well in the game. In this case, the main motivation for students' engagement in the game and pursuit of perfection was rooted deeply in attaining good grades at the end of the semester. Thus, Bouchillon and Stewart [48] approach on game failure affected the participants' motivations and engagement both positively and negatively as opposed to the expectations of the design choice.

In contrast, a study by Hefkaluk, Linehan and Trace [51] recruited participants using the "Player Experience of Needs Satisfaction" (PENS) questionnaire based on their competency and mastery of playing difficult games. This survey approach is based on a motivation theory that suggests competencies, relatedness, and autonomy as the main psychological factors that players predominantly aim to satisfy when playing games, known as "Self-Determination Theory" (SDT) [52]. By knowing the mastery level of the students beforehand, in this study, TAG TEAM's

fail-states can be designed to be challenging without being too strict. Therefore enhancing learning outcomes while testing self-efficacy.

The themes *Celete* [51] findings proved that self-efficacy enabled participants to consistently retry difficult levels until they eventually progressed. With high self-efficacy, the participants persevered through numerous challenges, focusing on a purpose without showing any negative effects or drawbacks. However, the findings of this study only offered the assumed measure of self-efficacy through the transcribed and analysed data using "Reflexive Thematic Analysis" (RTA). Thus, the conclusions derived from the study had three potential limitations in presenting generalised data.

Firstly, the admissibility of participant feedback was purely qualitative and was not backed up with any analytical data from the games like the ones proposed in the SMART framework by [47]. Secondly, the themes formed by [51] had potential researcher bias even before data collection. Finally, as illustrated by Braun and Clarke [53], concerns about the subjectivity through the way players perceived the game would have resulted in high self-efficacy. The research would have benefited more from additional quantitative data from screen time, level analytics, and haptics. Thus, the design of TAG TEAM will integrate a mixed-method approach to measure the student's self-efficacy and decision-making.

In-game failure can be experienced in many ways, such as equipment-based loss, time-based loss, partial progress loss, story branching and game restart. These failed states can be categorised into two categories: soft and hard fail states [47]. In soft failed states, the punishment is not severe, and often, the player can carry on play having incurred minimal punishment; on the other hand, hard failed states can be daunting due to the severity of the punishment enforced in the game.

While the findings of [39] on previous literature acknowledge the glaring overlook of failure in serious games, it still highlights the importance of the star awarding system at the end of every level. A lack of enough stars would clearly indicate to the player that they did not attain the expected goal, motivating them to replay the level to attain all stars. This soft failure does not hinder players from progressing to the next level but encourages them to aim for better results.

Furthermore, Bouchillon and Stewart [48] did not enforce learning objectives through repetitive attempts since the serious game did not allow level replay that would improve game mastery but instead cost students their final year grades. Their findings can not be entirely generalised due to the small sample size, gender imbalance, racial significance, and young age of the participants onboarded to partake in the study. This failed approach can demoralise players who do not consider themselves "gamers" into shying away from serious games due to the stakes accompanying them. Hence affecting their psychological and emotional balance [39]. While TAG TEAM intermixes learning outcomes with failures, the consequences of wrong decisions from the participants remain in the scope of the game and not to real-world grades; in this way, the game will not entice the students to play for the sake of grades but for the sake of gaining knowledge.

Altomari et al. [40] encourage students to learn through exploration and perseverance through continuous trials without facing any consequences beyond the game. [47] also agrees

that hard-fail states allow players to observe and learn how poor choices can lead to devastating consequences. [39] further reiterates the importance of carefully designing fail states that still pursue motivation and engagement while upholding psychological well-being. In the sense that failure should be considered an opportunity for improvement and constructive criticism [54]. Therefore, this study adopts this proposal by incorporating explicit feedback into TAG TEAM that boosts the players self-efficacy after failing a level. In doing so, the game will improve engagement and learning outcomes through hard fail-states and explicit feedback.

Hefkaluk, Linehan, and Trace [51] have successfully used a video game to measure players' self-efficacy through repeated level failure in *Celeste*. Although, this approach can only be used for assessing soft skills and not teaching them. In that case, a video game with hard fail states can effectively test self-efficacy, but it cannot teach self-efficacy. With this rationale, the design of TAG TEAM is directed towards filling this gap by striking a balance between fail states, whereby the visual novel will incorporate soft fail states in order to motivate students to learn decision-making, while tasks will in-cooperate hard fail states that will test the student's self-efficacy. This combination of fail-states will improve engagement, and motivation will enable students to seek mastery and, in doing so, attain the desired soft skills.

2.4.4 Fun

Serious games are designed to be fun and engaging, regardless of whether they help achieve goals or overcome obstacles. *"Among the Office Criticality"*; immersive serious game specifically made to assess the soft skills of University of Calabria students in a simulated job market scenario." [54] concludes causes of fun from the quantitative analysis of 160 higher education students through open-ended questionnaire feedback. The participants found the game enjoyable, with generalised data regarding individual soft skill score systems. However, the time allocated for the study was only thirty minutes; hence, it does not entirely separate fun from novelty experience. Furthermore, the positive remarks of the participants deeply route towards the novelty experience by using vocabulary such as "functional, realistic and innovative" [54]. Therefore, high fidelity increases fun and engagement, especially when creating serious games that aim for realism. This way, the entertainment facet of the serious game will be archived through consistency with the real-world environment. Thus enabling the players to work towards achieving learning objectives [54] in an interestingly relatable experience.

Additionally, presenting different "mini-games" or story branching improves the perception of novelty. This can be done by embedding smaller projects or mind games and puzzles that tie back into the overarching learning objectives of a serious game. Márquez et al. [19] claim that dividing serious games into sections will result in positive learning outcomes in communication skills and problem-solving. This entertaining learning outcome can be archived similarly to fail states through stressful variations. With this rationale, TAG TEAM'S design will incorporate tasks in the form of mini-games to serve as breaks from the content-heavy visual novel storyline. Another advantage of this approach is the capability of these mini-games to set a clear transition

between storyline chapters, thus enhancing the novelty of the game while reducing fatigue that might arise from extraneous decision-making.

Motivation and fun are the main driving factors associated with serious games, especially when designing a game specifically for a rather *"not interesting"* or challenging activities to do like the ones involved in education [55]. Empirical evidence suggests that these games are beneficial for improving cognitive and soft skills [55, 56, 57]. However, [43] argues that regardless of the amusement and adrenaline pump experienced in play, students are less likely to achieve positive learning outcomes if the serious game has not been developed around the existing pedagogy. Thus, developers and designers must employ the correct theoretical framework that balances artistic game design and educative learning material.

2.4.5 Cognitive Load on Learning outcomes

Cognitive load theory (CLT) is an essential educational framework introduced by John Sweller in the late 1980s, which states that cognitive processing is reduced when the cognitive load outweighs the working memory [58]. Cognitive load is the mental strain that occurs when the brain tries to understand complex information [59]. Game-based learning has been proven to reduce and simplify these tasks through motivation, fun, and engagement [7, 20, 59], thus reducing cognitive load. [56] found that cognitive demands are one of the most essential parts of a successful serious game.

The aim of designing serious games is to enhance the learning experience while enriching the brain plasticity [20]; another reason is to reduce confusion that arises from overwhelming information [55, 59]. Integrating learning into CBL and serious games is beneficial for training in sectors where practical experiments are expensive or dangerous [2] and enables students to be better prepared for work-based environments [20]. Furthermore, a holistic experience associated with playing serious games addresses the gaps in the rigid traditional pedagogies [7]. Serious games have been positively accepted due to their promising and fruitful outcomes, mainly attributed to their captivating nature, rules, and challenging tasks.

Literature finds that when students complete tasks, they experience joy, and their motivation improves tremendously [60, 61], hence encouraging them to continuously learn to achieve the educational goal without feeling imposed and forced into learning. This voluntary feeling reduces cognitive load by enabling them to have a relaxed mindset when learning, thus allowing them to gain the most out of the game without straining [59]. This can be beneficial, especially when dealing with students who face difficulties understanding new technology due to health issues [55].

Based on these in-group experiment findings of [20], serious games effectively transfer and improve learning objectives without stressing the brain, regardless of whether they are used through in-person or distance learning. This enables the students to learn while unsupervised [40, 2] and still effectively grasp the intended learning material without having to attend physical lectures. However, this should not be an intention to skive attendance but rather

complement learning material during catastrophic events like the COVID-19 pandemic or for take-home assignments.

However, it is essential to avoid the pitfall of oversimplifying the in-game scenarios just to reduce cognitive load; this drawback can happen in the form of superficial learning where the serious game is rendered ineffective in transferring knowledge. As discussed earlier, serious game design should be thoughtful and in the case of TAG TEAM, this thought has been considered; thus, CLT will only be applied with hard fail states. Soft fail states will not consider CLT since it will make the game too easy for the participants. Finally, the study by [20] guides the development of TAG TEAM design to consider both online and in-person platforms that can be indistinguishable from the participants. This rationale will aid the game in offering a simulated work environment that can be embraced by students at the pleasure of their homes, thus offering a cost-effective and accessible solution to the gap encountered in experiential learning, as discussed earlier.

2.5 Conceptual Framework

This study's conceptual framework portrayed in Fig. 2.1 is grounded on the CLT (CLT) and CBL. These are combined to inform the serious game design that imparts soft skills. Using this framework, the study offers a minimally designed 2D environment with an explicit and implicit approach to learning and evaluating soft skills. Therefore, CBL is employed to serve the purpose of letting students master selected soft skills through an experiential learning approach where students progress at their own pace according to their ability. CBL focuses on problem-solving and making decisions in real life, with collaboration hence its employment in game design for the study.By doing so, learners will actively engage with soft skills through practical application, thus promoting both short-term and long-term knowledge retention

In CLT learning approach, learning should be optimised by minimising the unnecessary strain on the students' brains since the working memory is finite. The developed game will minimise extraneous load and promote germane load by focusing the learners' cognitive resources in relation to soft skills. This framework further incorporates feedback and failure states; the Game design principles dictate the level of engagement and immersion that supports playful learning outcomes. The proposed design will consider both aesthetic and explicit feedback; while putting more emphasis on explicit feedback. It will also ensure that this serious game is not only effective but also pedagogically sound with respect to CBL, CLT, and Game Design Principles.

2.6 Summary

Following the critical thematic analysis of the literature, this chapter has identified important evidence supporting the existence of a gap due to the absence of the best framework for teaching soft skills. Outcomes of previous studies related to serious games point to an optimum solution that may help bridge this gap and provide support in facilitating a seamless learning experience that integrates CBL. Other literature has focused on serious game design in order to be appealing

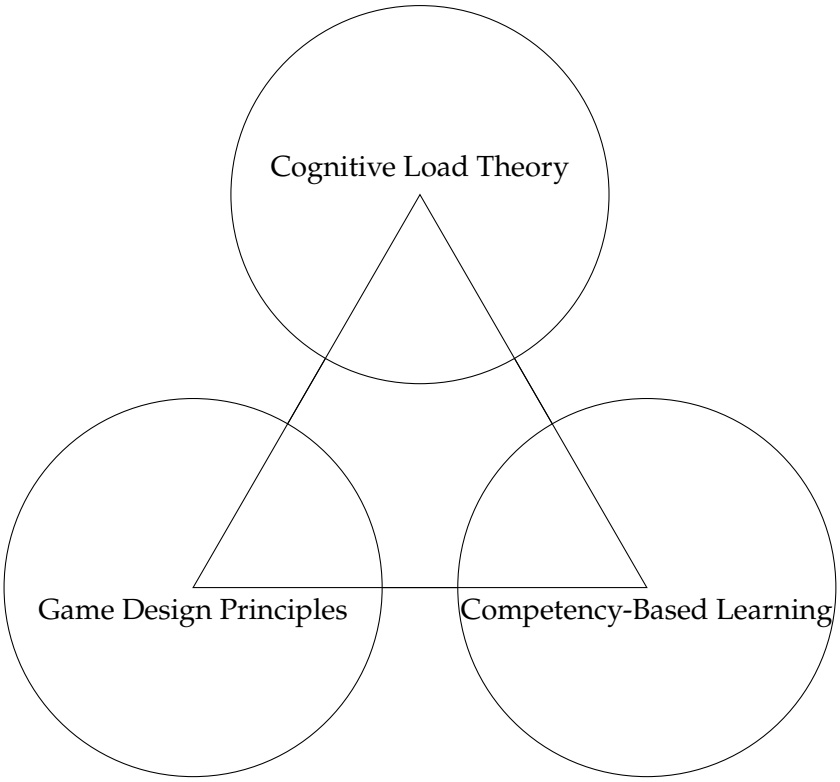

Figure 2.1: Conceptual framework

and enjoyable, considering student competencies and the cognitive load of a game, which greatly influences the results of learning. In relation to that, the proposed conceptual framework of this study presents novelty with respect to considering the independent learning ability of the learner without him/her feeling overwhelmed or exhausted.

Chapter 3

METHODOLOGY

This chapter outlines how the pragmatic approach was used to answer the study's main questions. It also highlights the rationale behind the researcher's decision in the formulation of questionnaires, recruitment of participants, and ethical considerations.

3.1 Research Philosophy

Pragmatism is a philosophy that denotes the need to test and evaluate one's idea scientifically. If the idea enormously contributes to society, it is embraced; it is disregarded otherwise [62]. This study embraces this philosophy through a mixed methods approach in data collection and analysis to answer its aims and objectives. Qualitative data offers rich insight into the participants' subjective experiences, while quantitative data offers structured, measurable data in scales. This double-edged design enabled the researcher to ascertain the practical implications of serious games as a tool for teaching soft skills.

3.2 Participants

This research was initially intended to onboard a random sample of participants from the United Kingdom. Although, this was not the case since it was undertaken during the summer holiday. Thus, the researcher resorted to seeking a convenient sample. While the researcher was able to onboard some participants from the United Kingdom, the majority of the sample was predominantly from Kenya. 25 undergraduates from Swansea University, United States International University (USIU), Kenyatta University (KU), and the University of Nairobi (UON) were requested to volunteer. The Kenyan-based participants were approached through email, WhatsApp groups, and Facebook communities. The UK-based participants were requested through word-of-mouth at a social gathering at All Nations Church in Swansea.

Before commencing the study, four participants from Kenya dropped out. Three did due to the lack of financial inducement, and one did not have access to a device that met the minimum requirements to run the game. Despite the small sample, it consisted of volunteers from diverse backgrounds, as presented in Table 3.1. There was a good balance in gender, with

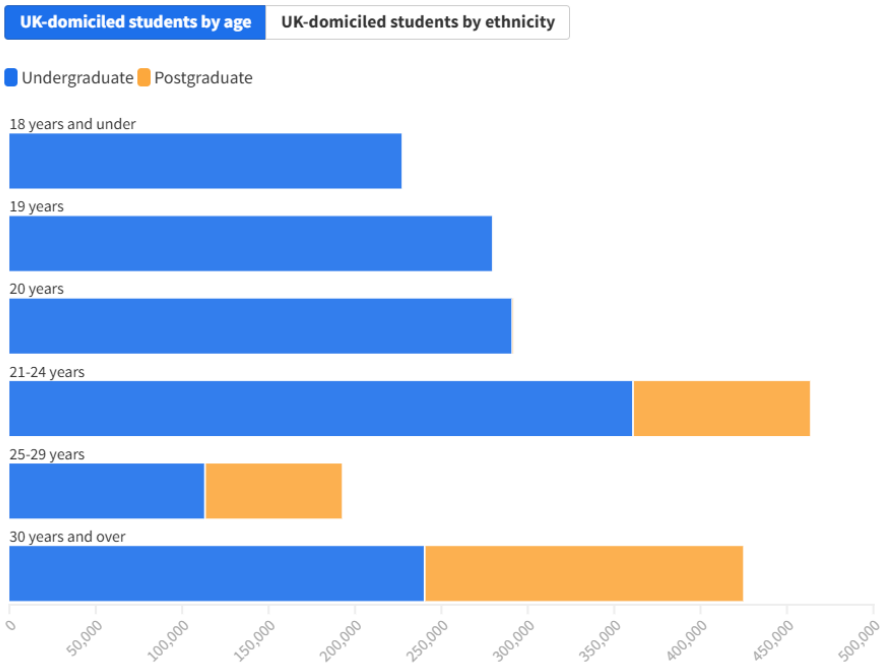

Figure 3.1: Age of higher education students in the UK [1]

males accounting for eleven and females for ten participants. Regarding the field of study, STEM contributed eight and NON-STEM thirteen of the participants. These diversities in the sample demographic can enhance the generalisability of the findings to some extent [63], thus representing the entire population of undergraduate students.

Table 3.1: Diversity of the Participants in the Sample

Nationality	Number of Participants
Kenyan	14
British	2
Nigerian	2
Korean	2
Malaysian	1

The researcher purposefully sampled the participants aged between 20 and 21 from Swansea University and 20 and 22 from Kenya. Fig. 3.1 portrays that the majority of Undergraduates in the UK lie between 18 and 21 years old [64, 1], furthermore in Kenya is slightly higher at 18 and 22 [65]. This decision was intended to ensure that the participant pool consists of final-year undergraduates or recent graduates with little to no work experience. By adhering to this range, the study's findings were not distorted by outliers that have immense work experience [63]. The researcher also purposefully selected final-year and recent graduates since these participants represent the majority of the undergraduates the employers have found to lack soft skills. Since these participants are expected to have completed the majority of their studies, they are a better representation of undergraduates/graduates that future employers will interact with.

The participants also needed to be tech savvy and have access to a laptop to be onboarded. For instance, While the researcher did not deem participants' prior interaction with video games as a variable that would affect the study's findings, measures were taken to ensure none of the onboarded participants had prior experience with serious games. This was to ensure that the bias towards game-based learning was annihilated. In doing so, the researcher upheld the impartiality of the findings.

3.2.1 Technological Considerations

Every study should aim to eliminate all sorts of discrepancies that can taint the reliability of the findings. In this case, the devices used to run TAG TEAM were required to offer a similar gaming experience to all participants. [66] advises researchers to reduce confounding variables as much as possible when conducting research in order to observe findings as a result of the intended interaction and not from external factors. It is important for this study to maintain this consistency across the sample pool since the experiment is not undertaken in a controlled environment.

The participants' devices were expected to neither exceed nor fall short of the laid-out requirements. Firstly, the device in question had to be a laptop between thirteen and fifteen inches in size. The expected system requirements for TAG TEAM to run smoothly were at least 4GB RAM and a dual-core processor (Intel Pentium or AMD Athlon was preferred). The laptop was also required to have an integrated graphics card to achieve the game's standard quality resolution of 1920 by 1080p. Furthermore, Windows 10, macOS Sierra, and later versions of the operating systems were also considered to ensure TAG teams do not run into any compatibility issues. This technical uniformity in participant devices enabled the TAG TEAM to offer consistent experiences to the participants regardless of their prior experiences with serious games.

3.3 Data Collection Instruments

Before gathering data, it was essential for the researcher to determine which information was befitting for the study .[67] states that using a mixed method approach enables the study to fully comprehend the participant's experience. Therefore, considering this rationale, questionnaires and in-game analytics were the preferred instruments to collect data in line with the study's objectives. These instruments enabled the researcher to capture qualitative and quantitative data, allowing for more nuanced findings.

3.3.1 Questionnaire

In order to effectively capture feedback, the researcher systematically designed pre- and post-game questionnaires. The pre-game questionnaire captured demographic data, participants' previous knowledge of soft skills, the importance of soft skills, and the participant's willingness to use serious games as an educational tool for learning soft skills. All the post-game questionnaire questions were closed-ended with checkboxes and radio buttons for multiple-choice answers. The

post-game questionnaire covered all the variables related to the study through a closed-ended Likert Scale and three open-ended questions.

Each variable was represented by a group of 5-point Likert questions whose means were used for quantitative analysis. The grouping of the questions to represent a variable ensured that the participant's answers would be a more accurate representation of their experience as opposed to if each answer would have represented a variable [68]. Open-ended questions were adopted to enrich findings by capturing the nuances that might have been missed in the close-ended Likert questions [53]. Table 3.2 and Table 3.3 highlight the design of the questionnaires and how the questions represent variables.

Table 3.2: Pre-Game Questionnaire Summary

Question Number	Variable Represented
1–3	Demographic
4, 5, 7	Knowledge Test
6, 8, 9	Willingness

Table 3.3: Post-Game Questionnaire Summary

Question Number	Variable Represented
1–3	Demographic
4–8	Knowledge Test
9–13	Willingness
14–20	Engagement
21–24	Usability
25–28	General Thoughts

3.3.2 In-Game Analytics Observation

In-game analytics are the basic tools that capture the behavior and engagement of a player from TAG TEAM by recording every available data point from the playing. These analytics detail how participants engage with the game mechanisms, which tasks they execute, and their strategy or decisions during game performance. It measures time spent on each task, the frequency of completion of a specific task, and the players' responses to any particular challenge within the game environment. This will be an important trend in highlighting participant performance and hence helping to appraise not only the effectiveness of the game for soft-skills learning but also individual learning trajectories. For instance, according to a player's solution time or number of retries after previous failures, the researcher will be able to estimate his levels of self-efficacy and persistence.

Using in-game analytics could, therefore, yield insights into user engagement through activity tracking over feedback mechanisms and indicators showing progress through a game. It allows nuanced tracking of aspects that work or do not work in the game and that may require corrective action in terms of delivering learning outcomes. This overall analysis is enriched when these quantitative findings are combined with qualitative data from post-game

questionnaires. This research attempts to embed in-game analytics in the research methodology to support findings for discovering the effectiveness of serious game mechanics in fostering self-efficacy and decision-making in undergraduate students.

3.3.3 Data Collection Tools and Process

Both questionnaires were created in Google Forms (see Appendix A). While the effectiveness of such online methods of data collection has received criticism [69], the circumstances in which this study was conducted justified their use. In a practical sense, Google Forms was the counter-measure to circumvent the financial, time, and geographical constraints. Finally, Google Forms enabled the researcher to organize questions systematically in categories related to the variables.

The IBM SPSS software was employed for data analysis. It has the ability to compute rigorous data analysis, making it a suitable tool for statistical research. With the use of this software, the collected data was cleaned and analysed. It enabled the researcher to conduct descriptive statistics, regression analysis, correlation analysis, and plot representative graphs, charts, and tables. While only the paid version of the software is available, it was offered to the researcher for free by Swansea University.

3.4 Reliability and validity

Validity and reliability are crucial when researching since they determine the credibility and transferability of a study. Reliability is considered in regard to the generalisability or reproduction ability of the results. Thus, we can conclude that the same outcome could have been arrived at again if the same study was repeated at similar circumstances. To ensure increased dependability, the documentation of the research approach was systematically done including documenting the process of data collection and the context in which the study was executed [70].

Since every participant is different from the other, they might respond differently even if the study was conducted again with the same participants under the same conditions. This variation draws particular attention to the need for the proper assessment of variability and the most appropriate ways of showing the results [71]. By ensuring a detailed transcription as well as an in-depth Content Analysis, the research confirmed that the results presented are a true reflection of the participant's experiences. Lastly, the analyses and coding process were done in a very comprehensive manner in order to enhance clear documentation of the process that would enable replication of the study by other researchers in the future.

On the other hand, validity means how accurate the findings are or how accurate the measures are likely to be. It relates to whether the results obtained are truly reflective of the subject under investigation and if, indeed, the research assesses what it is posited to assess. There are various methods that were used in this study to ensure validity; first of all, the methodology selected was appropriate for determining the effectiveness of TAG TEAM in teaching soft skills since the chosen research design was relevant to the topic of the research. As a result, to ensure the

questions are relevant and specific, the questionnaires were developed based on the literature review of the field of educational games and soft skills [72].

The diversity of the sample helped to enhance the generalisability of the results, which would not have been constricted to a single geographical region. Moreover, the multiple sources of data, which were collected through in-game analytics and questionnaires given to the participants before and after the games, also increased validity through the triangulation of different perspectives of the same events [73].

Nevertheless, despite such attempts to ensure validity, it is still necessary to highlight that subjectivity shall always be incorporated within the stages of data collection and analysis. That subjectivity might induce bias; thus, reflexivity was employed in an effort to minimize this by having the researcher assess their presumptions [74]. Furthermore, member checking was used to increase the authenticity of the results since the participants were given a chance to go through the responses and correct anything that was inaccurate.

3.5 Ethical Considerations

The ethical considerations in this study were regulated by the "General Data Protection Regulation (GDPR)" [75], which ensured the safety of participants' data. First of all, the informed consent of the participants was sought by the researcher so as not to compel them into doing what they did not want to do. The participants were provided with PDF documents explaining the purpose of the research, why they were chosen to participate, and the extent to which they would be involved in the research. The participants were also made aware that they had the right to withdraw at any time for no reason whatsoever without any ramifications [76]. This openness ensured the research had no hidden agenda with allowance for voluntary participation.

The participants had their privacy and anonymity through the confidentiality of their responses, which does not allow disclosure to any third-party persons. They were also assured that their identification details would not appear in the final copy of the results. Another ethical issue deemed relevant to the study was how the researcher would manage the collected data in line with the Data Protection Act(DPA) [77]. Hence, the electronic data were encrypted and stored in a password-protected device operated by the researcher only. All these procedures have been implemented with the purpose of protecting information about the participants and a right to privacy. More so, the researcher sought permission from the Swansea University Research Ethics Committee through a Research Ethics Form. The form was later considered and approved by the relevant authorities prior to conducting the research.

The study also applied the principles of beneficence by ensuring that the research was conducted in a way that would ensure the best possible outcomes from the participants while minimizing harm to them [78]. As such, it was ensured that TAG TEAM did not cause psychological distress or injury to the participants. The game was assessed to ascertain that the material contained in TAG TEAM is not unfit for the designated age nor contains anything that may offend any individual.

Finally, the researcher ensured that the treatment of the study was done at a high level of professionalism by ensuring that integrity and transparency were maintained. In data collection and analysis, the researcher stringently observed the principles of neutrality in order not to influence the participants' answers. An application of reflexivity was quite instrumental in identifying and reducing any emerging bias that would serve to distort the results of the study.

3.6 Summary

Chapter 3 of this dissertation describes the research methodology underpinning this study in terms of the pragmatic philosophy and mixed-methods research design. This chapter discussed the rationale behind participant selection and technological considerations. Furthermore, it discussed the instruments for data collection, including questionnaires and in-game analytics. This chapter has addressed the most appropriate considerations involving the validity and reliability of the findings. The chapter also included ethical considerations through informed consent, data protection, and confidentiality, which were upheld to protect the welfare of the participants and maintain research integrity.

Chapter 4

Implementation

Chapter 4 of this dissertation describes the practical design and development of the serious game, TAG TEAM. The development, analytics, and version control tools to be explained here are Unity, C#, PlayFab, and GitHub. This section shall put into perspective the storyline, character design, and user interface in developing the game, guided by the Agile Development approach. Specific implementation challenges encountered during the development process will also be discussed, including any technical quagmires that were encountered and the solutions used to solve them.

4.1 Tools and Technologies Used

4.1.1 Unity Game Engine

[79] states that Unity is the most popular tool for making games due to its ability to allow for the creation of games that can be used both for education and entertainment. Unity allows developers to create cross-platform games, which can reach a wide audience of over twenty-five supported platforms [80]. It has a very convenient asset store for 2D and 3D environments where developers can find pre-built assets, sprites, effects, textures, avatars, and plugins. The asset store can also integrate third-party tools like PlayFab and Google Analytics required by complex, serious games inside Unity.

[81] proposes Unity for serious games since it offers user-friendly visual scripting options to developers with limited programming experience. This feature also benefits researchers planning pilot studies on in-game UI/UX and human-computer interaction. Non-programmer developers can use this graphical interface to achieve complex game logic, especially if the aim is to deliver content and not focus on programming [81]. Generally, the MonoBehavior code of the game engine also provides minimal code requirements to run the game. The level of abstraction through user interface drag and drop makes Unity a user-friendly option for all-round developers.

Unity's scene manager benefits serious games by allowing developers to organise levels, scenarios, and mini-games [80]. Learning content can be separated and organised into distinct modular environments, providing variations for a practical learning experience in serious

games. This feature was utilised to separate task levels from the storyline visual novel scene, thus enhancing the game's novelty.

In designing high-fidelity games and simulations, Unity's physics engine enables developers to mimic the virtual environment to resemble real-world scenarios. Unity's physics engine enhances a realistic, immersive educational experience through collision detection, rigid body dynamics, and environmental dynamics [82]. The archived realism can significantly impact the game's aesthetic feedback, thus enabling practical learning experiences in a safe, immersive, controlled environment.

Finally, Unity has a vast community of developers that enables resource sharing, troubleshooting and debugging [83]. Unity also offers valuable learning materials and up-to-date documentation covering everything from basic setup to advanced scripting. Before developing *TAG TEAM*, the resources from Unity Learn were helpful, making the interaction with Unity and C# comfortable.

4.1.2 C#

C#, also known as C-SHARP, is a versatile high-level object-oriented programming language developed by Microsoft as part of the .NET initiative [84]. [85] states that C# has gained popularity among game developers due to its powerful features, ease of use and flexibility. It is the primary scripting language for Unity, and it has also been lately integrated into other game engines such as GODOT [86], Stride [87], and Wave Engine [88].

This Object-Oriented language enabled the *TAG TEAM* codebase to be scaleable, manageable and reusable. Classes were used to create generic data types and objects that could be easily manipulated per the game's requirements. In *TAG TEAM*, this feature was important in creating the visual novel engine, managing avatars, and even separating user interface objects from data handling objects. In Unity, these classes were attached to game objects in the Inspector, creating objects when the scene starts and destroying them when the scene is exited, allowing for efficient memory management.

The unity's garbage collector reduces the likelihood of memory leaks through automatic memory allocation and delegations, hence enhancing game performance, which is one of the game priorities for fidelity. Furthermore, developers can use C# structs to manage object life cycles and optimise performance for frequently accessed data and objects [89]. In *TAG TEAM*, C# scripting enabled the implementation of an interactive game environment, efficient processing of storyline, task logic and game controls. Furthermore, accessing these scripts from Unity's console IDE was effortless during functional testing and refinement.

C# events and delegates also enable developers to manipulate the physics engine through event programming for collision detection and game state changes. These events are essential for aesthetic and explicit feedback, enhancing serious game immersion and enjoyment. In the case of *TAG TEAM*, it uses the event system to capture in-game analytics and player behavioural logs.

Finally, it has a massive community and intensive documentation for game development and other Microsoft technologies such as Linq [90], .NET framework, and Visual Studio [91]. A vast catalogue of tutorials and books teach programming in C#, starting from console apps to more complex software like APIs. Fundamentally, this knowledge can be building blocks that get programmers into game development since games use programming concepts such as variables, functions, classes, objects, enums, and conditionals. Prior knowledge from other languages such as JAVA, Python, JavaScript and C++ makes C# easier to pick up and start development within a short period.

In conclusion, this language offers the power and flexibility to create interactive and immersive serious games. Its compatibility with Unity and huge community made it a good choice for scripting *TAG TEAM's* functionalities.

4.1.3 PlayFab API

[92] proposes this robust backend server-side platform specifically designed for live games. It has been part of Microsoft's Azure cloud service suite since it was acquired by Microsoft in 2018. Player performance of soft skills can be measured during play [93], through online data collection [47]. PlayFab supports rapid game development by providing comprehensive services for data management, real-time analytics, and multiplayer functionalities [94]. It enabled *TAG TEAM's* development process to focus on enhancing user experience while handling most of the backend operations. It is suitable for serious games that require real-time data processing and analytics provided the game is played on a strong internet connection.

TAG TEAM, uses this technology to track in-game player decisions, button clicks, and scene transitions, providing deep insights into how players interact with the game. Fig. 4.2 illustrated how player decisions and analytics were saved on this PlayFab's database. The PlayFab SDK is free and accessible from the Unity Asset Store and the GitHub repository. Unlike Firebase and Gradle, PlayFab can easily integrate into a serious game through the Unity project hierarchy. Since the PafFab SDK is written in C#, these libraries enabled the creation of custom data management solutions and detailed player analytics.

API calls were also implemented using C# lambda expressions to handle asynchronous processes [84]. However, it is essential to note that for consistent analytics and data management across all scenes and levels, scripts related to PlayFab should be abstract and detached from the objects in the hierarchy. In *TAG TEAM*, this ensured that even when objects were destroyed for memory efficiency, the PlayFab scripts remained accessible through static methods and variables.

The main advantage of choosing PlayFab in *TAG TEAM's* development is that it consolidates all backend needs into one platform for essential gaming services. Unlike other technologies, developers need Firebase for database management, Google Analytics for analytics, and a third service for leaderboards. This unified approach made it easier to manage and maintain project-related data without the burden of learning and integrating multiple technologies.

4.1.4 Github Version Control

This is a version control platform built upon Git [95]. It is accessible on the web, command line, and desktop for Windows systems. It enables developers to maintain a large code base and collaborate in game development. It enables researchers working on group projects to work on different branches without introducing bugs to the *"main branch"*. In *TAG TEAM's* development, GitHub enabled subsequent iterations of scenarios and functional improvements. Since Agile methodology was employed in building the game, this technology ensured that every improvement was on track, enabling consistent testing of new features.

GitHub Desktop [96], a user interface version, was utilised since the command line version faced compatibility issues with Unity. GitHub Desktop works precisely like the command line version when pushing and pulling changes to the repository. Based on previous experiences of losing progress on past projects due to working directly on the main branch, *TAG TEAM's* development was handled in three branches. One for rapid development, another for refactoring, and the main branch to review and merge pull requests.

By doing so, accidental bugs and errors that would have been introduced in the official codebase were avoided. Hence, it was easy to experiment with new features in a controlled environment without stressing out or feeling anxious about losing progress. The rapidly developed code efficiently was *cleaned* through the refactoring branch without introducing accidental syntactical and logical errors.

In conclusion, this tool is essential for researchers and developers who intend to work with serious games or other programming-related projects. Its ability to offer version control for any programming language is remarkable; hence, it is a better choice than Unity's version control. Furthermore, GitHub is an affordable open-source option for researchers working on a tight budget.

4.2 Game Design and Development

4.2.1 Game development Life Cycle

[97] states that Agile scrum (see Fig. 4.1) is the best game development methodology for building pedagogical tools for building competencies. The Agile methodology implemented during the development of TAG TEAM was in line with the repeated sub-step recommendations by Kristiadi et al., [98] for game developers. These recommendations proved to be very apt since this approach fits with the iterative and incremental nature of game design. The flexibility of Agile lets the project organically take shape and makes room for later changes and refinements suggested by the project supervisor. Thus, with this approach, TAG TEAM was functional and testable at the end of every iteration without affecting the previously completed versions [98]. Furthermore, it allowed the researcher to stick to a tight schedule involving upcoming deadlines assigned to developing and reviewing this game.

This allowed the methodology to show more benefits in meeting the project objectives and expectations, thus making it easy to incorporate supervisory feedback. By maintaining the

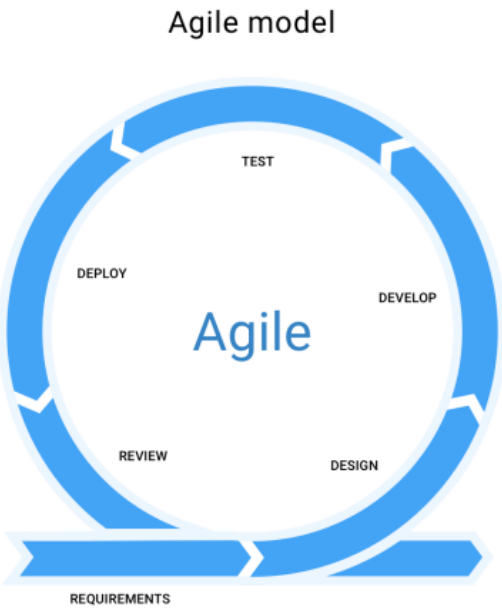

Figure 4.1: Agile Model Iteration Process [2].

constant implementation of the suggested improvements, the modification was successfully conducted with respect to the project's demands. Mechanisms about feedback were aimed at bettering certain functionalities by integrating them into the game's specifications for the next sprint cycle (see Fig. 4.1). Most importantly, it allowed for improvements in gameplay mechanics that were crucial in ensuring the polishing of the game for the overall satisfaction of a deeply engaging user experience.

Also, frequent integration testing after every sprint cycle was necessary to keep the game stable and functional [98]. The bugs were caught early in the development process, and their fixing kept the game out of technical debt. This would ensure that any issues were fixed before they began affecting the later stages of development. All these proactive ways of testing and refactoring enhanced the overall quality of TAG TEAM and smoothed out the whole development process.

In each successive version, the focus on specific aspects, such as the story, characters, tasks, data management, and analytics, was met. The cycles ensured a far more rigorous and concentrated effort to ensure everything was functional and could be integrated smoothly into the overall system. This conscious approach to development simplified the management of complex game features [98]. It also ensured that every building block of the game was on solid ground, with each feature adding its share of value to the final version of the game.

4.2.2 Storyline

While the use of storylines in serious games is still under-explored, they have been known to create a narrative-driven context in the game, which enhances motivation and engagement [99]. *TAG TEAM's* storyline was built based on the European Erasmus+ framework [41], which

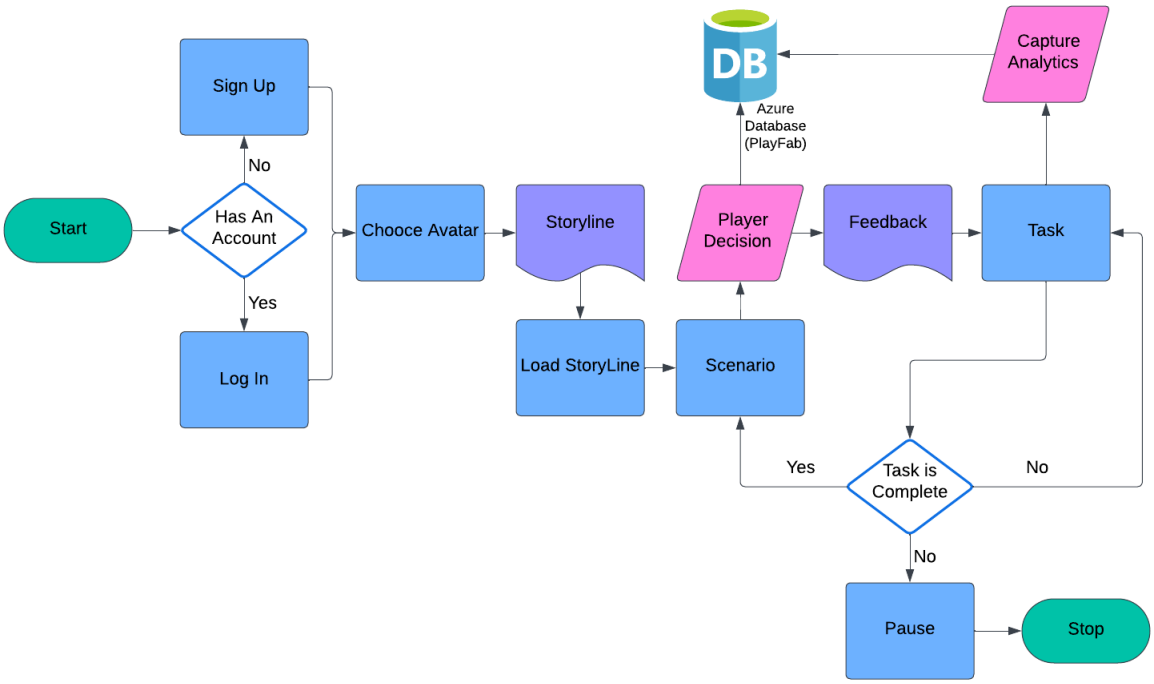

Figure 4.2: TAG TEAM Data Flow Diagram.

presents a startup business management consultancy company called Orbit Corp based in Swansea. A board of directors, site management, and associates run it, with the protagonist being the assistant manager. The company aims to go international, sending the manager on a business trip to Australia to benchmark and start an annexe branch. With the manager's absence, the protagonist assumes the role of interim manager for the time being, thus setting the protagonist into the game's storyline to motivate them to play.

The protagonist encounters numerous unexpected challenges throughout the story and must take the best action in each situation (see Table 4.1). The storyline is broken down into six short chapters separated by cognitive tasks in between them (Fig. 4.2). While all the chapters aim to test communication skills and decision-making, some have been explicitly designed to test other skills, as highlighted in Table 4.2, which depicts the mapping between chapters and soft skills.

4.2.3 Character Design

All the avatars in the game embody a personality according to the Proteus effect [100] which suggests that the gamer's characteristics can be influenced by the in-game avatars. They are meant to be generally friendly and use polite words when communicating with the protagonist to make them feel safe and comfortable. Non-player characters have a name and a role, as depicted in Table 4.3, to make them mimic real-life colleagues to immerse the protagonist into perceiving them as actual people in the virtual world.

Table 4.1: Chapter Summary

Chapter Title	Key Elements
The Takeover	The protagonist receives task delegation from Dylan and tests the self-efficacy of Ann and Warren after a CEO's debrief. Participants self-report their self-efficacy.
Team Leader	The protagonist guides associates on pending tasks from the previous manager, testing their leadership skills.
Toner Replacement	The protagonist resolves an issue but is blamed for a colleague's mistake, requiring them to take responsibility as a leader.
Personal Life	The protagonist's patience, trust, and emotional intelligence are tested by offering time off to a colleague during a busy period.
The Conflict	The protagonist resolves conflicts among colleagues while maintaining work policies and professionalism.
The Dilemma	The protagonist faces an ethical dilemma regarding a deal for a new office, choosing whether to take it or turn it down.

Table 4.2: Chapter and Soft Skills Mapping

Chapter	Leadership	Communication Skills	Decision Making	Self Efficacy	Emotional Intelligence
The Takeover	✓	✓		✓	
Teamleader	✓	✓			
Tonner Replacement	✓		✓	✓	
Personal Life		✓			✓
The Conflict	✓	✓	✓		✓
The Dilemma	✓		✓		

4.2.4 Cognitive Task Design

This task tests the protagonist's self-efficacy when faced with stressful conditions similar to [51], as discussed in the literature review. The simplistic design ensures that the working memory is not overloaded but can simultaneously register various information to the brain schema [101]. Task One, Ann's Task, and Task Two are designed to jog the protagonist's memory and cut away from the storyline portrayed in Fig. 4.2. The learning outcomes of this technique are twofold: serving as time for the participant's brains to process the previous chapter's learning objectives and enabling the mind to be fresh for another chapter; refer to Fig. 4.2.

The player's ability to retry tasks after failure enables the researchers to monitor the behaviour logs through PlayFab analytics, which serves as a scale to measure self-efficacy (see Fig. 4.2). However, this design can be ineffective on participants with pattern recognition skills. When the string pattern is deciphered, the task's difficulty reduces, eliminating failure. Literature

Table 4.3: Character Roles and Behavioral Traits in TAG TEAM

Character	Role	Behavioral Traits
Dylan	CEO	Authoritative, results-driven, expects high performance
Stacy	Manager	Supportive, trustworthy, provides guidance and advice
Warren	Associate	Responsible, vocal about issues, takes action when frustrated
Ann	Associate	Family-oriented, seeks empathy, initially perceived as untruthful
Player	Assistant Manager	Leader, confident, problem-solver, empathetic, decision-maker

suggests when the player gains mastery of the game, the challenge should also scale accordingly [93]; however, this design choice was deemed beyond *TAG TEAM's* objective.

4.2.5 Unlock Stacy's Laptop Breakout Room

The protagonist has successfully been promoted to the managerial position in *Orbit Corps* Swansea Branch. They are taking over the previous manager's office, which has eight clues hinting at archiving the objective of unlocking Stacy's laptop. This level is designed to foster collaboration, teamwork, and communication skills through collaborative play; however, it can also be accomplished individually.

The protagonist may choose two other participants to represent Warren and Ann, who will assist them in deciphering the clues. These assistants guide the protagonist to achieve the level objective but cannot interact with the game directly. However, there is a twist; one assistant can be truthful while the other is deceitful. Literature suggests that this approach provokes strategic decision-making through that is influenced by negative trust when solving complex scenarios [102]. Additionally, they can switch roles during play or agree to lie or be truthful at the same time without the protagonist knowing. This way, the protagonist must make wise decisions based on the assistants.

The success of this stage requires a supervisor(tutor) to give insights into how the protagonist interacted with the nonplayer characters(NPC) during the storyline. If the protagonist had some conflict with one of the NPCs, the assistant embodying the NPC could use this to their advantage. The protagonist will also be aware of this information and know that their past decisions will impact the help they receive on this level. By introducing the potential for deception and the impact of past actions, the game offers a unique and immersive learning experience for players [102].

4.2.6 User Interface Design

When designing the game's user interface, adhering to Shneiderman's Golden Rules of Design in Human-Computer Interaction (HCI) is important [103] as depicted in Fig. 4.3. *TAG TEAM's* design focuses on striving for consistency and reducing short-term memory load through a simplistic design that allows intuitive navigation, such as positioning in-game currency, shaping buttons and shading icons (see Fig. 4.3). Also, blending font colour with the background colour palette ensured text readability (see Fig. 4.3).

Consistent colour schemes on clickable buttons: "white" for active, "yellow" for Hoover state, and "dark blue" for inactive state provided uniformity throughout the game interface. It also enabled players to learn and interact with the game easily without extensive tutorials. This design choice also aimed to reduce the cognitive load on participants who did not have prior gaming experience.

In Fig. 4.3, the *login* interface shares a similar background with the *pause menu*; it also has the "next arrow" positioned the same way as in the *avatar dialogue* (see Fig. 4.3). The *player responses* interface is identical to the *avatar dialogue*, and it also contains buttons with a shade similar to the ones in the *pause menu*.

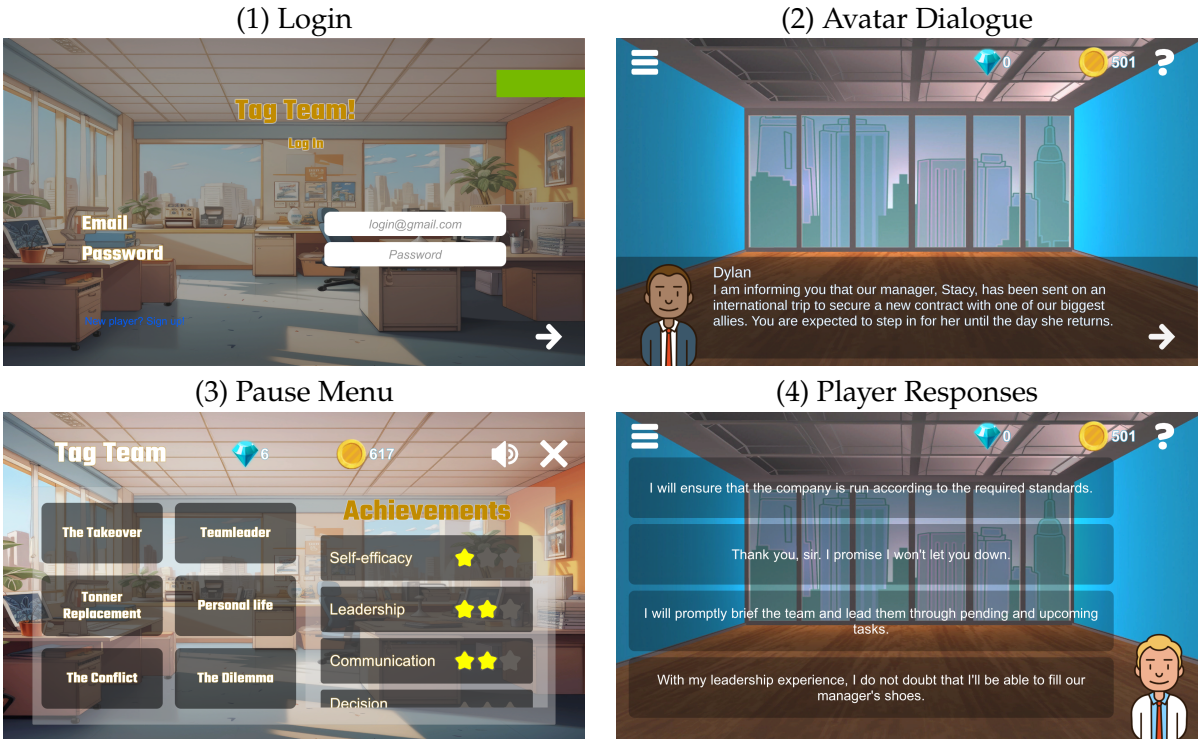

Figure 4.3: Simplistic user interface showcasing consistent design for easy navigation

4.3 Challenges and Solutions

The development process of *TAG TEAM* was affected by various challenges financial and technical. All the assets used in the game are open-source and free to use (all have been cited). Due to

financial constraints, browsing for accessible sources consumed time. This meant that assets like sounds, VFX, and avatars were selected based on the convenience of the online resources.

During the early stages of development, two stations were used: a Swansea University virtual machine and a personal computer(PC). Since the PC was running a newer version of Unity, cloning the pushed repositories into the virtual machine workstation was unsuccessful due to incompatible library dependencies. To resolve this problem, both devices were required to have a similar version of Unity as the one used to create the root folder. After a failed attempt to request a newer version from the librarian, the rest of the development continued on the PC.

The PC required a powerful CPU for programming the scripts and a good GPU for generating visuals. Thus, a 12th Generation Intel Core i5-12450H-a high-performance processor-was used. It ran game tests aided by a Geforce RTX 2050 NVidia graphics card with CUDA cores capable of 3D modelling and machine learning model training.

4.4 Summary

This chapter discussed the design principles and implementation of *TAG TEAM*, a novel serious game designed and evaluated in this study. The design rationale and tools used in development have been highlighted and extensively discussed, as well as how they tie back to the literature. Also, various challenges that were faced during the implementation process and their solutions have been highlighted while providing recommendations to future developers who may want to develop similar serious games. The next chapter presents a thorough analysis of the findings from the evaluation of *TAG TEAM*.

Chapter 5

EVALUATION AND RESULTS

Chapter 5 of this dissertation presents an in-depth assessment of the serious game TAG TEAM. It analyzes the raw data that was collected from the survey feedback and in-game analytics to assess the game's effectiveness in engaging participants and delivering learning outcomes. The key dimensions of the analyses include engagement, usability, willingness to learn, and learning outcomes, all of which were measured quantitatively. Usability and learning outcomes also incorporated subjective qualitative analysis. These derived from this chapter will give insight into the effectiveness of the game design, participant interaction, and overall pedagogical value of the game.

5.1 Survey Feedback

The pre-and post-game questionnaires outlined the participants' general insights regarding learning soft skills using TAG TEAM. The pre-game questionnaire highlights the perceived importance of soft skills among the participants before play. As conveyed in Fig. 5.1, the ranking of the importance of soft skills outperformed technical skills, with 76.2% of the participants rating both to be equally as important, 9.5% rating soft skills as somewhat more important and 14.3% soft skills as much more important. In this survey question, none of the respondents perceived technical skills as superior to soft skills. The question also highlights a deficit in the perceived importance of soft skills in STEM subjects. Fig. 5.2 indicates this deficit in the coded clustered bar chart where 3 represents both equally important, 4 soft skills are somewhat more important, and 5 shows soft skills to be superior.

5.2 Data Presentation

The results had to be assessed for reliability and feasibility before further analysis. In this study, the reliability test was carried out using IBM SPSS Statistics software [104] to test the internal consistency of this study's key variables. These included students' learning outcomes, motivation to learn soft skills, level of engagement, and the game's cognitive usability. According to [105], the threshold for internal consistency of the tested variables should not decrease

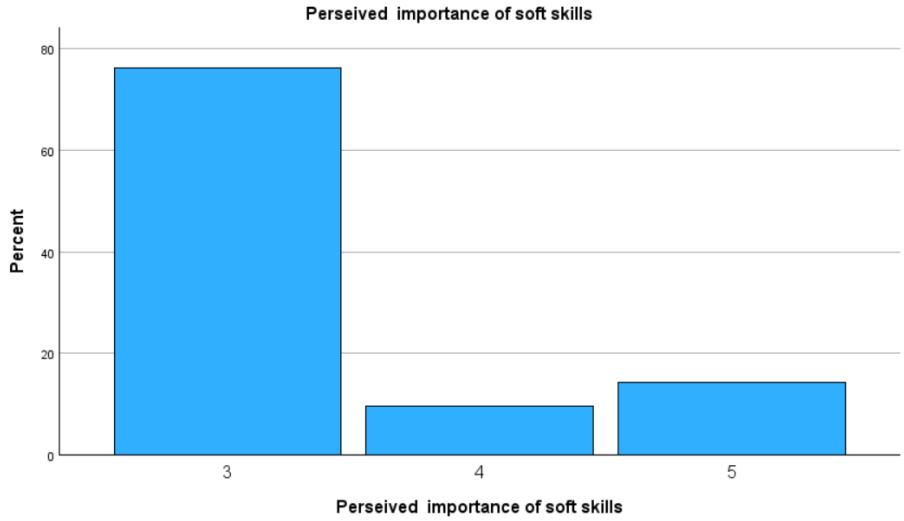

Figure 5.1: Bar chart of the perceived importance of soft skills.

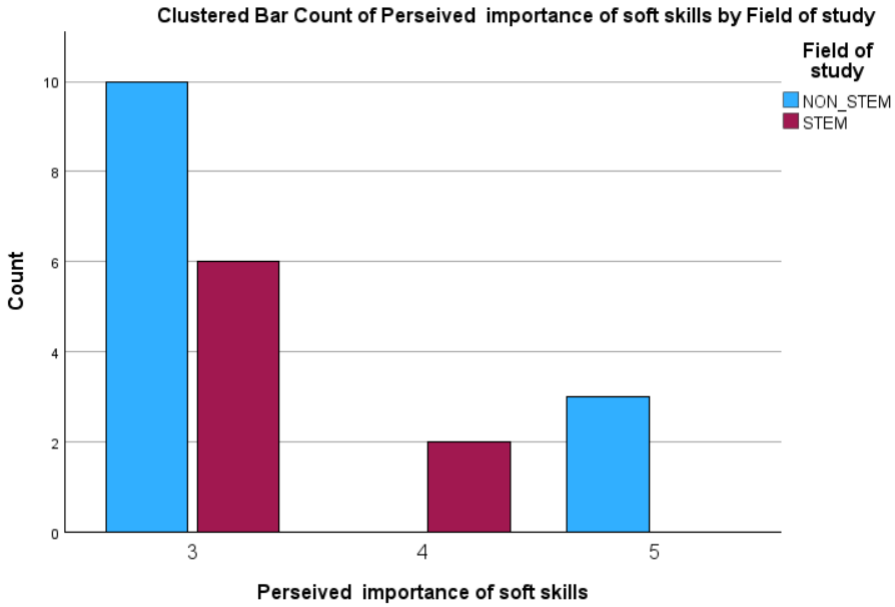

Figure 5.2: Importance of soft skills clustered by field of study.

below an internal consistency of 0.7. In this current setting, the measured variables yielded a Cronbach's Alpha consistency value of 0.714, as shown in Table 5.1; this value is slightly above the minimum accepted value proposed by [105]. Thus, the value of Cronbach's Alpha ascertains that the collected data is valid and trustworthy.

Table 5.1: Variable Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.714	0.715	4

5.3 General Sample Descriptive statistics

Table 5.2 provides an overview of the distribution and characteristics of the collected data from a sample of 21 participants (N = 21) across four variables on a 5-point Likert scale. It depicts the important statistical indicators such as mean, standard deviations, skewness, and kurtosis.

Table 5.2: Descriptive Statistics Summary of Variables

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Learning_Outcomes	21	3.33	5.00	4.0952	.52855	.279	.061	.501	-1.348	.972
Engagement	21	3.40	5.00	4.2571	.51046	.261	-.433	.501	-1.139	.972
Willingness_to_Learn	21	2.20	5.00	4.0000	.74833	.560	-.696	.501	.028	.972
Usability	21	3.00	5.00	4.1746	.50132	.251	-.343	.501	.071	.972
Valid N (listwise)	21									

Results show high mean values that are above 4 on all the tested dimensions, leading through engagement with a mean of 4.2571. This high value aligns with the negative skewness of -0.433, which leans towards 5 points on the Likert scale, purporting that the game effectively engaged participants. The dimensions of engagement also demonstrate a relatively flatter distribution than a normal curve.

The second most highly rated variable was usability, with a mean of 4.1746. The low variance of 0.251 indicates that the responses from the majority of the participants are concentrated near the mean. The dimension of usability also lacked outliers, thus reflecting a consistent pattern of consensus. The strong agreement among participants suggests that, in regard to usability heuristics, the game design was advantageous to all individuals, irrespective of demographic differences.

The skewness value in the learning outcomes dimension is about 0.061, a relatively small deviation compared to the normal standard deviation. This measure suggests that the distribution of the learning outcomes results are fairly symmetrical. Also, a mean of 4.0952 reflects good results in participants' learning outcomes, while there are no identifiable outliers. These findings show how TAG TEAM was able to transfer educational content to the participants since they were assessed on the material they learned.

Willingness had the lowest mean of 4.0 of all the dimensions in Table 5.2. This low value was highly influenced by a high variation in response. Again, this dimension reflects an outlier with a minimum score of 2.20 on the willingness scale presented in Fig. 5.3. Furthermore, despite the small sample size, this dimension yielded the highest standard deviation of 0.74833. However, it still attained a skewness of (-0.696), showing that the distribution is concentrated around higher values despite the broad deviation and low outlier value. It also had a kurtosis of (0.028), demonstrating that the graphical distribution is fairly normal in shape Fig. 5.3.

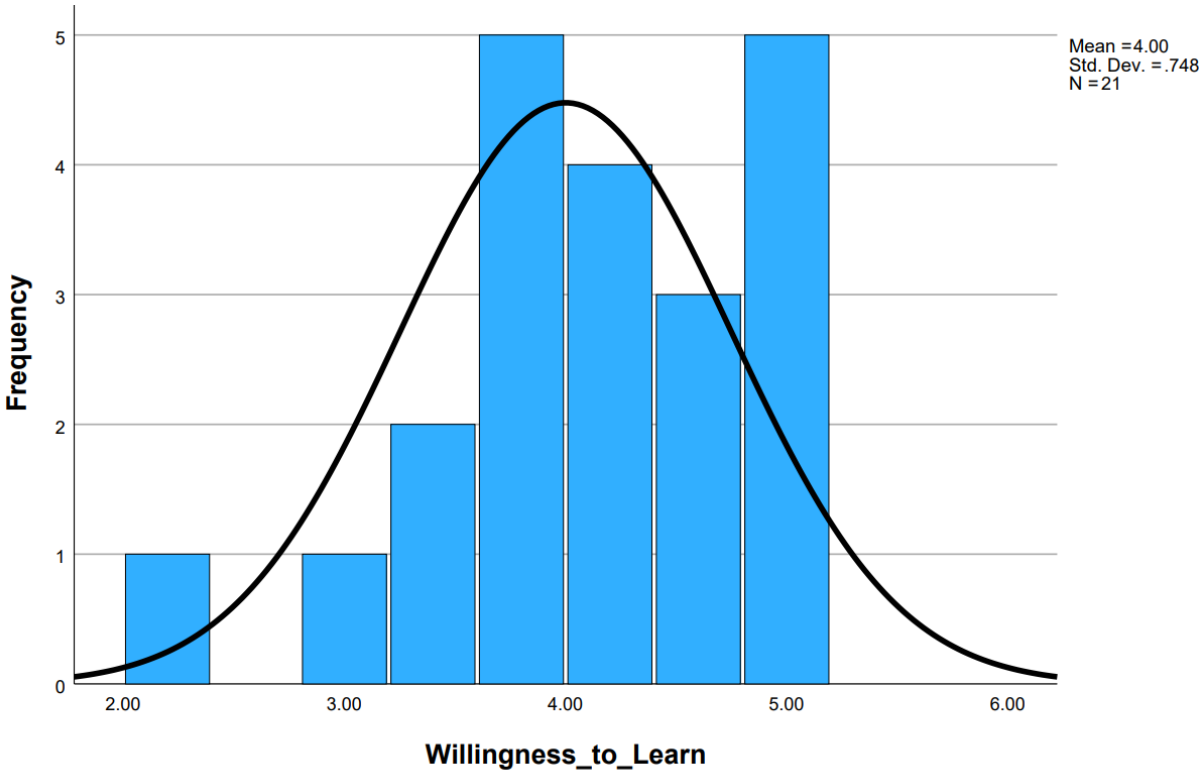

Figure 5.3: Histogram of willingness to learn

5.4 Findings on the research questions

To fulfil this study's aims and objectives, it is pertinent to use the findings of the experimental survey and observations to answer the proposed research questions. Quantitative data was collected purely from surveys, and qualitative data was collected through open-ended short-answer survey questions, observation, and in-game analytics.

5.4.1 Research Question 1

RQ1: Can a serious game effectively teach and assess soft skills in undergraduate students without prioritizing fun over learning?

To answer this research question, a regression analysis was conducted to investigate its key variables. A correlation analysis was also performed to quantify the relationship between game engagement and learning outcomes. This analysis is essential in understanding the course and effect between independent and dependent variables. In this study, a regression analysis aims to provide a deep insight into whether the level of engagement significantly affects the learning outcomes.

The findings show no significant relationship between the improvement of learning outcomes and the level of engagement. This is evident from the weak correlation coefficient of ($R = 0.078$) and a low explained variance ($R^2 = 0.006$), which indicate that engagement only contributes to 0.6% of the variation in learning outcomes. Furthermore, the low F-statistic and a high

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.128[a]	.016	-.157	.56855	.016	.095	3	17	.962

a. Predictors: (Constant), Usability, Willingness_to_Learn, Engagement

Figure 5.4: Anova model Summary

p-value portrayed in the ANOVA results in Fig. 5.4 confirms that the regression model is not statistically significant. Therefore, it can be concluded that engagement does not substantially impact learning outcomes in *TAG TEAM*.

Furthermore, demographic data was also measured, and no significant shift in the learning outcomes was affected by engagement. Both gender (male/female) and play mode (single/multiplayer) were tested alongside the key variables (engagement and learning outcomes) to gather further insights. There was no significant shift in learning outcomes ($B = 4.418$, $p = 0.001$) based on gender ($p = 0.550$) or play mode ($p = 0.107$), thus suggesting that demographic factors had no meaningful variance in the learning outcomes.

From these findings, an implication can be deduced that fun in *TAG TEAM* did not overshadow the intended learning objectives. Thus, the findings support the rationale behind the formulation of *RQ:1*. The question was formed on a hypothetical basis of the positive achievement of learning outcomes among undergraduate students without emphasizing entertainment. Despite these findings, the subjective high mean of the two variables shows that the students found the bot game fun and essential for learning. Investigating whether the willingness to learn and usability significantly affected the learning outcomes also became essential.

However, these findings were deemed insufficient to answer this research question; hence, a thematic analysis was conducted on the open-ended question regarding learning outcomes. A six-phase qualitative data synthesis model was favourable for this dimension as instructed by Braun and Clarke [53]. The researcher's bias was considered; thus, a comprehensive mitigation strategy was undertaken to ensure the rigour and reliability of the findings. First, the researcher sought to understand the background knowledge and then generated codes that aided in identifying themes. Afterwards, the themes were fine-tuned to meet the dimension needs, and then they were defined and presented in a report.

The findings from the qualitative responses offer a deeper insight into phenomena that could have been missed if this study had been purely a quantitative experiment. Table 5.3 show the essential themes that aided in attaining a deeper understanding of the precursors that enhanced learning outcomes. These themes explained why fun and learning outcomes did not have a strong relationship in TAG TEAM and opened a new debate on how learning material can be presented to enhance learning outcomes.

Table 5.3: Themes Associated to Learning Outcomes

Dimention	Themes
Learning Outcomes	Skill Improvement Real-world Application Sharpening the Mind Collaborative Learning

5.4.2 Research Question 2

RQ2: Are undergraduate students willing to use serious games to learn soft skills? A paired sample analysis of the collected data is used to answer the above-mentioned question. It was expected that the participants would be willing to use serious games to learn soft skills, and their willingness would improve after the interaction with TAG TEAM.

Firstly, descriptive statistics of willingness measurement factors were generated to observe the means, standard deviations, and standard errors(see the Fig. 5.5). Generally, both means scored highly, with pre-game willingness at 4.71 and post-game willingness declining to 4.00. This suggests that the students are open to using serious games to learn soft skills. The pre-game willingness shows a slight standard deviation of 0.46291, thus proving that the responses were clustered around the mean; this is factual since the participants reported their willingness at a low of 4 points a piece in the 5-point Likert scale. On the other hand, the post-game willingness results show a more significant standard deviation among responses, thus suggesting that participants' opinions after interacting with *TAG TEAM* were no longer uniform (see Fig. 5.3). The drop in the mean indicates that the game might have negatively influenced the participants' attitudes; thus, a paired samples t-test was conducted to investigate this phenomenon.

Before running the t-test, the correlation between paired samples was tested to see if there was any relationship between the willingness levels before and after the game. The results brought out a very weak positive correlation, as evidenced by the correlation coefficient of ($r = 0.029$). The results show a non-linear relationship between the participants' attitudes before and after interacting with the game. Furthermore, the results record a high p-value of ($p = 0.901$), further indicating that the correlation was not statistically significant. These low correlation values state that participant behaviour was unpredictable and may have been influenced by their personal experience with *TAG TEAM*.

A paired sample t-test was finally conducted to determine the statistical significance of the presented results. The test results demonstrated a -0.71429 difference in means, which can be interpreted as the participants were less willing to use serious games after interacting with *TAG TEAM*. There was also a variability in each participant's change of sentiment towards the game, as depicted by the 0.086850 standard deviation of the difference.

The findings also show a t-value of -3.769 and degrees of freedom ($df = 20$), which resulted in a 0.001 two-sided p-value. There was a statistically significant decrease in the participants' willingness; thus, it is safe to imply that the game affected the players' perspectives and reject

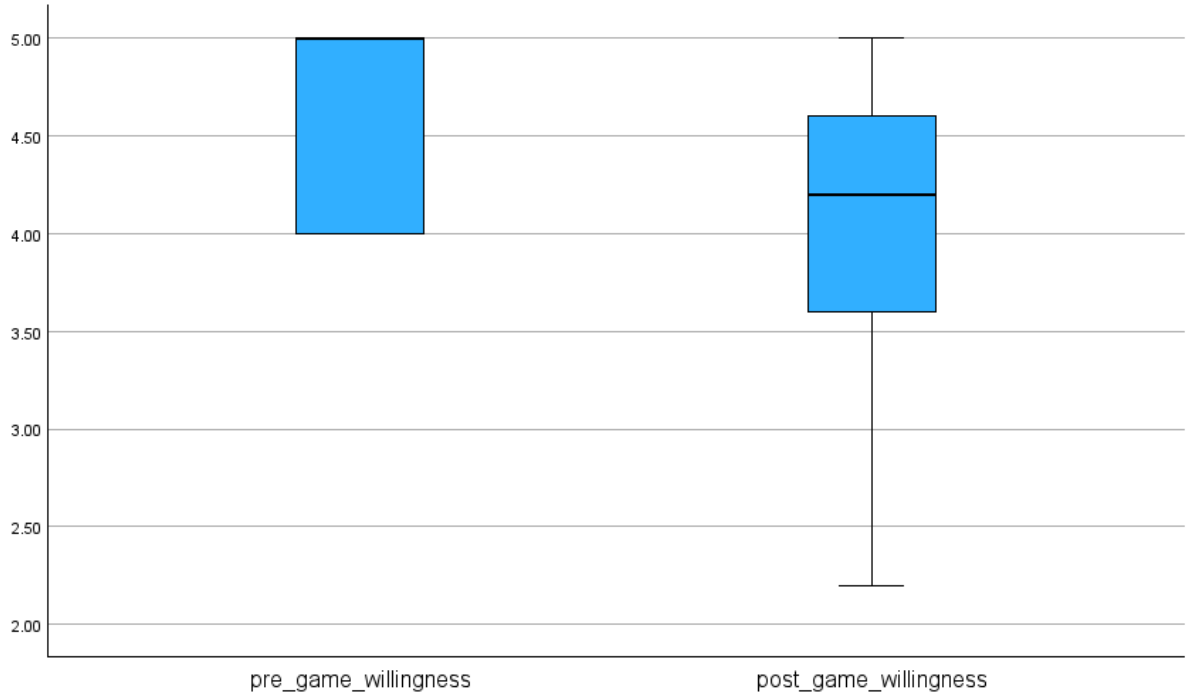

Figure 5.5: Box Plot of willingness to learn soft skills using serious games.

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Willingness_to_Learn - pre_willingness	-.71429	.86850	.18952	-1.10962	-.31895	-3.769	20	<.001	.001

Figure 5.6: Paired Samples t-Test

the null hypothesis that states that the phenomenon occurred by random chance. Furthermore, the 95% confidence interval did not include 0 in the measure (see Fig. 5.6), solidifying the statistical significance of the findings. The confidence interval also highlighted that the true mean difference ranged between a moderate to large effect size.

5.4.2.1 Effect Size

To consider whether the magnitude of the effect size was substantial to the generalizable population, the measurements were calculated using Cohen's d and Hedges' correction as presented in Fig. 5.7. The resulting Cohen's d value of -0.822 indicates an evident moderate-to-large effect. These findings imply that the shift in willingness to learn is not only applicable to this sample size but also inferential to the generalized population.

A Hedges' correction was also conducted to determine if these results were substantial, especially given the small sample size (N = 21). The calculations yielded a slightly lower value of -0.791, close to Cohen's d results. This finding further proves that even after accounting for the small sample size, the effect of the decreased willingness to learn soft skills using serious games was moderate to large. Maintaining a 95% confidence interval for both measures

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	Willingness_to_Learn - pre_willingness	Cohen's d	.86850	-.822	-1.312	-.318
		Hedges' correction	.90285	-.791	-1.262	-.306

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 5.7: Paired Samples Effect Sizes

reinforces the conclusions drawn from both Cohen's d and Hedges' correction calculations that the findings were insightful and substantial.

5.4.3 Research Question 3

Q3: Do serious game design elements improve player engagement for learning soft skills? To address this research question, various statistically appropriate analyses were conducted on two dimensions. The effect of game design elements was represented on the scale by the term usability, while engagement and motivation only adopted the name engagement. A mean of the collected answers from different participant Likert scale responses was transformed from ordinal into scale dimensions. This step was necessary to generate plots and measurements from the analyzed variables. The steps taken to perform the analyses included a combination of various statistical approaches such as descriptive statistics, correlation analysis, regression analysis, and factor analysis. These techniques offer a comprehensive overview of how the independent variables affect the dependent variable.

The generated descriptive statistics revealed that both usability and engagement were highly rated by the participants as depicted in Table 5.2. Engagement scored the highest with a mean of (Mean = 4.2571) with a moderate standard deviation of 0.51046, thus implying that the participants felt engaged by the game in general. Similarly, usability also received a high rating with (Mean = 4.1746) and a lower standard deviation of 0.50132, which implies that the participants generally found that using the game was easy and intuitive. Both variables were negatively skewed, indicating that most participant ratings are clustered towards the higher end of the scale, with engagement having a slightly higher tendency of these frequencies. These descriptive statistics prove that the overall satisfaction of the participants in regard to usability and engagement was met. This finding aligns with the hypothesis around the rationale that states that designing game elements well can improve engagement.

A Pearson correlation analysis was conducted to gain substantial insight into the nature of the relationship between usability and engagement. The results generated from this analysis indicated a moderate positive correlation between the two variables with the following values ($r = 0.532$, $p = 0.013$). Thus, the results imply that an increase in usability ratings positively affects the increase in participant engagement ratings. The chances of this relationship happening by

Correlations

		Engagement	Usability
Engagement	Pearson Correlation	1	.532*
	Sig. (2-tailed)		.013
	Sum of Squares and Cross-products	5.211	2.724
	Covariance	.261	.136
	N	21	21
Usability	Pearson Correlation	.532*	1
	Sig. (2-tailed)	.013	
	Sum of Squares and Cross-products	2.724	5.026
	Covariance	.136	.251
	N	21	21

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 5.8: Pearson Correlation Table Between Usability and Engagement

chance are highly unlikely due to the low statistical significance of the correlation with a low p-value ($p < 0.05$) as presented in Fig. 5.8. With this correlation, it is evident that improving the efficacy of the game's design could positively improve player engagement.

A regression analysis was also conducted to test the predictive power of usability on engagement. From the model summary, there is an evident relationship between the two variables since usability contributes to 28.3% of the variance in engagement ($R^2 = 0.283$, $p = 0.013$). The results of this analysis indicate that although usability plays an important role in determining the level of player engagement, other factors also contribute to the level of engagement. Despite this revelation, the generated F-test confirmed that the overall model was statistically significant ($F(1, 19) = 7.508$, $p = 0.013$), thus, suggesting that usability meaningfully predicts engagement(see Fig. 5.9).

Fig. 5.10 further presents the regression coefficients, which indicates that for every unit increase in usability, there is an expected 0.542 units increase in engagement ($B = 0.542$, $p = 0.013$). Fig. 5.10 also shows that the significance of the variable relationship since the confidence interval for the usability coefficient did not include zero. Thus, the findings demonstrate that *TAG TEAM's* usability has a direct positive impact on the player's engagement with it.

A collinearity diagnostic was also conducted to measure whether the regression model was reliable and whether the relationship between usability and engagement was robust. The

Figure 5.9: Engagement and Usability Regression Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					PRESS
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.532[a]	.283	.246	.44340	.283	7.508	1	19	.013	4.479

a. Predictors: (Constant), Usability

b. Dependent Variable: Engagement

Figure 5.10: Engagement and Usability Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.995	.831		2.400	.027	.255	3.735		
	Usability	.542	.198	.532	2.740	.013	.128	.956	1.000	1.000

a. Dependent Variable: Engagement

diagnostic was also intended to assess whether the two dimensions were influenced by their Independence. The diagnostics showed a 1.000 variance inflation factor(VIF) for usability, and there were no multicollinearity issues in the model. Furthermore, a principal component Analysis (PCA) was conducted to examine whether engagement and usability formed any distinct factors representing independent game elements. A factor analysis was deemed acceptable after attaining a 0.500 sampling adequacy measure from the Kaiser-Meyer-Olkin (KMO). However, the ($p = 0.013$) value presented from Bartlett's Test of Sphericity suggested that the correlation matrix was suitable for the factor analysis.

Furthermore, Fig. 5.11 portrays that both engagement and usability had communalities of 0.766, which were affected by an underlying component. This component was then extracted and the researcher documented them to be a representative of the latent variables related to engagement and usability. This component (marked as Component 1) accounted for 76.61% in the Total Variance Explained table with an eigenvalue of 1.532 (see Fig. 5.11). Component 2 had an eigenvalue below 1, and it was not significant to the findings; the Scree Plot also favored the retention of Component 1 and not Component 2. Component 1 generally depicted a tendency to be the only shared factor that explained the variance in usability and engagement. The findings show a shared underlying dimension between the two variables in relation to the design efficacy of *TAG TEAM.*

5.5 In-Game Analytics

An overall in-game engagement observation was recorded through PlayFab analytics, which was then extrapolated and plotted into a bar chart in Microsoft Excel and finally presented in Fig. 5.12. The figure presents the top ten most clicked buttons in TAG TEAM. The findings show that the final level called *UNLOCK LAPTOP* received the highest amount of engagement,

Figure 5.11: Extraction Method Principal Component Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.532	76.610	76.610	1.532	76.610	76.610
2	.468	23.390	100.000			

Extraction Method: Principal Component Analysis.

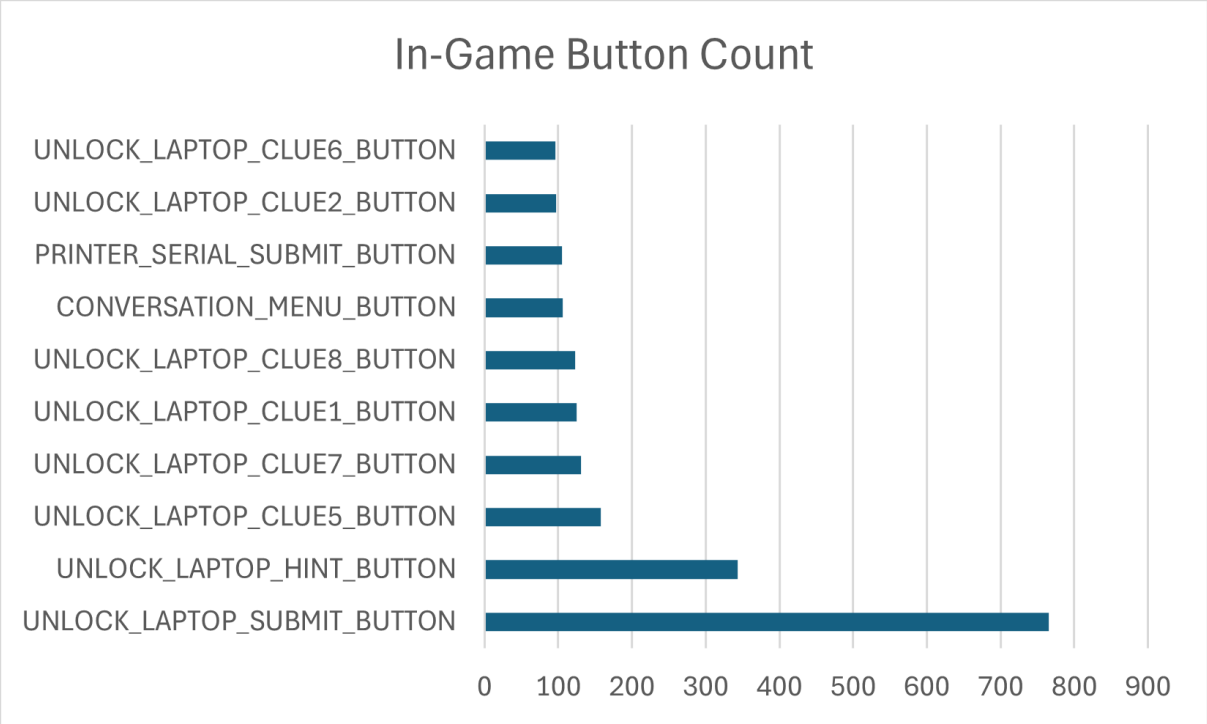

Figure 5.12: TAG TEAM Engagement Analytics

with eight components appearing on the top ten component bar graph Fig. 5.12 and the most clicked button being the *UNLOCK LAPTOP SUBMIT BUTTON* at 765 clicks. The whole analytics report can be accessed at Fig. D.1 in the appendix section. This level offered the participants unlimited attempts to get the correct response without being rushed by the timer. The level was designed with collaborative learning in mind Table 5.3.

5.6 Summary

This chapter has offered a detailed account of the analyses that this study undertook. It has critically evaluated survey feedback, statistical results, and in-game analytics. These analyses were relevant to the study in understanding TAG TEAM's pedagogical impact in teaching and assessing soft skills. These findings portray that the participants considered soft skills highly and were willing to use serious games to learn them.

The key findings show that TAG TEAM offered immersive engagement. However, students declared the educational content of TAG TEAM to be the capstone of their learning outcomes. In doing so, the findings show no significant relationship between engagement and learning outcomes. This anomalous result fails to concur with the existing literature that agrees on the substantial impact of engagement on learning outcomes in serious games. The rationale behind this phenomenon is raised majorly from the design framework of TAG TEAM, which focuses more on learning outcomes than entertainment.

Further critical considerations are warranted in regard to the drop in participant willingness to use serious games subsequent to interacting with TAG TEAM. A number of questions come to mind about how the design, difficulty, or perceived relevance of the game contributed to participants' attitudes. It could be indicative that even though TAG TEAM was engaging, it did not provide a meaningful enough learning experience to the students. It is also possible that the assessment mechanics used were too geared toward entertainment rather than educational value. This points, again, to a sensitive balance between fun and educational effectiveness in serious games and indicates that a more iterative, user-centered design approach may be needed.

More specifically, the interpretation of the meaning of a moderate positive correlation value of usability with engagement is that, indeed, a good interface can be further improved to enhance user experience. However, judging from the regression analysis, only 28.3% of the variance in engagement is explained by usability, which suggests that other factors such as peer engagement, content relevance, narrative, and level of challenge may also be responsible. These findings confirm that an effective serious game design needs to take into consideration many different aspects beyond usability in order to increase engagement.

Finally, while the in-game analytics indeed provided a view of which components of the game were most interacted with, that inherently does not suggest meaningful engagement. The fact that certain buttons have a high click rate could also be explained by trial-and-error behavior rather than by purposeful learning, which would suggest that metrics derived from in-game metrics need to be considered with much caution if learning outcomes are to be derived. The next chapter continues this discussion with a deeper dive into the results, which are discussed in much greater detail against prior frameworks and literature.

Chapter 6

DISCUSSION

This chapter critically discusses the results described in Chapter 5. It then relates them to relevant literature and theoretical settings that were discussed earlier in Chapter 2. It evaluates the effectiveness of TAG TEAM in teaching undergraduate students soft skills and compares it with previous pedagogical methodologies. The chapter further discusses the implications of game design principles, student sentimental value, and learning outcomes. The results are put into the broader perspective of the discourse on GBL and studies regarding serious games.

6.1 Learning outcomes

Overall, the results show that the participants retained the knowledge they had learned from the feedback they received on decisions they made in the game. The majority of the participants embraced soft skills positively, more so than technical skills, as earlier presented in Figure 5.1. This observation corresponds to the general scholarly trends, which stress that soft skills are becoming increasingly significant in the context of the modern world job market [7, 40]. The students favoured decision-making as the most essential soft skill, while emotional intelligence was given little to no attention. The study by [93] resonates with these findings on the lack of sentimental value for emotional intelligence. In addition, students with high self-efficacy did not perceive teamwork and emotional intelligence as essential to them.

Nevertheless, the results show that STEM students still lag behind in soft skills acquisition than NON-STEM students (see Fig. 5.2). Literature also found similar results in that many students in STEM departments tend to believe less in soft skills [11]. Thus, further research is required in this area to make these students become more desirable candidates for hire [7, 20]. This gap draws out an essential need for serious games that can be better suited to make soft skills appealing to STEM students. This study's findings resonate with the proposition by [47], which states that serious games need to be specialized into different categories.

6.2 Willingness to Use Serious Games for Learning

Students and their tutors must be willing to achieve the set forth educational objectives [3]. Initially, [20] proposed the need to test the willpower of undergraduate students in their study; thus, this study found that it was essential to fill this gap. Usually, when students encounter a new serious game, they portray a heightened willingness to use it for educational purposes. However, this affection tends to fade off over time [56]. TAG TEAM was not a special case to this phenomenon since the students' willingness declined from (Mean = 4.71) to (Mean = 4.00) after interacting with it as presented in Fig. 5.5.

Despite this drop, the willingness of students to use TAG TEAM as an educational tool for learning soft skills was relatively high. However, this decline posits a significant novelty effect [106] on game design that cannot be overlooked. [107] state that one of the reasons for this decline is the nature in which serious games offer educational material. Serious games tend to use approaches that do not concur with traditional learning methods. Hence, students fail to appreciate the knowledge they have attained during the playful learning experience.

Novelty can also be maintained in serious games when the students are motivated to overcome in-game quagmires through the SDT framework [52]. In doing so, the game assessed self-efficacy while teaching decision-making at the same time. Intrinsic motivation is primarily built on curiosity, divergence, yearnings, and novelty [106]. When this motivation is consistently retained, it manifests into a willingness to learn. From a psychological viewpoint, novelty is deemed more or less a basic need rather than a peripheral requirement for learning [108].

[109] states that the willingness of students to continue using serious games can be maintained if the game successfully transfers the expected educational content. This study's findings concur with [109] in the sense that learning material was the driving factor of intrinsic motivation (see Table 5.3). However, the drop in the willingness to learn encourages further scrutiny of the reasons behind these results.

In order to determine the probable cause of this behaviour, the thematic analysis from the qualitative data was used to draw further conclusions. 71% of the students stated that they struggled a lot with time-constrained tasks. One of the participants, despite positively taking failure as an opportunity to improve [51], stated that *"Time was very short and the fail sound was slightly annoying."*. By directly interpreting the participant's sentiment, it is evident that hard fail states can negatively influence a student's perception of the game's intent. On this basis, TAG TEAM concurs with *Celeste's* [51] approach in using hard fail states to test self-efficacy. The success of TAG TEAM in promoting participants' willingness to learn even after encountering daunting cognitive tasks shows the ability of serious games to maintain engagement with a considerable amount of failure.

6.3 Edutainment in Serious Games

Edutainment has been loosely extrapolated by [41] to integrate education and entertainment. This implies that serious games are expected to be fun and engaging to motivate undergraduate students to use them as learning materials. The fun accompanied by games makes sophisticated subjects more appealing to learn in an immersive way [43]. However, [110] found that when excessive entertainment is in-cooperated with game-based learning, it can hinder students from achieving the intended sought-after educational objectives. TAG TEAM was designed with this thought in mind to assess if and to what extent entertainment affects the learning outcomes of soft skills in serious games.

To measure the acceptable level of edutainment, entertainment and learning outcomes were statistically measured in Chapter 5. Although both variables had high mean values and slightly negative skewness, engagement (Mean = 4.2571) did not significantly affect the student's learning outcomes (Mean = 4.0952) as presented in Table 5.2. Even after testing demographic data, there was no shift in the variance between engagement and learning outcomes (see Fig. 5.4). The weak correlation of these variables necessitated a further investigation of the qualitative insights from the participants' feedback.

While fun and engagement only contributed to 0.6% of knowledge transfer, the participants seemed to have related and enjoyed the benefits of the game's educational material and task contexts. The formulated themes supporting these results are soft skill improvement, real-world application of the scenarios, mind sharpening, and collaborative learning as presented in Table 5.3. The second theme on Table 5.3 portrays that most of the participants associated the learning experience in TAG TEAM to be transferable to real-world settings. This result affirms the findings of [3], which supports the subjectivity involved in immersive play [20, 93, 54, 107].

[41] emphasizes that fun enhances engagement, which eventually results in positive learning outcomes. It is evident that TAG TEAM, though minimally, abides by these recommendations without deviating from its aims and objectives. Although marginally, TAG TEAM was able to teach emotional intelligence. One of the participants related the game to be both fun while instilling interpersonal awareness. The participant was from the business management department (NON-STEM) and stated as follows: *"It is a fun game that helps us understand the real work environment and what attitude we ought to have."*.

Only one psychology student (STEM) out of the 21 participants despised TAG TEAM's ability to teach soft skills and engage students. Unfortunately, due to the small sample size, this participant's responses intensively affected the general results of the findings. The results from the willingness to learn and learning outcomes suffered the most due to this fact. This participant's own responses had an average mean of 2.2 on the willingness dimension of the Likert group of questions. With this mean, this participant stands out as an outlier in this study Fig. 5.3. Furthermore, this low value corresponds with their remarks which stated that the game was "boring". They also added that they were unwilling to play serious games in the future and would not recommend them to a friend. To the researcher's knowledge, this peculiar finding

has not been documented in any prior work. Therefore, further investigation on how to cater to the needs of students in the field of psychology needs to be explored further.

6.4 Game Design Principles on Engagement

6.4.1 Capturing Behavioural logs

TAG TEAM to capture students' behavioural logs through PlayFab analytics Fig. 5.12. These logs facilitated the gathering of formative and summative components deemed essential to gaining a deeper understanding of the participant's behaviour when using serious games. TAG TEAM captured the player's responses to scenarios and measured their task completion rates. This approach enabled TAG TEAM to effectively portray the level of decision-making and self-efficacy in the students. However, the conclusion derived from this technique would require an observer with a deeper understanding of human psychology [53].

6.4.2 Employing immediate feedback

Immediate feedback [20, 40, 93] is one of the most important mechanics in designing a successful serious game [93]. [47] points out a gap in the literature regarding the uncertainty of the best feedback to use in a serious game. This study's research question seeks to fill this gap by using TAG TEAM's feedback mechanisms. While TAG TEAM did not entirely harness aesthetic feedback, it provided an impressive revelation for explicit feedback. In TAG TEAM, explicit feedback was informative and yielded closure to the player [103], thus allowing them to learn from their mistakes and stay engaged at the same time. Since TAG TEAM was divided into chapters (see Fig. C.2 in the appendix), the players were able to retry levels having a new perspective from previous feedback. Unlike [48], this feedback mechanism enables the players to concentrate on the specific areas of improvement [37], allowing them to attain mastery.

6.4.3 Using explicit feedback

Explicit feedback can be used in serious games as scaffolding for an easier learning experience [101]. TAG TEAM offered explicit feedback through coins, beep sounds, and, most importantly, a direct explanation of the protagonist's choices in the scenario. More often than not, people get into wrangles at work and always lack the required techniques to effectively resolve these issues. With explicit feedback, serious games can be an essential pedagogy that enables undergraduates to practice and experience the consequences of their decisions in a controlled environment [2]. By doing so, students gain situational awareness of such intricate matters in the real world. This rationale does not entirely answer [47] gap on which feedback mechanism is the best; however, it offers a practical transferability of soft skills using explicit feedback in serious games.

6.4.4 Third-person perspective for learning disabilities

The player's perspective is one of the most important mechanics when accounting for cognitive load and emotional immersion in serious games. The first-person perspective is the most common approach in commercial video games in both 2D and 3D environments. However, it cannot be entirely deemed the most appropriate choice, especially with players who have learning disabilities and medical conditions. Firstly, the frequent changes in camera angles can impose motion sickness on the players. Secondly, the observable large field of view requires the player to interact with a lot of game elements simultaneously. These two factors impose a lot of strain on working memory against the standards of the cognitive load theory [58].

On the other hand, the third-person perspective offers an environmental awareness of the player's game surroundings. The players are able to see the avatar's non-verbal cues in the form of facial expressions and body movements. This visual interaction enhances engagement and immersion through a parasocial emotional body like the one formed between people and their celebrity idles. Similar to [48], TAG TEAM maintained engagement between the protagonist and their avatar by fostering this emotional bond. [48] states that this one-sided bond can grow even stronger with time, leading to deeper engagement and immersion. By following the suggestions of [58] on reducing memory load and [48] on parasocial emotions, this study's findings on TAG TEAM propose the third-person perspective to be the best suited for serious games.

6.4.5 Simplistic user interface

The design of TAG TEAM ensured high cognitive fidelity by integrating game mechanics and Shneiderman's human-computer interaction principles [103]. By carefully considering the cognitive load the game would impose on players, the design thoughtfully ensured consistency of the scenes and levels. This consistency lessened the strain the player would have encountered through icon memorization and level navigation. It is evident that the participants found the intuitiveness and simplicity of TAG TEAM advantageous for learning soft skills by ranking its usability as the second-highest dimension with a mean of 4.1746 (see Table 5.2). In doing so, TAG TEAM addressed a viewpoint on serious games that has rarely been discussed in the literature. This study's findings on incorporating HCI principles into game design mechanics open a new debate on how serious games should consider cognitive usability to enhance soft skills learning outcomes.

6.4.6 Allowing for Internal Locus of Control

Finally, to ensure that the protagonist of the storyline feels in control of the game [47], most of the commands have to be initiated by them, thus achieving an internal locus of control. This study's findings observe a strong relationship between cognitive usability and engagement by implying that the more intuitive it is to use a serious game, the more fun and engaging it will be. Furthermore, the high levels of engagement accompanied by TAG TEAM'S ease of use aligns

with the theoretical framework of Self-Determination Theory (SDT) [52]. This framework posits that intrinsic motivation can be achieved in serious games through autonomy [52], competence [37], and relatedness. In that case, TAG TEAM allowed player autonomy in decision-making and problem-solving. It further allowed for mastery of competencies by engaging players with an unlimited amount of level repeats so as to pursue better decisions.

6.5 Summary

In conclusion, this chapter discusses the efficiency of TAG TEAM in teaching soft skills to undergraduate students by consolidating this study's findings with the relevant literature. It provided meaning to the importance of soft skills to students, more so in decision-making and self-efficacy, but it has yet to put emphasis on emotional intelligence. There was a novelty effect decrease in the willingness of the students to learn soft skills using serious games; nevertheless, it remained rather high. This chapter advances further with an extended discussion of the balancing role of edutainment for fun and educational outcomes as part of the reflection on the impacts of principles related to game design.

Chapter 7

Conclusions and Future Work

This chapter concludes the research by summarising key findings and tying them back to this study's main aim and objectives. It also highlights this study's contributions to academia and serious game developers in general. Finally, it highlights this study's delimitation and limitations and addresses them with recommendations for future work.

7.1 Discussion of Overall Findings

This study addressed a gap in the existing pedagogy. The gap stated that there is a lack of an effective framework for teaching and assessing soft skills to undergraduate students. This study attempted to fill this gap by incorporating CLT and CBL principles into game-based learning. To ensure the effectiveness of this framework, the researcher set four objectives. First, it was to determine the game design principles that enhance the fun in serious games; second, it was to evaluate how effectively serious games would teach soft skills. Thirdly, it was to propose the game design principles that enhance learning outcomes and finally to develop and evaluate a novel serious game. With this road map in place, the proposed framework successfully composed a serious game called TAG TEAM.

The research indicates that TAG TEAM successfully addresses the primary aim of this study, which was to develop an effective pedagogical framework for teaching and assessing soft skills for undergraduate students. The research posed three questions to challenge the formulated framework. Research question one intended to test whether serious games created with this new framework can offer transferable learning outcomes without prioritizing fun. The second research question was to determine whether this framework would retain students' willingness to learn soft skills using serious games. Finally, the last research question aimed to assess how the framework enables serious games to maintain students' engagement and motivation.

The findings from testing TAG TEAM indicate that the framework successfully drives engagement without prioritizing fun over learning outcomes. TAG TEAM challenged the students without overloading their minds [58], thus creating a situation where students could harness failure to develop soft skills. Furthermore, the findings also indicate that the students

found the learning experience through TAG TEAM to be engaging but meaningful. Thus, this study amplifies how serious games created with this framework offer an alternative experiential mode of learning soft skills that supplement conventional pedagogues.

Despite this study's positive advancements, the results for answering research question one did not support the unanimously agreed-upon belief that engagement in serious games can be sought out through fun. Needless to say, TAG TEAM motivated students through the authenticity and relevance of its educational content. These findings contribute to academia by suggesting that serious games designed with this framework can achieve engagement without over-reliance on fun.

7.2 Delimitations and Limitations

While the research offers significant insights into serious game design for teaching soft skills, it is essential to acknowledge its limitations and delimitations. It is worth noting that this study was affected by a number of constraints, some intentionally set by the researcher and others unavoidable.

7.2.1 Delimitations

On the researcher's account, scope, participant selection, game design principles, and methodological approach were thoughtfully considered in order to attain a feasible but rigorous study. This rationale ensured that this study was practically achievable and produced significant results that can be trusted. Firstly, this study acknowledges that soft skills are diverse. In a sense, all soft skills can not be covered in one research alone, so this study's primary focus was on self-efficacy and decision-making. Other soft skills that were mentioned in this study included communication, teamwork, and emotional intelligence. However, they were included to masquerade the intended skills being tested by this study.

The researcher chose to focus on undergraduate students with the assumption that they would be the population with the most likelihood of soft skills deficiencies. This assumption was derived from previous literature that points out that postgraduate students have high regard for the importance of having soft skills [111]. Furthermore, postgraduate students, especially those with managerial experience, portray extensive knowledge of soft skills [112]. These assumptions necessitated the researcher to consider the nuances of collecting data from postgraduate students. Thus, the rationale was to avoid adding them to the sample pool.

This study focused on creating and assessing a novel serious game. The findings might not be generalized since other serious games were only discussed in the literature review section but were never tested in real-time. Future studies should consider testing various serious games to gain a broader understanding of the game mechanics that are successful in various games. The researcher found inspiration from [41] and considered countering this limitation by incorporating mini-games in the form of tasks. However, the analysis of this study was not rigorous enough to draw substantial conclusions about this matter.

Finally, although the researcher employed a mixed-method approach, this study was predominantly quantitative. The qualitative data was intended to support the findings of the quantitative data. However, not all nuances were accounted for, and the participants' experiences were not fully explored. This study would have benefited more from open-ended interviews and focus groups.

7.2.2 Limitations

This study also faced challenges that were practically beyond the researcher's ability to mitigate. Initially, this study aimed to use a random sample of undergraduate students from Swansea University. However, since this study was conducted over the summer holiday, it ment that the researcher had limited access to the proposed participants pool. This resulted in adopting a convenience sample, which was also relatively smaller than the expected sample size. Furthermore, it necessitated the researcher to use a mixed-method approach instead of purely quantitative research so as to acquire tangible results.

The lack of the expected sample also shifted this study design from the context of the United Kingdom perspective into a more general direction by incorporating participants from Kenya. While this limitation intensively shaped this study's scope, it offered findings from a more diverse sample group. The findings might also be limited to generalizability for other students of lower or higher academic levels since the focus of this study had been upon undergraduate students. Other future studies should also replicate this study with a larger sample size to enrich the generalizability of the finding.

Another key issue that limits the statistical strength of the findings is time. This study was constrained to three months, which entailed background research, game design and development, and data gathering and analysis. With this in mind, the data collection was conducted in a span of ten days, excluding weekends. This means that the participants only got a chance to interact with the game once since the sessions were 1 hour long. The sessions also included a short break and time to answer the questionnaires.

Furthermore, since this study was conducted off the school premises and during the holiday season, the findings can not represent how undergraduate students would engage with other serious games if they were integrated into the existing curriculum. To get a better insight into whether the game enhances self-efficacy and decision-making, future studies would benefit more from a longitudinal study where similar games can be used both for in-class and take-home practice.

Since the survey data was collected on a participant's self-reported basis, there is a possible limitation in social desirability bias. This effect would also limit the accuracy of the participant's extent of soft skill attainment and improvement. While surveys are excellent in capturing data from quick responses, the techniques hinder the ability to acquire a deeper understanding of a phenomenon.

Finally, this study, just like many other exploratory studies, was limited in terms of funding and financial capabilities. Lack of finance affected the decisions made while implementing the serious game and the overall study. This hindered the researcher from using top-quality sound effects and sprites when making TAG TEAM. Furthermore, this constraint made the option of using financial inducement for participants' onboarding unpractical. The researcher relied on participant goodwill to participate in this study, with four potential participants failing to participate when they knew there was no financial gain.

7.3 Recommendations and Future Work

The above-mentioned limitations have impacted this study's findings in many ways. However, they have also presented an opportunity to propose beneficial recommendations for future work. First and foremost, it would be best to consider a broader scope of soft skills beyond the ones measured in this study. It would also be beneficial to dive deeper into how emotional intelligence impacts decision-making and self-efficacy.

Future studies can be integrated into a formal education setting to provide findings that are suitable for educational standards. Longitudinal studies can be integrated into the current curriculum to assess the long-term impact of serious games in a practical scenario. This would further shed light on how to curb students' declining motivation to use serious games. Furthermore, these studies can also consider co-designing serious games with the students, which would enhance motivation and engagement. Co-designing would also enable future researchers to meet student's expectations that this study would have missed.

Enhancing game mechanics by embedding artificial intelligence to offer adaptive difficulties and story branching to mimic flow theory [14] and Self-Determination Theory (SDT) [52] robustness of future frameworks. In doing so, they would enable the students to attain mastery, self-learn, and focus on specific competencies [37] without overloading the student's cognitive abilities [58]. Designing these dynamic challenges in future games might also retain novelty, thus maintaining engagement for extended periods. While TAG TEAM's manifesto was baked on "simplicity," it would be worth noting that serious games would attain more if a wide variety of modalities were harvested. Future research should consider harnessing haptic and augmented reality to improve player experience.

7.4 Contributions

This framework is tailored to effectively teach soft skills and to convert theoretical concepts into playable game mechanics. In this respect, this study presents TAG TEAM as a prototype for serious games that will be developed to teach and assess soft skills in the future. The design patterns of TAG TEAM will be helpful for educators, game designers, and curriculum developers in the future as long as the guidelines below are followed.

7.4.1 Guidelines for Designing Serious Games

1. Use immediate feedback to reinforce learning outcomes.
2. Balance fail states appropriately to enhance pursuit for mastery.
3. Tailor serious games for specified demographics.
4. Employ mini-games to enhance novelty.
5. Regulate entertainment to make the learning material stand out.
6. Use a simple, intuitive user interface to reduce intrinsic load.
7. Enable internal locus of control to drive self-learning.

7.5 Summary

This chapter summarizes the contribution of the study to the development of an effective framework for teaching soft skills through serious games, in particular by using cognitive load theory and competency-based education principles. The serious game developed for this study, TAG TEAM, effectively demonstrates how serious games can attain engagement and learning outcomes without relying on fun. This chapter also underlined the limitations of this study and presented recommendations for future research, such as the integration of adaptive artificial intelligence and augmented reality into serious games.

Bibliography

[1] U. UK, "Higher education in facts and figures: 2021," https://www.universitiesuk.ac.uk/what-we-do/policy-and-research/publications/higher-education-facts-and-figures-2021, 2021, accessed: 2024-09-26.

[2] V. Leendertz and G. D. Matthew, *F-EMS Incorporated: A BCOM Mobile Serious Game to Simulate the Business Environment*. New York, NY, USA: Association for Computing Machinery, 2023, p. 19–23. [Online]. Available: https://doi.org/10.1145/3572549.3572553

[3] P.-S. Seow, G. Pan, and G. Koh, "Examining an experiential learning approach to prepare students for the volatile, uncertain, complex and ambiguous (vuca) work environment," *The International Journal of Management Education*, vol. 17, no. 1, pp. 62–76, 2019. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1472811718301393

[4] S. Majid, Z. Liming, S. Tong, and S. Raihana, "Importance of soft skills for education and career success," *International Journal for Cross-Disciplinary Subjects in Education*, vol. 2, no. 2, pp. 1037–1042, 2012.

[5] H. Idrus, "Important soft skills to be integrated in the teaching of technical courses: Views of lecturers versus students," in *2017 7th World Engineering Education Forum (WEEF)*, 2017, pp. 585–588.

[6] R. Ziatdinov and J. Cilliers, "Generation alpha: Understanding the next cohort of university students," *arXiv preprint arXiv:2202.01422*, 2022.

[7] D. L. Sutil-Martín and F. J. Otamendi, "Soft skills training program based on serious games," *Sustainability*, vol. 13, no. 15, 2021. [Online]. Available: https://www.mdpi.com/2071-1050/13/15/8582

[8] P. C. Otermans, D. Aditya, and M. Pereira, "A study exploring soft skills in higher education." *Journal of Teaching and Learning for Graduate Employability*, vol. 14, no. 1, pp. 136–153, 2023.

[9] D. H. Autor, "Why are there still so many jobs? the history and future of workplace automation," *Journal of economic perspectives*, vol. 29, no. 3, pp. 3–30, 2015.

[10] D. T. Harmon, *Your Soft Skills Are Showing: Organizational Efforts to Develop Soft Skills*. University of Southern California, 2021.

[11] C. Mohtadi, O. McAree, and J. Schlosser, "Bridging the skills gap in stem industries," in *SEFI 2014 42nd Annual Conference*, 2014.

[12] D. for Education, "Mobile phones in schools: Guidance for schools on prohibiting the use of mobile phones throughout the school day," February 2024, accessed: 2024-07-22. [Online]. Available: https://assets.publishing.service.gov.uk/media/65cf5f2a4239310011b7b916/Mobile_phones_in_schools_guidance.pdf

[13] J. Magano, C. Silva, C. Figueiredo, A. Vitória, T. Nogueira, and M. A. Pimenta Dinis, "Generation z: Fitting project management soft skills competencies—a mixed-method approach," *Education sciences*, vol. 10, no. 7, p. 187, 2020.

[14] A. C. Zoltan Buzady, Agnes Wimmer and P. Szentesi, "Exploring flow-promoting management and leadership skills via serious gaming," *Interactive Learning Environments*, vol. 32, no. 2, pp. 757–771, 2024. [Online]. Available: https://doi.org/10.1080/10494820.2022.2098775

[15] S. P. Smith, D. Hickmott, R. Bille, E. Burd, E. Southgate, and L. Stephens, "Improving undergraduate soft skills using m-learning and serious games," in *2015 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, 2015, pp. 230–235.

[16] M. Hassenzahl, *Experience design: Technology for all the right reasons*. Morgan & Claypool Publishers, 2010.

[17] M. Lüftenegger, R. Van de Schoot, B. Schober, M. Finsterwald, and C. Spiel, "Promotion of students' mastery goal orientations: Does target work?" *Educational Psychology*, vol. 34, no. 4, pp. 451–469, 2014.

[18] Z. Buzady, "Flow, leadership and serious games–a pedagogical perspective," *World Journal of Science, Technology and Sustainable Development*, vol. 14, no. 2/3, pp. 204–217, 2017.

[19] R. Márquez, A. Vizcaíno, F. O. García, and A. Manjavacas, "Global-manager: A serious game for providing training in project manager skills," in *2020 ACM/IEEE 15th International Conference on Global Software Engineering (ICGSE)*, ser. ICGSE '20. New York, NY, USA: Association for Computing Machinery, 2020, p. 127–131. [Online]. Available: https://doi.org/10.1145/3372787.3390443

[20] A. P. Agostino Marengo and K. A. Soomro, "Serious games to assess university students' soft skills: investigating the effectiveness of a gamified assessment prototype," *Interactive Learning Environments*, vol. 0, no. 0, pp. 1–17, 2023. [Online]. Available: https://doi.org/10.1080/10494820.2023.2253849

[21] S. A. Andari, O. Cardin, P. Berruet, and R. Ardi, "Serious game as learning media for reconfigurable manufacturing system: A model development," *IFAC-PapersOnLine*, vol. 55, no. 10, pp. 1675–1680, 2022, 10th IFAC Conference on Manufacturing Modelling, Management and Control MIM 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2405896322019553

[22] E. Kemenade and E. van Kemenade, "Skills for quality managers in a time of breakthrough," in *Quality Management in a Time of Change*, 06 2013.

[23] S. I. Marin-Zapata, J. P. Román-Calderón, C. Robledo-Ardila, and M. A. Jaramillo-Serna, "Soft skills, do we know what we are talking about?" *Review of Managerial Science*, vol. 16, no. 4, pp. 969–1000, 2022.

[24] C. Succi, "Are you ready to find a job? ranking of a list of soft skills to enhance graduates' employability," *International Journal of Human Resources Development and Management*, vol. 19, no. 3, pp. 281–297, 2019.

[25] C. R. Litecky, K. P. Arnett, and B. Prabhakar, "The paradox of soft skills versus technical skills in is hiring," *Journal of Computer Information Systems*, vol. 45, no. 1, pp. 69–76, 2004.

[26] M. Nino and M. A. Evans, "Fostering 21st-century skills in constructivist engineering classrooms with digital game-based learning," *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje*, vol. 10, no. 3, pp. 143–149, 2015.

[27] S. Ahmad, K. Ameen, and M. Ullah, "Needed soft skills and their status: Self-perceptions of university information professionals," *Pakistan Journal of Information Management & Libraries*, vol. 18, no. 2, pp. 75–90, 2016.

[28] D. Pachauri and A. Yadav, "Importance of soft skills in teacher education programme," *International journal of educational research and technology*, vol. 5, no. 1, pp. 22–25, 2014.

[29] W. H. Organization *et al.*, "Life skills education for children and adolescents in schools. pt. 3, training workshops for the development and implementation of life skills programmes," World Health Organization, Tech. Rep., 1994.

[30] W. A. Bakheet Al-Fayez, "The degree of jordanian science teachers' practice of soft skills in the classroom," *Pegem eğitim ve öğretim dergisi = Pegem journal of education and instruction.*, vol. 14, no. 2, pp. 192–204, 2024-01-01.

[31] O. Bak, C. Jordan, and J. Midgley, "The adoption of soft skills in supply chain and understanding their current role in supply chain management skills agenda: A uk perspective," *Benchmarking: An International Journal*, vol. 26, no. 3, pp. 1063–1079, 2019. [Online]. Available: https://www.proquest.com/scholarly-journals/adoption-soft-skills-supply-chain-understanding/docview/2497035995/se-2

[32] S. Snell, C. Snell-Siddle, and D. Whitehouse, "Soft or hard boiled: Relevance of soft skills for is professionals," in *Proceedings of the 15th Annual Conference of the National Advisory Committee on Computing Qualifications*, 2002, pp. 403–408.

[33] A. A. Bakar and C.-Y. Ting, "Soft skills recommendation systems for it jobs: A bayesian network approach," in *2011 3rd Conference on Data Mining and Optimization (DMO)*. IEEE, 2011, pp. 82–87.

[34] B. Almatrooshi, S. K. Singh, and S. Farouk, "Determinants of organizational performance: a proposed framework," *International Journal of productivity and performance management*, vol. 65, no. 6, pp. 844–859, 2016.

[35] P. Pradhan, L. Costa, D. Rybski, W. Lucht, and J. P. Kropp, "A systematic study of sustainable development goal (sdg) interactions," *Earth's Future*, vol. 5, no. 11, pp. 1169–1179, 2017.

[36] M. Ellis, E. Kisling, and R. G. Hackworth, "Teaching soft skills employers need," *Community College Journal of Research and Practice*, vol. 38, no. 5, pp. 433–453, 2014.

[37] E. Levine and S. Patrick, "What is competency-based education? an updated definition." *Aurora Institute*, 2019.

[38] A. Aslan, "Problem- based learning in live online classes: Learning achievement, problem-solving skill, communication skill, and interaction," *Computers Education*, vol. 171, p. 104237, 2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0360131521001147

[39] F. Powers and R. Moore, "When failure is an option: a scoping review of failure states in game-based learning," *TechTrends*, vol. 65, pp. 615–625, Aug. 2021. [Online]. Available: https://doi.org/10.1007/s11528-021-00606-8

[40] L. Altomari, N. Altomari, and G. Iazzolino, "Gamification and soft skills assessment in the development of a serious game: Design and feasibility pilot study," *JMIR Serious Games*, vol. 11, p. e45436, Jul 2023. [Online]. Available: https://games.jmir.org/2023/1/e45436

[41] N. McGowan, A. López-Serrano, and D. Burgos, "Serious games and soft skills in higher education: A case study of the design of compete!" *Electronics*, vol. 12, no. 6, 2023. [Online]. Available: https://www.mdpi.com/2079-9292/12/6/1432

[42] F. Bellotti, R. Berta, A. De Gloria, E. Lavagnino, A. Antonaci, F. Dagnino, M. Ott, M. Romero, M. Usart, and I. S. Mayer, "Serious games and the development of an entrepreneurial mindset in higher education engineering students," *Entertainment Computing*, vol. 5, no. 4, pp. 357–366, 2014.

[43] V. Pelser-Carstens and V. Leendertz, "Towards a theoretical serious game design framework for accountancy education," in *Proceedings of EdMedia + Innovate*

Learning 2022, T. Bastiaens, Ed. Online: Association for the Advancement of Computing in Education (AACE), November 2022, pp. 557–576. [Online]. Available: https://www.learntechlib.org/p/221340

[44] R. Crawford, "The sound of visual novels: Differences and similarities in experience for japanese and english-speakers," *Mechademia*, vol. 13, no. 2, pp. 169–186, 2021.

[45] J. T. Murray, *Annotating Player Experience in Telltale Games The Wolf Among Us*. University of California, Santa Cruz, 2018.

[46] B. Whaley, "Who will play terebi gēmu when no japanese children remain? distanced engagement in atlus' catherine," *Games and Culture*, vol. 13, no. 1, pp. 92–114, 2018.

[47] P. Healy, K.-L. You, A. Xu, T. H. Thomas, and D. Babichenko, "A narrative serious game to teach self-advocacy skills in advanced cancer," *Procedia Computer Science*, vol. 206, pp. 162–172, 2022, international Society for Research on Internet Interventions 11th Scientific Meeting. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1877050922009681

[48] B. C. Bouchillon and P. A. Stewart, "Games-based trust: Role-playing the administrative experience of immigrants," *New Media & Society*, vol. 23, no. 3, pp. 479–496, 2021. [Online]. Available: https://doi.org/10.1177/1461444819900557

[49] S. M. Evangelou, V. Kapsoulakis, and M. Xenos, "Evaluation of a serious game for young software engineering graduates: Interviewing skills and soft skills," in *2023 IEEE Global Engineering Education Conference (EDUCON)*, 2023, pp. 1–7.

[50] D. Ávila-Pesántez, L. A. Rivera, and M. S. Alban, "Approaches for serious game design: A systematic literature review." *Computers in education journal*, vol. 8, no. 3, 2017.

[51] N. Hefkaluk, C. Linehan, and A. Trace, "Fail, fail again, fail better: How players who enjoy challenging games persist after failure in "celeste"," *International Journal of Human-Computer Studies*, vol. 183, p. 103199, 2024. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1071581923002082

[52] R. M. Ryan and E. L. Deci, "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being," *American Psychologist*, vol. 55, no. 1, p. 68 – 78, 2000, cited by: 25285. [Online]. Available: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85043751872&doi=10.1037%2f0003-066X.55.1.68&partnerID=40&md5=3ae1ed6a521943d58b3eb02792fffc9c

[53] V. Braun and V. Clarke, "Reflecting on reflexive thematic analysis," *Qualitative Research in Sport, Exercise and Health*, vol. 11, no. 4, pp. 589–597, 2019. [Online]. Available: https://doi.org/10.1080/2159676X.2019.1628806

[54] L. Altomari, N. Altomari, and G. Iazzolino, "Using gamification for assessing soft skills: A serious game design," in *2022 IEEE 10th International Conference on Serious Games and Applications for Health(SeGAH)*, 2022, pp. 1–7.

[55] J. Urakami, Y. Z. Hu, and M. Chignell, "Monitoring cognitive performance with a serious game: A longitudinal case study on online cognitive assessment using serious games," in *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*, 2021, pp. 1–7.

[56] T. M. Connolly, E. A. Boyle, E. MacArthur, T. Hainey, and J. M. Boyle, "A systematic literature review of empirical evidence on computer games and serious games," *Computers Education*, vol. 59, no. 2, pp. 661–686, 2012. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0360131512000619

[57] R. L. Lamb, L. Annetta, J. Firestone, and E. Etopio, "A meta-analysis with examination of moderators of student cognition, affect, and learning outcomes while using serious educational games, serious games, and simulations," *Computers in Human Behavior*, vol. 80, pp. 158–167, 2018. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0747563217306143

[58] J. Sweller, "Cognitive load during problem solving: Effects on learning," *Cognitive Science*, vol. 12, no. 2, pp. 257–285, 1988. [Online]. Available: https://www.sciencedirect.com/science/article/pii/0364021388900237

[59] C.-C. Chang and S.-T. Yang, "Interactive effects of scaffolding digital game-based learning and cognitive style on adult learners' emotion, cognitive load and learning performance," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 16, 2023.

[60] Y. Hu, T. Gallagher, P. Wouters, M. van der Schaaf, and L. Kester, "Game-based learning has good chemistry with chemistry education: A three-level meta-analysis," *Journal of Research in Science Teaching*, vol. 59, no. 9, pp. 1499–1543, 2022. [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/tea.21765

[61] Y.-L. Tsai and C.-C. Tsai, "A meta-analysis of research on digital game-based science learning," *Journal of Computer Assisted Learning*, vol. 36, no. 3, pp. 280–294, 2020. [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1111/jcal.12430

[62] C. Legg and C. Hookway, "Pragmatism," in *Stanford Encyclopedia of Philosophy*, 2019. [Online]. Available: https://plato.stanford.edu/entries/pragmatism/

[63] C. A. Lawson and A. V. Fisher, "It's in the sample: The effects of sample size and sample diversity on the breadth of inductive generalization," *Journal of Experimental Child Psychology*, vol. 110, no. 4, pp. 499–519, 2011. [Online]. Available: https://doi.org/10.1016/j.jecp.2011.07.001

[64] H. E. S. A. (HESA), "He student enrolments by personal characteristics 2015/16 to 2019/20," https://www.hesa.ac.uk/data-and-analysis/sb258/figure-5, 2021, accessed: 2024-09-26.

[65] Republic of Kenya, Ministry of Education, *Basic Education Statistical Booklet*. Nairobi, Kenya: Republic of Kenya, Ministry of Education, 2019. [Online]. Available: https://demo.education.go.ke/wp-content/uploads/2021/11/Approved-Basic-Education-Statistical-Booklet-2019-approved.pdf

[66] D. T. Campbell and J. C. Stanley, *Experimental and quasi-experimental designs for research*. Ravenio books, 2015.

[67] A. Bryman, "Integrating quantitative and qualitative research: how is it done?" *Qualitative Research*, vol. 6, pp. 113 – 97, 2006.

[68] R. Likert, "A technique for the measurement of attitudes." *Archives of psychology*, 1932.

[69] N. N. S. H. V. Raju and N. S. Harinarayana, "Online survey tools: A case study of google forms," in *National Conference on Scientific, Computational & Information Research Trends in Engineering, GSSS-IETW, Mysore*, January 2016, pp. 1–12.

[70] R. K. Yin, *Case Study Research and Applications: Design and Methods*, 6th ed. Los Angeles: SAGE Publications, 2018.

[71] J. W. Creswell and C. N. Poth, *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications, 2016.

[72] J. A. Maxwell, *Qualitative Research Design: An Interactive Approach*, 3rd ed., ser. Applied Social Research Methods. Thousand Oaks, CA: SAGE Publications, 2013, vol. 41.

[73] N. K. Denzin, *The Research Act: A Theoretical Introduction to Sociological Methods*, 1st ed. Routledge, 2009.

[74] L. Finlay, *Phenomenology for Therapists: Researching the Lived World*. Wiley, 2011.

[75] European Union, "General data protection regulation (gdpr) – legal text," 2018, accessed on September 26, 2024. [Online]. Available: https://gdpr-info.eu

[76] A. Orb, L. Eisenhauer, and D. Wynaden, "Ethics in qualitative research," *Journal of Nursing Scholarship*, vol. 33, no. 1, pp. 93–96, 2001.

[77] UK Parliament, "Data protection act 2018," c. 12, 2018, accessed on September 26, 2024.

[78] T. L. Beauchamp and J. F. Childress, *Principles of biomedical ethics*. Edicoes Loyola, 1994.

[79] A. Gazis and E. Katsiri, "Serious games in digital gaming: A comprehensive review of applications, game engines and advancements," *ArXiv*, vol. abs/2311.03384, 2023.

[80] Unity Technologies, *Unity User Manual 2022.3 (LTS)*, Unity Technologies, 2022, accessed on August 31, 2024. [Online]. Available: https://docs.unity3d.com/Manual/index.html

[81] P.-C. V. Manuel, P.-C. I. José, F.-M. Manuel, M.-O. Iván, and F.-M. Baltasar, "Simplifying the creation of adventure serious games with educational-oriented features," *Journal of Educational Technology Society*, vol. 22, no. 3, pp. 32–46, 2019. [Online]. Available: https://www.jstor.org/stable/26896708

[82] Unity Technologies, *Unity User Manual 2022.3: Physics Section*, Unity Technologies, 2022, accessed on August 31, 2024. [Online]. Available: https://docs.unity3d.com/Manual/PhysicsSection.html

[83] ——. (2024) Empower your content through our community platforms. Unity Technologies. Accessed on August 31, 2024. [Online]. Available: https://unity.com/community

[84] Microsoft. (2024) A tour of the c# language. Microsoft. Accessed on August 31, 2024. [Online]. Available: https://learn.microsoft.com/en-us/dotnet/csharp/tour-of-csharp/overview

[85] J. Chen and E. Price, 2022.

[86] Godot Engine Community. (2024) Godot engine - free and open source 2d and 3d game engine. Godot Engine. Accessed on August 31, 2024. [Online]. Available: https://godotengine.org/

[87] Stride Contributors. (2024) Stride game engine - free, open source c# 2d and 3d game engine. Stride. Accessed on August 31, 2024. [Online]. Available: https://www.stride3d.net/

[88] GameFromScratch. (2022) Wave engine 3.1 released. GameFromScratch. Accessed on August 31, 2024. [Online]. Available: https://gamefromscratch.com/wave-engine-3-1-released/

[89] M. Sharma, "How important are soft skills from the recruiter's perspective." *ICFAI Journal of Soft Skills*, vol. 3, no. 2, 2009.

[90] Microsoft. (2024) Language integrated query (linq) - c#. Microsoft. Accessed on August 31, 2024. [Online]. Available: https://learn.microsoft.com/en-us/dotnet/csharp/linq/

[91] ——. (2022) Visual studio product family documentation. Microsoft. Accessed on August 31, 2024. [Online]. Available: https://learn.microsoft.com/en-us/visualstudio/?view=vs-2022

[92] B. Bors, *CloudScript and Azure Functions*. Berkeley, CA: Apress, 2023, pp. 355–374. [Online]. Available: https://doi.org/10.1007/978-1-4842-8910-5_9

[93] F. Almeida, "Adoption of a serious game in the developing of emotional intelligence skills," *European Journal of Investigation in Health, Psychology and Education*, vol. 10, no. 1, pp. 30–43, 2020. [Online]. Available: https://www.mdpi.com/2254-9625/10/1/4

[94] Microsoft. (2024) What is playfab? Microsoft. Accessed on August 31, 2024. [Online]. Available: https://learn.microsoft.com/en-us/gaming/playfab/what-is-playfab

[95] GitHub. (2024) Start your journey - github docs. GitHub. Accessed on August 31, 2024. [Online]. Available: https://docs.github.com/en/get-started/start-your-journey

[96] ——, "Github desktop," GitHub, 2024, accessed on August 31, 2024. [Online]. Available: https://github.com/apps/desktop

[97] R. R. Zamora, I. A. S. Hernández, and L. A. E. Núñez, "Development serious games using agile methods. test case: Values and attitudinal skills," pp. 270–281, 2018.

[98] D. P. Kristiadi, F. Sudarto, D. Sugiarto, R. Sambera, H. Warnars, and K. Hashimoto, "Game development with scrum methodology," *2019 International Congress on Applied Information Technology (AIT)*, pp. 1–6, 2019.

[99] E. Novak, "A critical review of digital storyline-enhanced learning," *Educational Technology Research and Development*, vol. 63, pp. 431–453, 2015.

[100] K. Szolin, D. Kuss, F. Nuyens, and M. Griffiths, "Exploring the user-avatar relationship in videogames: A systematic review of the proteus effect," *Human–Computer Interaction*, vol. 38, pp. 374 – 399, 2022. [Online]. Available: 10.1080/07370024.2022.2103419

[101] S. Matook, Y. M. Wang, N. Koeppel, and S. Guerin, "Metacognitive skills in low-code app development: Work-integrated learning in information systems development," *Journal of Information Technology*, vol. 39, no. 1, pp. 41–70, 2024. [Online]. Available: https://doi.org/10.1177/02683962231170238

[102] J. Simpson, P. Nalepka, R. W. Kallen, M. Dras, E. D. Reichle, S. Hosking, C. J. Best, D. Richards, and M. J. Richardson, "Conversation dynamics in a multiplayer video game with knowledge asymmetry," *Frontiers in Psychology*, vol. 13, 2022.

[103] F. K. Mazumder and U. K. Das, "Usability guidelines for usable user interface," *International Journal of Research in Engineering and Technology*, vol. 3, no. 9, pp. 79–82, 2014.

[104] J. Pallant, *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge, 2020.

[105] G. R. Hancock, R. O. Mueller, and L. M. Stapleton, *The reviewer's guide to quantitative methods in the social sciences*. Routledge, 2010.

[106] D. E. Berlyne, M. A. Craw, P. H. Salapatek, and J. L. Lewis, "Novelty, complexity, incongruity, extrinsic motivation, and the gsr." *Journal of experimental psychology*, vol. 66, no. 6, p. 560, 1963.

[107] A. Imbellone, B. Botte, and C. M. Medaglia, "Serious games for mobile devices: the intouch project case study." *International Journal of Serious Games*, vol. 2, no. 1, 2015.

[108] D. González-Cutre, Álvaro Sicilia, A. C. Sierra, R. Ferriz, and M. S. Hagger, "Understanding the need for novelty from the perspective of self-determination theory," *Personality and Individual Differences*, vol. 102, pp. 159–169, 2016. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0191886916307863

[109] L. M. Jeno, V. Vandvik, S. Eliassen, and J.-A. Grytnes, "Testing the novelty effect of an m-learning tool on internalization and achievement: A self-determination theory approach," *Computers Education*, vol. 128, pp. 398–413, 2019. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0360131518302793

[110] A.-C. E. Ding and C.-H. Yu, "Serious game-based learning and learning by making games: Types of game-based pedagogies and student gaming hours impact students' science learning outcomes," *Computers Education*, vol. 218, p. 105075, 2024. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0360131524000897

[111] N. Volkova, N. Zinukova, K. Vlasenko, and T. Korobeinikova, "Development and mastery of soft skills among graduate students," *Ukrainian Journal of Educational Studies and Information Technology*, 2022.

[112] H. Tseng, X. Yi, and H.-T. Yeh, "Learning-related soft skills among online business students in higher education: Grade level and managerial role differences in self-regulation, motivation, and social skill," *Comput. Hum. Behav.*, vol. 95, pp. 179–186, 2019.

Appendix A

Survey Questionnaire

Pre Game Questionnaire

This form is an in-game questionnaire that tests how interested students are to learn soft skills and what they know on soft skills.

* Indicates required question

1. Email *

Demographic Data

2. What is your age? *

3. What is your field of study? *
(Please select the option that best describes your field of study.)

Mark only one oval.

- Engineering (e.g., Mechanical Engineering, Electrical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Aerospace Engineering)
- Information Technology and Computer Science (e.g., Computer Science, Information Systems, Software Engineering, Data Science, Cybersecurity)
- Health Sciences (e.g., Medicine, Nursing, Pharmacy, Public Health, Biomedical Sciences)
- Business and Management (e.g., Business Administration, Management, Marketing, Finance, Human Resources, International Business)
- Social Sciences (e.g., Psychology, Sociology, Political Science, Anthropology, Economics)
- Natural Sciences (e.g., Physics, Chemistry, Biology, Environmental Science, Earth Sciences)
- Humanities (e.g., History, Literature, Philosophy, Languages, Religious Studies)
- Arts and Design (e.g., Fine Arts, Graphic Design, Interior Design, Performing Arts, Fashion Design)
- Education (e.g., Elementary Education, Secondary Education, Special Education, Educational Leadership)
- Law and Criminal Justice (e.g., Law, Criminal Justice, Forensic Science, Legal Studies)
- Agriculture and Food Sciences (e.g., Agricultural Science, Food Science, Animal Science, Horticulture)
- Architecture (e.g., Architecture, Urban Planning, Landscape Architecture)
- Communications and Media (e.g., Journalism, Media Studies, Public Relations, Advertising)
- Hospitality and Tourism (e.g., Hospitality Management, Tourism Management, Event Planning)
- Mathematics and Statistics (e.g., Mathematics, Statistics, Actuarial Science)
- Other (please specify): _____

Awareness of soft skills

4. Do you know what soft skills are? *

Mark only one oval.

- Yes
- No

5. Have you ever been taught any of this skills? (Only mark the ones you have been taught in the university) *

Check all that apply.

- [ ] Teamwork and Collaboration
- [ ] Communication
- [ ] Self Efficacy
- [ ] Time Management
- [ ] Emotional Intelligence

6. How do you rate the importance of perfecting soft skills (e.g., communication, teamwork, and emotional intelligence) compared to technical skills (e.g., programming, data analysis, engineering, teaching) in your professional development? *

Mark only one oval.

- Soft skills are much more important than technical skills
- Soft skills are somewhat more important than technical skills
- Both soft skills and technical skills are equally important
- Technical skills are somewhat more important than soft skills
- Technical skills are much more important than soft skills

7. Do you agree or disagree with this statement: 'Some people are naturally good at communicating in front of others. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

8. State whether you agree or disagree with this statement: It is easier to work on a group assignment than an individual assignment. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

9. How do you feel about learning soft skills? *

Mark only one oval.

- Very Excited
- Somewhat Interested
- Neutral
- Somewhat Boring
- Very Boring

Post Game Questionnaire

This questionnaire is aims to test your experience with the game.

* Indicates required question

1. Email *

2. What is your gender *

Mark only one oval.

- Male
- Female
- Prefer not to say

3. Have you ever played a similar game in your school *

Mark only one oval.

- Yes
- No

4. Did you play the game alone or with a friend? *

Mark only one oval.

- Alone
- With a friend

Knowledge Test

5. I will always think carefully before confronting a colleague about their behavior. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

6. I believe I deserved the promotion to the Sydney Branch. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

7. Ann should have been clear with me about why she needed time off. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

8. Stacy should have taken the blame for the toner issue instead of me. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

9. I can help cover a shift if a colleague is 15 minutes late. *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Willingness

10. I would play more games like this in the future *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

11. It would be a good idea if our school used this method to teach us complex topics *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

12. The game should be used only for entertainment purposes *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

13. If I had the game on my device I would replay it and make better choices *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

14. I would recommend this game to a friend *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Engagement

15. The feedback I received on my choices helped me make better decisions *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

16. I was happy when I got promoted permanently *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

17. I felt like retrying a choice when I did not get stars for an answers *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

18. I kept on retrying the task even when I ran out of *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Diasgree

19. The storyline of the game was captivating *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

20. The timer rushed me into allocating wrong tasks *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

21. When the levels were too hard I gave up and got frustrated *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Diasgree

Usability

22. The audio effects from getting correct answers kept me attentive *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

23. The position of the buttons made it easy to navigate the game *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

24. The design of the game was easy to understand and use *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

25. The game used to many confusing colors *

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Recommendations

26. In two sentences lease tell us about what you think about the game in general *

27. In two sentences please describe the challenges you faced when playing the game *

28. Do you think the game was enjoyable, kindly explain why *

29. How do you think we should improve the game *

Appendix B

Ethics Forms

PARTICIPANT DEBRIEF

(Version 1.1, Date: 06/08/2024)

Swansea University
Prifysgol Abertawe

Project Title:

Game Design for Teaching Soft Skills: A Serious Game For Undergraduate Students

Introduction:

Thank you for taking part in this research study. We greatly appreciate your time and commitment. This debriefing form is provided to give you more information about the study and how the data you have provided will be used.

Data Storage and Confidentiality:

All the provided information will remain confidential and anonymous in accordance with GDPR and the Data Protection Act 2018. No personal data has been collected, and all information has been anonymized. The questionnaire responses and game data will be analyzed confidentially and not shared with any third party. After the research project is complete, all data will be disposed of following GDPR and DPA 2018 requirements.

Contact Information:

If you have any questions or concerns about the study, please get in touch with the researcher **Cephard Kipkemboi**, email: 2324276@swansea.ac.uk . You may also contact the project supervisor, **Dr Tom Owen,** by email: at t.owen@swansea.ac.uk for further information or queries.

Future Communication:

If you have expressed interest in receiving an electronic copy of the findings upon completion of the research, you will be contacted via the email address you provided once the final report is ready.

Once again, a big thank you for taking part in this study. Your input and know-how mean the world to us in improving serious games for teaching soft skills most efficiently and effectively

PARTICIPANT CONSENT FORM
(Version 1.1, Date: 06/08/2024)

Project Title:

Game Design for Soft Skills Teaching: A Serious Game for Undergraduate Students

Contact Details:

Email: 2324276@swansea.ac.uk
Phone: 07979474451

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/research-privacy-notice/

PARTICIPANT INFORMATION SHEET
(Version 1.1, Date: 06/08/2024)

Project Title:
Game Design for Soft Skills Teaching: A Serious Game for Undergraduate Students

Contact Details:

Cephard Kipkemboi
2324276@swansea.ac.uk
07979474451

1. Invitation Paragraph

Hey there! Welcome to the Participant Information Sheet for our study. We're thrilled to invite you to take part in our research, which focuses on using fun and engaging serious games to help undergraduate students improve their soft skills. Your participation will be incredibly valuable in helping us understand how playing these games can positively impact your learning experience. We genuinely appreciate your time and effort in considering taking part.

2. What is the purpose of the study?

Our study aims to create and test an exciting new serious game designed to teach and assess soft skills in undergraduate students. We're eager to hear your thoughts on how this game could benefit students like you in higher education settings.

3. Why have I been chosen?

You've been chosen to take part because you're an undergraduate student. We believe that the success of this study could truly benefit you and your peers by enhancing your soft skills through a competency-based learning approach. Your participation is entirely voluntary, and you're free to withdraw at any time without having to provide a reason.

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

Well, you'll get to play a serious game called TagTeam. Before and after playing, we'll ask you to fill out a short questionnaire, plus we may also ask for your general feedback on the game. Don't worry, everything you share with us will only be used for this study.

5. What are the possible disadvantages of taking part?

Now, we understand that your time is precious, and we truly appreciate it. You might need to dedicate about an hour to play the game and answer some questions for the study. Also, just a heads up, the game will be played only on a device we provide to ensure everyone has the same experience.

6. What are the possible benefits of taking part?

Well, by participating, you'll get the chance to learn more about essential soft skills like communication, teamwork, leadership, and emotional intelligence. Plus, as a token of our appreciation, you'll receive a non-monetary reward for taking part. And here's the best part – your feedback will be crucial in making this game even better!

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

Yes, your privacy is important to us, so rest assured that all the information we gather will be kept confidential under the General Data Protection Regulation (GDPR) and Data Protection Act 2018 (DPA 2018). Your identity and personal details won't be collected, and any data we collect will be recorded anonymously.

8. What if I have any questions?

If you have any questions or need clarification, please don't hesitate to contact Cephard Kipkemboi using the provided contact details. We're here to address any concerns you might have about the study.

We hope you will consider participating in this study. Your input will play a significant role in helping us enhance the design of educational tools for teaching soft skills. Thank you for considering joining us on this exciting journey!

Appendix C

Game User Interface

Figure C.1: TAG TEAM pause menu

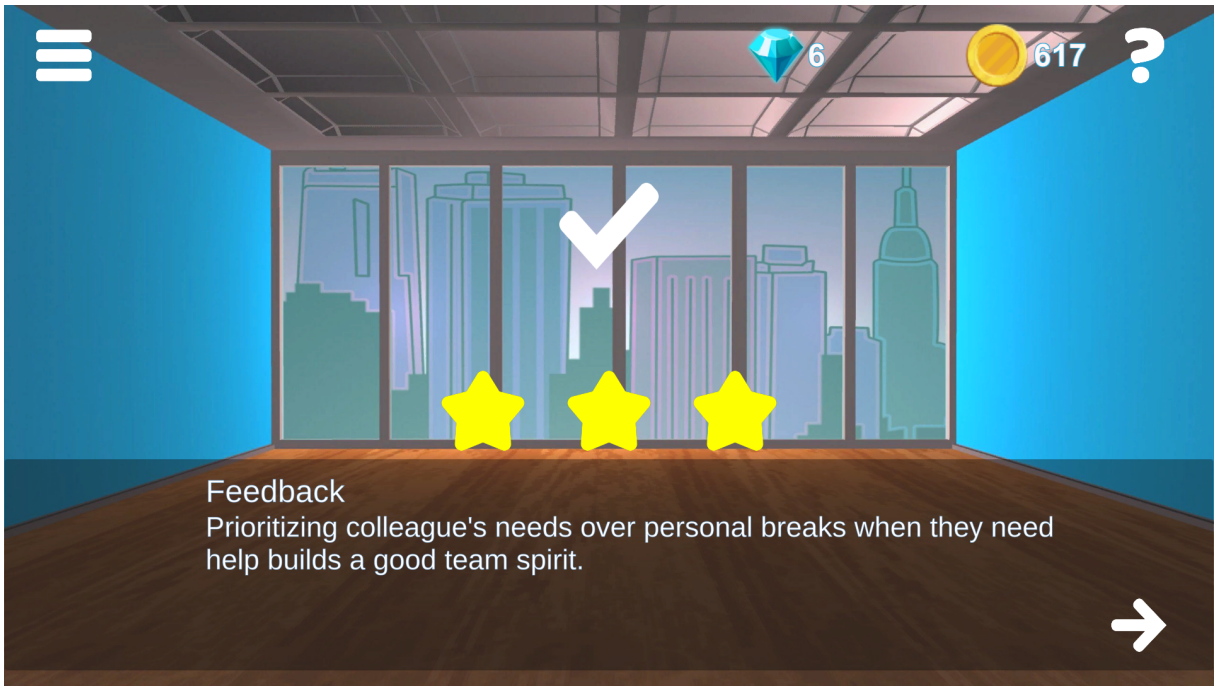

Figure C.2: TAG TEAM feedback screen

Appendix D

In-Game Full analytics

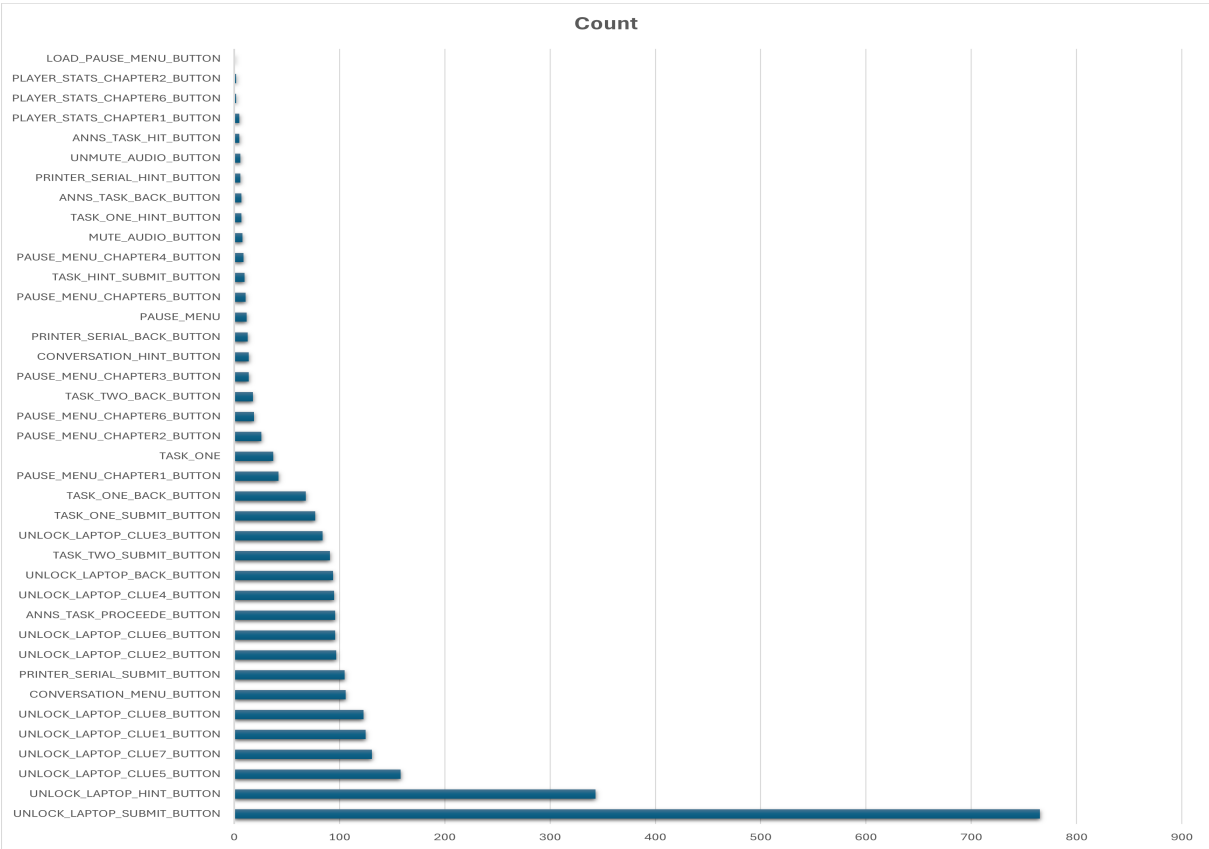

Figure D.1: Tag Team Full In-game Analytics