USING SERIOUS GAMES DESIGNED THROUGH THE GAME ELC+ FRAMEWORK TO ENHANCE DEEP LEARNING IN HUMAN RESOURCES DEVELOPMENT

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DEDICATION

This thesis is dedicated to my mother Lucy and my husband Ini, who have always been my biggest fans, always fuelling my intentions and passions.

Thank you from the bottom of my heart.

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DECLARATION

I declare that this thesis is my work and all the studies referenced have been credited to the owners. This thesis is research carried out at the University of Westminster, College of Design, Creative and Digital Industries, School of Computer Science and Engineering. No part of this thesis has been submitted elsewhere for any other degree or qualification.

Signed:

Mamfer- ter Jacklyn Gemade

Date: 16th May 2022.

ABSTRACT

The traditional method of learning has been widely criticised for its limitations and inflexibility to application in non-educational settings. These observations about the traditional modes of learning have necessitated the contemplation and discovery of new approaches embracing technological tools that advances better learning experiences. Hence, new technological innovations, such as Stronger Game or Serious Games (SGs) have been embraced as more effective methods of achieving deep learning. The application of serious game has indeed, gained traction in both the formal educational and human resource (HR) settings, especially for employees' training and development. Thus, the core question of this PhD research is hinged on whether the SGs are more effective in creating deep learning in adult learners, compared to the more traditional teaching methods. To respond to this query, the study examines the traditional and SGs learning approaches, in order to ascertain which is more effective in creating deep learning in adults, in addition to achieving human resource training and development. To guide the design and development of SGs to support adult DL, this research proposes a pedagogical framework referred to as the Game ELC+ framework that comprises four learning theories namely: The Game (Elements) within the Yu Kai Chou's Octalysis Framework; Bloom Taxonomy's Player (Learning) Levels; (Cognitive) Theory of Multimedia Learning; and the Ruskov's four evidence of Deep Learning (+). This framework provides the standard for measuring DL in the design of SGs.

The research instruments developed include a traditional andragogical test which uses e-Learning materials containing ten different learning scenarios in the context of workplace HR scenarios, and a digital Serious Game using exactly the same content and scenarios with the traditional andragogical test.

ANOVA was utilized as the data analytical approach for comparing the mean score of learners using serious games and the tradition eLearning platforms. The study hypothesised that deep learning can be achieved through the SGs and that it is more effective than the traditional andragogy. It further asserts that participants who used the SGs achieved a higher learning outcome than participants in traditional process. Participant observation during the testing phase suggests that the participants interacting with the SGs demonstrated high level of engagement and curiosity, when compared to participants who used the traditional eLearning platform. The study findings validate the hypotheses. By implication, the SGs designed

according to the Game ELC+ framework results in improved learning outcomes. In summary, the findings claim that incorporating SG elements in HR training and development can improve professional practices and mitigate some of the challenges experienced by human resource in the traditional learning environment.

LIST OF ABBREVIATIONS

BLM	Bloom's Learning for Mastery
CTML	Cognitive Theory of Multimedia Learning
DEG	Digital Educational Game
DeLEC	Deep Learning Empathy Creativity Framework
DGBL	Digital Game-Based Learning
DL	Deep Learning
EG	Experimental Group
EU	European Union
GBL	Game Based Learning
GDPR	General Data Protection Regulation
HR	Human Resources
HRD	Human Resource Development
HRM	Human Resource Management
ICT	Information and Communication Technologies
LFM	Bloom's Learning for Mastery
MDA	Mechanics, Dynamics and Aesthetics
MMOG	Massively Multiplayer Online Games
MMOG	Massively Multiplayer Online Games
OD	Organisational Design
RTS	Real-Time Strategy
SG	Serious Games
TETEM	Technology-Enhanced Training Effectiveness Model
VR	virtual reality

CHAPTER 1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Education or learning, whether formal or informal, is an integral aspect of human or societal existence. Learning is what keeps society on the part of growth and progress. No society with high density of educated people remain static, particularly in terms of human resource capacity development. Hence, nations, institutions and people have consciously embraced learning as a lifelong affair.

There are different approaches to teaching and learning. Teaching methods include the traditional andragogy- a teacher-centred and non-interactive approach, which is focused on teaching, not learning. There is also what could be described as the interactive method or active learning that is not teacher-centric but rather synergistic and coactive. In this method, both the instructor and the learners participate in the teaching and learning process. The traditional andragogy, that is the method and practice of teaching adult learners, corresponds with the Bloom's Taxonomy which perceives learning from a note-memorisation perspective (Bloom, 1984; 1956). For learners to access learning material and gain knowledge, tutorial time is also required as part of the teaching methods (Bouki and Economou, 2015, Klya and Bouki, 2014).

The traditional approach to teaching is out of place and incompatible in today's competitive global economy that is highly skilled-based and more emphatic on critical thinking (Heron, 2018). In fact, the efficacy of the traditional teaching model has been so challenged and severely critiqued for its many shortcomings, which brought to fore the necessity for learners to develop knowledge themselves. The search for new learning methods, such as Serious Games (SGs), Gamification, and Game-Based Learning (GBL) was motivated by the inadequacies of the traditional approach to teaching and learning.

These innovations in learning have helped learners to gain full knowledge of a subject before them and have also enhanced their skillset and attitude, thereby, promoting Deep Learning (DL) (Konopka *et al.,* 2015). Deep Learning, is defined as a form of machine learning which attempts to simulate the behaviour of the human brain. These learning strategies also help learners to reflect on their understanding and encourage them to make connections between their prior knowledge and new concepts, and in so doing, influence deeper learning (Marda, 2018; Cherney, 2008). Pedagogical practices such as these also allow learners to engage in meaningful learning experiences and think about what they are doing (Bonwell and Eison, 1991; Konopka *et al.,* 2015; Gudwin, 2015; Prince, 2004).

The various learning methods and teacher education approaches that have been identified in the foregoing are not far apart from one another; they are strongly connected as well as useful in other settings (Usdan *et al.,* 2001, Trigwell, 1999). At the workplace, for instance, Human Resource (HR) experts can utilise Serious Games (SGs) that are designed specifically for employees' training and development. The SGs pedagogical role character, challenges and rewards help employees to acquire knowledge and develop their skills, thereby improving productivity and self-development at any time without the need of HR professionals giving tutor time and lectures.

Drawing specific attention to adult education, this study examines comparatively, the effectiveness of the traditional teaching models and serious games in knowledge production among adult learners and in human resource recruitment, management and improvement. To achieve this goal, the study also interrogates different cases of SGs and demonstrates the various ways in which such games are used. It also assesses the impact of SGs on the individual and collective performance as well as on human resource management practice.

With a view to teaching soft skills in a way that ensures DL, the study further considers whether DL could be accomplished through SGs designed in line with the quadripartite Game ELC+ Framework, which is a fusion of four learning theories coalesced to support learners in achieving DL illustrated in Figure 1.1. These theories include: the Yu Kai Chou's Octalysis Framework, the Bloom's Taxonomy, Cognitive Theory of Multimedia Learning (CTML), and the Ruskov's four evidences of DL.

1. By way of simple clarification, the *Yu Kai Chou's Octalysis Framework* focuses on creating an effective game-based learning environment for motivating and ensuring learners engagement by using gaming elements. These elements are based on human motivations and core drives without which no behaviour will occur.
2. Bloom's Taxonomy centres on the classification of the learner's behaviours, recognition of knowledge and the development of the learner's intellectual abilities and skills.
3. On its own, the CTML takes to more effective learning channels, such as visual and verbal information processing system to help learners understand relevant information;
4. whereas *Ruskov's four evidences of DL* demonstrates DL through the use of certain scientific parameters.

The Game ELC+ Framework also provides a means of measuring DL and support the design of SGs to help learners develop DL. Overall, the study envisages a more SG-dependent society and presents the Game ELC+ Framework to do away with the traditional teaching and learning models, so as to promote adult DL. The study compares the traditional approach to learning with that of SGs and highlights the latter's centrality in improving HR learning.

1.2. STATEMENT OF RESEARCH PROBLEM

In recent years, several debates have centred on the potential of technological advancements to replace the acquisition of soft skills within corporate environments, particularly as it relates to

the future of jobs. Several articles in the field have argued that in the future, many jobs and people that work therein will be rendered redundant since they can be easily replaced with the technological tools that are being created (Schulz, 2008).

This raises a lot of concern such as if traditional modes of learning are limiting or can be incorporated in technological thinking, thereby contributing effectively in the advancement of adult DL (Laker and Powell, 2011). This research seeks to understand and measure the potential of Adult Learning through serious games. In itself, SG is a product of technological advancement that may offer several avenues for us to understand how its adoption by adults in corporate environments can improve their ability to thrive in today's world (Allal-Cherif and Makhlouf, 2015).

Furthermore, these debates show that there may be a need for higher education to adopt advanced technological methods in training talents for the job market. This need has also motivated this research effort to understand how new experiments could improve DL. To this end, the study intends to explore the potential of adopting SGs in corporate environments and to also build the relevance of soft skills by designing a framework that takes into consideration, the factors that motivate learning and how this may impact knowledge acquisition.

On the question as to whether SGs are more effective in creating DL in adult learners compared to the more traditional teaching methods, arguments abound. There are several debates on how traditional learning is regurgitation, and how there needs to be more adventurous and nuanced methods that have advanced new thinking.

DL associated with strong retention and the adoption of behavioural change through procedural learning and skills, is analysed and the mechanisms for encouraging DL have been extensively covered in academic literature. However, under-appreciated or under-researched in scholarship

is the extent to which SGs can influence learners' performance and outcome of learners, especially as seen in the education game of Kahoot that has been played 14 million times in 100 countries only in January 2015 (see Featherstone, et al., 2013, p.3).

Also deficient in literature is a robust framework that coalesces the digital game-based andragogy using SGs as a teaching tool and the traditional mode of teaching that will propel DL in adults and also activate new learning in human resource development and management. On record in this direction is only one of such initial attempts, as seen in Marda (2018). Marda's (2018) research is centred on the use of an educational model comprising Bloom's Taxonomy and Empathy and Creativity to assist learners in acquiring knowledge and DL. The study finally, suggests the evolution of SGs, using the Deep Learning Empathy Creativity Framework (DeLECF).

However, to achieve its own original thought, the research adopts a comparative approach to arriving at results. Essentially, the study examines the traditional and SGs approaches to arriving at DL and human resource learning, development and management. The notion is to determine which of the two teaching and learning models is more effective in generating adult DL and human resource policies. Beyond the debate of which is more effective, this thesis also attempts to determine if equal adoption of both models can help create new ways of understanding adult learning.

To this end, the study proposes a new pedagogical framework referred to as the *Game ELC+Framework.* This framework represents a systematic unification of the quadripartite components that have been identified and explained briefly in the preceding section. As shown in Figure 1.1 below, these components work cohesively with the processes of DL.

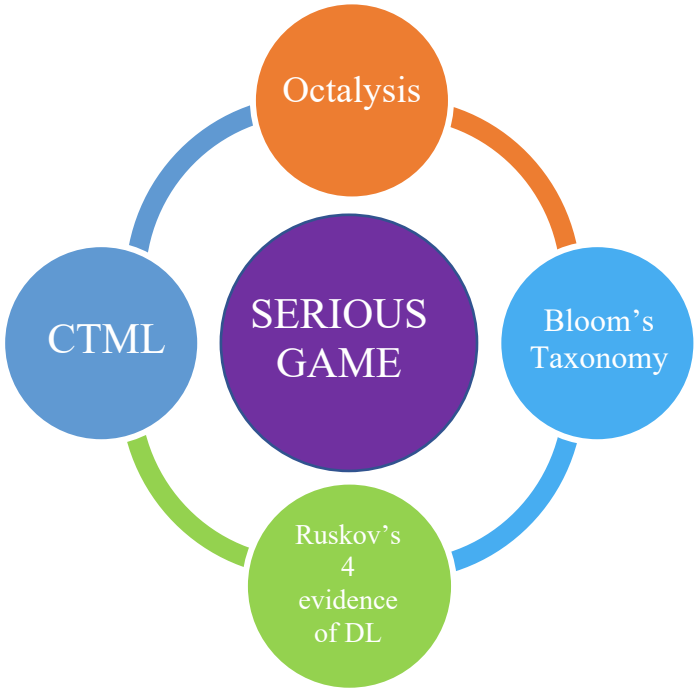

Figure 0.1: *The components of the ELC+ Framework*

The study applies the Game ELC+ Framework to create SGs that explore the roles of individual components and how they interact to allow learning in Human Resources Development (HRD), while also enjoying the gameplay within a simulated environment. Essentially, this study seeks to determine which is the most effective, between using SG resources and conventional online digital material for andragogy in HRD. In other words, the study compares the traditional andragogy, which entails using digital media without physical instructors in a classroom setting and Digital Game Based Learning (DGBL) andragogy, using SGs in order to understand which of the two is more effective in achieving adult DL.

Visible from the problem of this study are two key variables, and that is DL in adult and traditional andragogy / SGs. Adult DL is the dependent variable, while the traditional andragogy combined with SGs serve as the independent variables. In other words, DL in adults

depend either on traditional mode of teaching or SGs. The study is interested in explaining which of the two teaching methods, that is the traditional andragogy and SGs is more effective in achieving DL.

1.3. RESEARCH QUESTIONS

The research focuses on comparing teaching methods; traditional andragogy, using digital media — without physical instructors or classroom settings — and DGB andragogy, using SGs as a teaching tool by seeking to know which is more effective in causing DL. As such, the research seeks to answer two questions:

RQ1: Are SGs more effective in creating DL in adult learners, compared to more traditional teaching methods?

RQ 2: Can DL in adults be achieved through SGs?

The ultimate goal is to achieve DL in adults in corporate environments, who have to adapt to dynamic situations and build relevance through DL of soft skills. This research questions the possibility of using SGs to heighten the knowledge of specific subject / soft skill in adults.

1.4. RESEARCH OBJECTIVES

Following the research questions outlined previously, the goal of this research is to interrogate the utility of traditional andragogy and serious games in realising DL among adult learners by comparing their effectiveness in HRD. The following objectives outlined below will help meet this primary goal.

- **Research Objective 1:** The design of a framework that allows effecting and quantifying DL and that can be used to guide the design of SGs to support adult learners in achieving DL. This is the Game ELC+ framework, which is discussed extensively in Chapter 4.
- **Research Objective 2:** The application of the Game ELC+ framework for the design and development of a SG which forms a focal research instrument for this PhD research and serves the study in a two-fold manner: (a) it evaluates the application of the Game ELC+ framework for the design of SG; and (b) it is then used to be tested with users to evaluate if it helps to develop DL.
- **Research Objective 3:** The design of a comparative study using as the principal research instruments the SG that has been designed based on Game ELC+ framework, the e-learning lesson and a set of questionnaires all used in evaluation of the Game ELC+ framework.
- **Research Objective 4:** Data analysis and evaluation of the research output to answer the research questions and draw conclusions on the validity and the value of the proposed Game ELC+ framework.
- **Research Objective 5:** The generation of design guidelines for the creation of educational resources using the Game ELC+ framework targeting educators and game designers.

1.5. RESEARCH HYPOTHESES

H_1: Adult DL could be achieved and measured through the use of SG.

H_2: SG is a more effective tool than traditional andragogy for achieving adult DL and HR learning and management practice.

1.6. CONTEXT AND MOTIVATION OF THE STUDY

The prospect of a technology-rich society demonstrates how the true potential for pedagogies in learning can be realised, since learning has become a lifelong process, that is the processing of information derived from experience to update system properties (Barron *et. al.,* 2015). While our knowledge shelf life is ever increasing, many things that were once considered facts are being questioned by progress and new knowledge. There is need for a successful learning approach because of the fast-paced nature of information which needs to be absorbed.

New learning objectives include a shift in the way student-teacher relationships are structured, how teaching and learning are conducted, and how learning is assessed. Learning systems need to do more in encouraging different levels of learners to develop their own visions about what it means to connect and flourish in this constantly changing world, and to equip them with skills to pursue those visions. Prodigious technology contributes to the modern world of both children and adults alike (Fullan and Langworthy, 2013). This has provided the need to learn new skills on a continuous basis, thereby, giving rise to uninterrupted self-motivated learning to gain knowledge and expertise to enhance employable skills to create new opportunities for the future. It involves adults taking on challenges and self-initiative for personal and professional growth. People using continuous learning as a medium, offers the chance to engage in learning experiences in their adult life (Carlson, 2016).

There is a pressing requirement to look more closely at how the capabilities of a new workforce can be strengthened, with the need for continuous adult education. Today's adults need higher levels of academic knowledge to remain employable, especially as the economy would not depend solely on future graduate students. This study is therefore, inspired by the need to

measure the quality of andragogy, using the Game ELC+ Framework and to interrogate whether SGs and Conventional Online Digital Material are effective tools for accomplishing DL and andragogy in HRD. The research is conceived and conducted in two broad contexts. The first context is to experiment the usefulness of SGs in achieving adult DL, while the second is the utility of Andragogy in HRD. These two contexts provide the basis within which the subject is examined.

1.6.1. SERIOUS GAMES FOR ADULT DEEP LEARNING

In the history of Adult Learning, Knowles (1974) popularised and operationalised the term Andragogy and aggregated the work done by Organisational Design (OD) researchers. He developed the theory of adult education which he defined as the art and science of facilitating adult learning (Knowles, 1977). Initially, Knowles (1984) identified four underlying Andragogic assumptions among adult learners. Knowles, Holton and Swanson (2005) later expanded these four assumptions into six and they are as follows: (1) the need to know; (2) the learner's self-concept; (3) the role of the learners' experiences; (4) readiness to learn; (5) orientation to learning; and (6) motivation. The theory of andragogy strives to improve the learning experience by applying these 6 assumptions in online learning environment (Cochran and Brown, 2016).

Adult learners are an important part of the structure of higher education and businesses, as such learners pose a particular set of resources and needs for organisations. Letting the adult to undergo the learning process using educational processes that pertain to their real-life situation, therefore, provides a natural orientation to learn new theories and soft skills (Holyoke and Larson, 2009). Considering the 21st Century world, knowledge, abilities and competencies are

important for living and working, which give rise to the need to teach soft skills in a method that ensures DL (Schulz, 2008). Accordingly, this research tries to measure the quality of adult education (andragogy), using the Game ELC+ Framework to determine whether DL is achievable. It also compares and contrasts the effectiveness of SGs for andragogy in human resource development and that of conventional online digital material.

The study flow is divided into four phases, namely: *the pre-knowledge phase, the teaching phase, the post-knowledge phase, and the Retention knowledge phase* that are identified to optimise the quality and elasticity of output from knowledge learnt. The research combines teaching soft skills and the Game ELC+ framework in an effort to prove DL in adults as shown in Figure 1.2 below. The soft skills taught revolves round workplace HR scenarios.

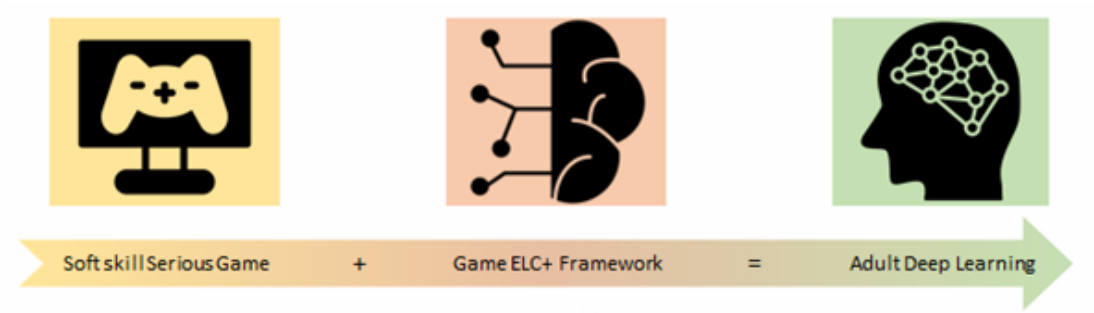

Figure 0.2: *Pictorial representation of the research objective effecting DL.*

Deep learning emphasises on understanding through note memorisation. It differs from surface learning, which is learning new information without understanding and attempting to store ideas and facts as isolated and unconnected fragments (Houghton, 2004). Deep learners have the ability to apply their knowledge and skills to different tasks and situations. They have such characteristics as strong initiatives and rebuilding knowledge structure, while also being able to focus on core concepts, providing solutions for new problems, and acquiring cohesive and

lasting knowledge. Deep learners can integrate learnt knowledge with self-adjusting learning strategies (Ning and Zhu, 2016).

1.6.2. ANDRAGOGY IN HUMAN RESOURCE DEVELOPMENT

In the world of the 21st Century, Human Resource Development (HRD) plays an important role in business development. The focus of HRD is to enhance and develop innovative job processes, goods and services (Kessels and Poell, 2004). It is important that corporations invest in the professional growth of its employees to ensure that employees remain compliant with corporate overall goals.

A function of Human Resource Management (HRM) to improve the HR of an organisation and previous statistical research indicates that the andragogical approach takes into consideration the development of the employees, their learning behaviour and attitude in the workplace (Kamaruddin *et. al.,* 2018; Ruona and Lynham, 1999). The andragogical approach and assumptions provide useful guidance in developing a learning environment that can be used to facilitate skills and professional development (Kessels and Poell, 2004).

1.7. SCOPE AND LIMITATION OF STUDY

This research was systematically conducted to determine the use of Serious Games as an effective learning model for HR training. The process took cognisance of the ethics governing doctoral research particularly in this field. Notwithstanding, the due diligence with which the research was carried out is not limitation-free. The limitations, which derives mostly from the research design and methodology, are more associated with the method of data collection and the prevailing period.

The study suffered limitations occasioned by the Covid pandemic. The Covid-19 outbreak disrupted the process of one-on-one delivery of questionnaires and interviews that would have

been conducted. The outbreak of Covid-19 prevented the researcher from engaging in physical collection of data. Instead, remote data collection method was utilised. Covid-19 and the short time factor, rather than bringing about more robust testing, weakened the researcher's ability to observe participants' experiences and capture same in the analysis.

Similarly, the empirical data collected did not cover traditional eLearning players. As such, it was impossible to ascertain whether deep learning occurred for players of traditional eLearning. Question as to whether some deep learning was achieved in the traditional mode of learning or not was not clearly ascertained in the study. It rather drew greater emphasis to the relative effectiveness of the serious games in creating deep learning over the traditional learning mode.

Essential to note as part of the study's limitations is that, due to GDPR and ethics restrictions, the researcher did not collect data covering participants' demographics, such as age, and email address. It was also impossible to reach out to the participants to follow up interviews for qualitative data on experience, which have provided more useful and detailed information on the learning experience.

The impact of game elements embedded in the different scenarios cannot be isolated, given that they cannot be directly measured. However, this does not invalidate the argument that if adult learners who play the game perform better as a whole, it may be because of these game elements.

The development of the andragogical gaming tool required research into available authoring tools or game development platforms. This entailed a comparative assessment of the various tools available to build the game, in line with the broader objectives of the research. When considering the platform to develop the game, it was necessary to choose a development platform that can allow to build a game within the timeframe of the research, but still intricate the required design and game elements and capabilities to study the research questions.

Following a careful consideration of available options that comply with these requirements, the Unity WebGL was selected as the preferred tool to build the SG. However, this came with its own challenges.

Unity WebGL and Game ELC+ Framework Compatibility: The compatibility of Unity WebGL with the Game ELC+ framework, was not without challenges. Testing indicated that although the API content is supported by major browsers, there are variations in the level of support offered by these browsers. As a result, the players may encounter errors from which they might not be able to recover.

Unity and WebGL API Compatibility: Although the Unity WebGL API could assimilate a good number of features from Unity as a game design tool, there were certain features that were unavailable, for instance:

- threads are not supported due to the lack of threading supporting in JavaScript. This applies to both Unity's internal use of threads to speed up performance, and to the use of threads in script code and managed *dlls*.
- WebGL builds cannot be debugged in Visual Studio.
- browsers do not allow direct access to IP sockets for networking due to security concerns (see WebGL Networking).
- the WebGL graphics API is equivalent to OpenGL ES 2.0 and 3.0, which has some limitations (see WebGL Graphics).
- WebGL builds use a custom back end for audio, based on the Web Audio API. This supports only basic audio functionality (see using audio in WebGL).
- WebGL is an AOT platform, so it does not allow dynamic generation of code using System. Reflection Emit. This is the same on all other IL2CPP platforms, iOS, and most consoles.

Unity WebGL Memory Restrictions: An additional challenge with development was the restrictions on how much memory could be used. This meant that the game being developed had to be highly optimised. Code and assets needed to be prepared efficiently, mechanics needed to be programmed elegantly, and models needed to have a small number of vertices while remaining detailed. Finding the right balance between all these elements provides a challenge when trying to build a game that meets the brief of a Minimum Viable Product but is also attractive and engaging to the player. This is even more important when the game is a simulation that needs to maintain levels of realism.

The study prioritised a simple game building tool that can be built within the timeframe of the research, but is still intricate enough to accommodate all elements and capabilities needed to teach in an engaging way. However, these practical considerations, as well as other requirements for game development grew into development challenges, which are further discussed in detail in Chapter 5.

To address the observed limitations of the study, the researcher not only relied on the existing literature, but also drew inferences for the available information by juxtaposing participants' responses to the questionnaire and the available literature on the subject.

1.8. STRUCTURE OF THE THESIS

The thesis is structured into seven interrelated chapters, each dealing with key components of the study. Chapter 1 sets out the background, defines the research problem, identifies the research questions, objectives, hypotheses to the tested, the scope and limitations of the study as well as explain the motivation and context within which the research was conceived and conducted. In line with the core objectives of the research, Chapter 2 covers empirical review of literature related to the topic. The chapter begins with a scholarly discourse on key concepts

and distilled their operational meanings or how they are applied from the various scholarly interpretations. It also identifies, explicates and justifies the theoretical framework deployed for the analysis.

Chapter 3 dwells on the research methodology. This encompasses a discussion of the research instruments, sample size as well as the method of data collection and analysis aimed at answering the research questions as well as verifying the two hypotheses put forward in chapter one. Chapter 4 attempts to operationalise or test the utility of the Game ELC+ framework and the various elements identified in the background discussion of the study. Drawing on data and available literature, this chapter takes a step further by determining the efficacy of the various elements of the Game ELC+ framework, such as the Octalysis Framework, Blooms Taxonomy, CTML and Ruskov's theory of DL, in accomplishing DL in adult learners. Chapter 5 discusses the research instruments used in gathering the data analysed and discussed in Chapter 6, which provides answers to the research questions by validating or invalidating the proposed hypotheses. It also discusses the findings of the research while Chapter 7 provides the summary, conclusion and recommendations as well as suggests areas for future research.

1.9. CHAPTER SUMMARY

This chapter sets out the background to the study, defined the problem statement, identified the research questions, objectives and hypotheses. The chapter provides the context in which the study was conceived and the motivation underlying it. It also delineates the scope and limitations as well as the ethical issues of the study. Together, these component parts shape and clarify the direction and focus of this research.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1. INTRODUCTION

To succeed in the struggle to develop technology and digital media to support learning, there is need to push far beyond the conventional view of teaching for distribution of knowledge (Brown, 2001). Technology, digital media and games offer great potential in supporting learning. As stated in the introductory chapter, the scope of this study is to determine which teaching method is a more effective means of creating deep learning in adults, between the traditional andragogy that uses digital media without physical instructors/classroom setting and the digital andragogy that uses serious games as an instruction tool.

In view of that, this chapter focuses on a review of related literature on the efficacy of the traditional andragogy or mode of teaching and serious games in creating deep learning in adults. Focusing on their differences and relationship to edutainment and e-Learning, the chapter begins with a conceptual discourse covering concepts, such as gamification, serious games, and game-based learning that are central to the study and precedes from that premise to reviewing the theoretical and empirical literature on the topic.

The chapter presents Serious Games as a concept in andragogy and a breakdown of the various game elements in SGs. It also addresses, with sub-topics, the different components that affects learner's ability to retain new knowledge. These include gaming motivations, the two different types of motivations (intrinsic and extrinsic motivation), attitude towards using SG for learning and a breakdown of the components used in the Game ELC+ Framework, a pedagogical framework that combines literary and informational texts for learners.

2.2. CLARIFYING GAMIFICATION, SERIOUS GAMES AND GAME-BASED LEARNING AS CONCEPTS

The concepts gamification, serious games and game-based learning, which are central to this study, all have the same goal, nevertheless they are different in practice. This chapter exposes readers to their meanings, differences as well as pros and cons.

2.2.1. *GAMIFICATION*

Gamification may mean different things to different people, depending on their disciplines and walks of life. Simply put, gamification represents the application of gaming elements in a non-gaming context. Deterding et al., (2011), describes gamification as the use of game-like characteristics or elements to enhance non-gaming context, increasing user interaction and user participation (Deterding, et.al., 2011). Any element, such as challenges, time, points, badges, trophies and so on found in the game is the game element (Deterding, et al., 2011).

Using game elements, gamification functions by enhancing learning materials. Kim *et. al*. (2013) mentions that gamification changes communication and information search behaviour of learners. In support, Schobel et al., (2017) posit that with the difficulties to convince, engage and motivate learners to explore, gamification is an assuring approach to engage in and motivate learning. Gamification integrates game elements, such as points, badges, leader-boards etc to learning activities to increase motivation and engagement. For instance, an online HR course discussion can be gamified via a badge. Students may be awarded with a “rocket” badge for earning 10 points and “moon “badge for earning 15 points and “star” badge for earning 25 points. The idea is for students to view their colleagues’ badges creating a sense of competition thereby influencing the students to be determined to aim higher and learn.

Game elements are essential tools for DL (Buckley, 2016, Agogue, et al., 2015). They have features that enable learners to solve problems and achieve essential skills which would be useful in the long term. Research has found that a well-designed gamification used for teaching and assessment gives the learner a rich narrative that inspires creativity, and therefore promotes effective communication, teamwork, and healthy competition amongst learners (Papp, 2017). In comparison to the teaching method and active learning; gamification is a useful tool for encouraging and engaging students to learn. Gamification does not necessarily require the assistance of a teacher to achieve knowledge. This is because students can access a gamified platform to receive information and knowledge at any time and place (Schobel et al.,2017). On the other hand, teaching method without a teacher present to teach students at tutor time or at an agreed place of teaching; is practically impossible for students to achieve information or knowledge. It is only when a teacher is present that students gain access to learning material and acquire knowledge (Mapesos et al., 2017).

Furthermore, active learning offers learning activities that are fundamentally game-like. Gamification employs game elements to learning activities that already exist (Landers and Landers, 2015). The benefits of gamification, as stated in the APM Thames Valle White Paper (2014), are not specifically applicable in the area of education only but are generally applicable to other domains including: increased engagement, higher motivation levels, increased interaction with the user (customer or employee) and greater loyalty. Engagement is identified as the willingness for a learner to complete tasks and want to explore more given prospects. Learner's engagement is important. Furthermore, motivation is a key aspect of learning and is important to engage learning activities (Cheong et al., 2013).

Gamification originated from the pedagogical thinking of how to motivate students to persistently complete a task and achieve DL (Freitas, 2018; Papp, 2017; Nah, 2013). However,

gamification provides a more enjoyable process to make students motivated to learn (Dicheva et al., 2015). According to Freitas (2018), as a student engages more in playing games, there is a positive experience of willingness to continue engaging by oneself.

Gamification practice has had a significant growth in the workplace, over the past decade. With the acceptance of technology in offices, classrooms, and hospitals, gamified learning has been considered as a teaching strategy to enhance DL. This study exposes various examples of gamification strategy; achieving points for completing tasks, use of competitive leader-board towards a goal and playing pedagogical games to learn academic skills.

According to Joosten and Stoeger (2011), research on increasing student learning have found that gamification platforms, such as mobile devices, encourage students to experience enhanced interactive learning, thereby, improving engagement, learning, and cause retention. In agreement, Sharples et al., *(*2002) stated that mobile devices enable motivation, provide information and solution to issues, and in addition, satisfies curiosity.

Furthermore, observing the influence game elements have on motivation and engagement, comparison of Siexas et al*.,* (2016) and Hameri et al., (2014) research combined game elements such as points, badges, levels and goal. The studies exhibited positive results (Schobel et al., 2017). However, Hanus and Fox (2015) used competitive leader-board towards achieving target and the results were negative. There is no best game element combination to sustain motivation and engagement, since Serious Game designs vary from one to another (Schobel et al., 2017).

More so, gamification platforms like ClassCraft (https://www.classcraft.com/), seen in Figure 2.1, adds an adventure game layer on top of the existing course infrastructure. Students create a character, play as part of a team, and gain experience points and rewards based on class-

related behaviours. Students are rewarded for helping other students, producing exemplary work, etc. Likewise, students can receive consequences for behaviours that are inconsistent with the desired learning environment (Hamari et al., 2014; Al-Azawi et al., 2016). Research shows that children use the trial-and-error strategy to learn when playing games and thus gamifying a course helps learner's "will" to think, do and act in order to achieve educational goals, which indirectly contribute to excellence in the higher education system (Sandberg, 2011; Al-Azawi *et. al.,* 2016).

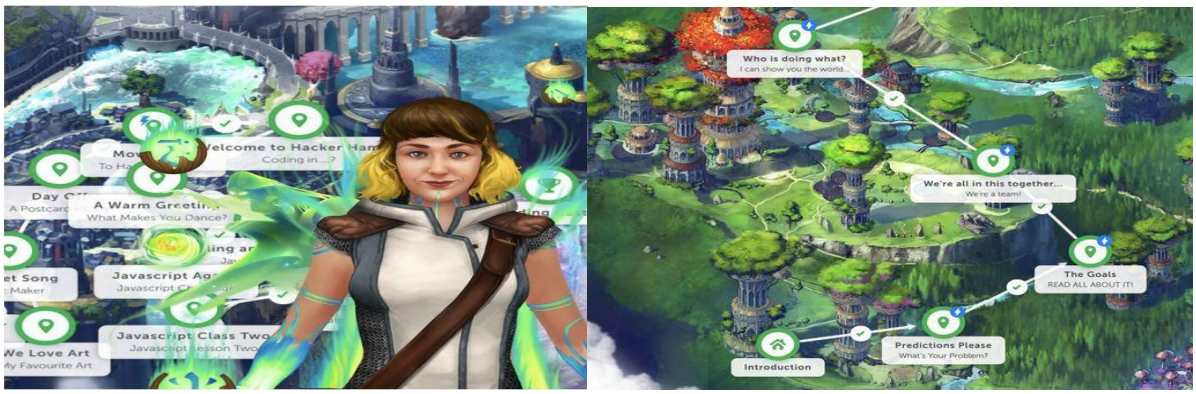

Figure 0.1. *Images showing the SG ClassCraft.*

Gamification has its advantages and disadvantages. When gamification is used incorrectly, learners may be interested in rewards and disinterested in DL (Richard et al., (2014)). Gamification is used with extra layer within existing environments, learning or training programmes. It is used in digital platforms and public places and it is meant for competitive and performance-driven people.

However, gamification can increase learner's attention span, engagement, extrinsic motivation for learning and training, creative thinking, retain knowledge and boost productivity (Papp, 2017); Buckley, 2016); Cook, 2013). The use of gamification platforms and strategies are to be properly defined, to gain the desired outcome which is to motivate and engagement learners to learn.

2.2.2. ***SERIOUS GAMES (SGS)***

The term SG is becoming more and more popular today. Though serious game as a term itself is already established, there is no universally accepted definition of it. Scholars' opinions of it differ. Zyda (2005, p.25), for instance, defines SGs as "*a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives*". For Michael and Chen (2006, p.1223), SGs are "*games that do not have entertainment, enjoyment, or fun as their primary purpose*".

Stone (2008, p.11) goes further to opine that SGs "*... move beyond entertainment per se to deliver engaging interactive media to support learning in its broadest sense*". Miller *et. al.*, 2011, p.1425) refer to SGs as "*games primarily focused on education rather than entertainment*". Zhonggen (2019, p.1) who offered a more generalist interpretation represents SGs as "*entertaining tools with the purpose of education, where players cultivate their knowledge and practice their skills through overcoming numerous hindrances during gaming*".

Serious games are potentially interesting tools to acquire knowledge, both for their motivational effect and their learning principles which includes a user-centred approach, interactivity, repetition, and continuous feedback (Murphy, 2012). It has been widely accepted that serious games, as a tool integrated into many courses, are playing an important role in learning, while also helping learners to focus on the target subject (Zhonggen, 2019). The reason why serious games are assumed to be beneficial for education, is that students are often motivated to play games (Stege, et al., 2011). This has helped fuel the development of more serious games.

SGs are today, drawing increasing attention and usage in the world. The increasing role of information and communication technology has transformed people's lives in all facets of human activity (Bylieva, *et. al.* 2019). Game universes, having become an essential part of the global internet space, has entered into the daily life of people. There are well over 2 billion active gamers, that is, people who are considered as regularly playing computer or videogames globally (Statista, 2022).

Increasing use of SGs have also been witnessed in various sectors, including the defence, aeronautics, pharmaceuticals, healthcare, banking, media and the automobile industries of countries (Oihab, 2014). They also appear to have revived and expanded the field of corporate simulations. Unlike e-learning tolls, SGs rely on new information and communications technologies. Serious games draw from the world of video games to offer players and learners with a new form of experience. They have become pervasive in the field of recruitment, which entails integration of new employees to interactive training, benchmarking and institutional communications (Oihab, 2014). In the companies that use them, SGs have had a major effect on human resource management. Generalisations drawn from SGs augurs some major and lasting changes in this function.

Similarly, businesses around the world now utilise SGs to make training more persuasive, effective and result driven. An analysis of the historic role of SGs in human resource management and the distinctions between SGs and other forms of professional development leads to the formation of a system for classifying serious games (Oihab and Makhlouf, 2016). In addition to the experiences exposed in a study of 43 leading French companies that employ SGs to manage various aspects of HR, the typology is also capable of helping managers, notwithstanding the location and industry, to choose or create the most effective SGs to attract, select, train, integrate, and retain today's top talent.

The appreciation for the ideas, skills, technologies, and techniques used in commercial entertainment games is at an all-time high; many commercial games are already being used for purposes other than entertainment, some of the titles, such as SimCity, Civilization, Hidden Agenda and others have been used as learning tools (Janarthanan, 2012). An example of SG can be found in its use in the Marda Framework wherein the research demonstrates the extent to which it supports deep learning and provides recommendation for improvements of its use.

Figure 0.2. *Screenshot of E and Eve's Electrical Endeavours.*

A transistor can be seen on the left part of the screen, while the character is seen moving through electrical wires on the bottom of the screen (Stege, et al., 2011). Considering the long history of attempts to align learning and fun with media-based learning environments, one might question how serious games vary from other concepts, such as entertainment education, e-learning and game-based learning. The primary purpose of such games, referred to as 'Serious Games', are not simply to entertain, but to train players in one or more specific disciplines (Mullet *et. al.,* 2016).

From the findings of previous studies, SGs attract or deepen the interest and attention of learners, thereby, causing increased motivation when teachers face difficulty in engaging with

students in a learning environment (Wrzesien and Raya, 2010). Not only do SGs impact high chance of active participation on learners, but they also expand players or learners' zeal to learn and achieve DL (Lameras et al., 2016). Serious games provide a valuable resource to support life-long learning, as they retain the ability to compel players and present realistic simulations (Bellotti, 2011). With knowledge, capabilities and skills being the vital tools for living and working, soft skills such as interpersonal skill or character traits are critical components of employability, for one to remain an invaluable asset to a company (Nickson et al., 2012). This gave rise to the need to teach soft skills in a method that ensures DL, in order to optimise the quality and elasticity of output from knowledge acquired (Margeti, 2018).

The Figure 2.3 below depicts the relation between SG and other similar concepts, based on a comparison and combination of the different classifications. From the diagram, when there is a combination of gaming, learning, education and entertainment, a Game Based Learning SG is the result, whereas if a digital medium is involved, the SG becomes a DGBL.

Edutainment is a culmination of entertainment and education, which is any attempt to make the educational process more enjoyable, regardless of whether it is media-based, mediated, or within a classroom setting. Similar to entertainment education, e-learning is a more general term that refers to any type of learning involving digital media (Connolly and Stansfield, 2006). E-Learning tools and digitalised traditional books help foster interaction. On the other hand, Game-Based Learning involves the use of any type of game to achieve learning (e.g., board games, card games, sports or digital games) for learning purposes.

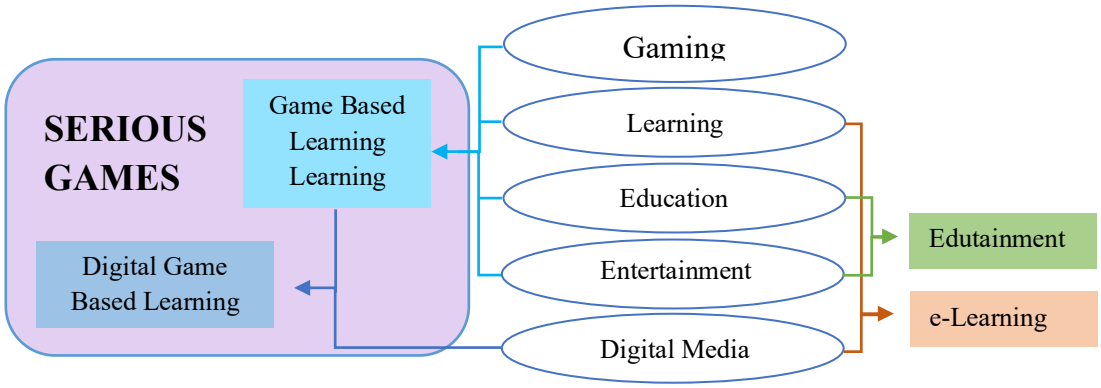

Figure 0.3. *The relations between serious games and other similar concepts.*

Serious games prompt motivation and engagement through the use of multimedia content, which are audio and visual features involving pictures, sounds and motion picture (Bouki and Economou, 2015). The Cognitive Theory of Multimedia Learning (CTML) which is also referred to as the "multimedia principle", emphasises that learners learn thoroughly from words and pictures than from the use of words alone (Mayer, 2002). GBL environment integrates elements, such as curiosity and challenge enhanced to influence high engagement (Malone, 1980, Van Eck, 2015).

SGs play a crucial role in the area of HRM practices and their performance. It is useful in andragogy and for shaping learners' attitude towards learning. In terms of HRM practices, the use of serious games leads to an improvement in performance of new employees' recruitment, training and integration (Allal-Cherif and Makhlouf, 2015). In the recent years, due to the recognition of how the workplace is changing, SGs have also proven their usefulness for recruitment purposes and are essentially used for assessing situations, making the right decision in a limited time, improvising when unexpected problems occur, maximising resources, coordinating skills and proposing new solutions (Dike, 2013). And even though recruits make mistakes, the recruits learn and adapt. HR administrators need to realise that SGs are real

instruments for improving practice and to maximise the success of workers and individuals in an organisation (Allal-Cherif and Makhlouf, 2015).

In terms of utility in andragogy, higher education appears to have the greatest potential for designing and implementing serious games. Serious games can be used in education across various fields like medicine, healthcare, agriculture, as well as in training military personnel. Gameplay utilises their skills to learn the game and perform better every time they play and so learners learn the technical aspects of the subjects and get the first-hand experience in real-life situations.

The pervasiveness, engaging and entertaining nature of video games has led to the evolution of gaming including learning concepts to birth DGBL. Kirreimur (2004) argues that the motivational power of digital games and their ability to let learners 'learn by doing' makes them very attractive learning tools. Smith (2007) argues that digital games can be used to augment learning in almost every subject.

The success of SG within an educational environment is, amongst other factors, due to their engaging and entertaining nature. Learners are also more comfortable with Gaming technologies because they are already familiar with similar technologies on a day-to-day basis (Roodt and Joubert, 2009). As a teaching strategy in higher education, the gamification concept is based on the idea that learning through play favours learners' motivation and autonomy and have been increasingly used in education and business (Deterding et al., 2011). This approach is successful and more effective in engaging learners (Almeida, 2017).

Regarding SG and attitude towards learning, Liaw, Chen and Huang (2008) emphasise the importance of how knowledge is communicated and assimilated through the collaborative effort of learners by developing new information, exchange of knowledge and by recognising

attitude. For game inventors to design effective teaching outlines for learners, learning the attitude towards learning is crucial towards designing appropriate serious games to promote learning performance (Zhonggen, 2019). Currently, several distinct frameworks in game design are fragmented, repeated, and sometimes inconsistent. Therefore, the models of game design need to be synthesised and incorporated into a well-structured paradigm for game enjoyment (Sweetser and Wyeth, 2005).

Largely, individual attitude towards serious games attribute matters, and the incorporation of this personal factor into the evaluation of games is beneficial for the theoretical and practical context of games designed by developers (Zhonggen, 2019; Lee, Chau and Lui, 2019). Learners held positive attitudes, positive cognitive perceptions, and high positive and low negative affective perceptions regarding various serious games assisted learning (Zhonggen, 2019).

Research has shown that there is a disparity between attitudes towards learning between males and females, due to gap in preference. According to the research by Chou et al., 2007 data from 535 Taiwanese high school students revealed that boys prefer role-playing games, followed by strategy games, action games, and sports games, while the girls prefer playing puzzle games. While Inal et al., (2007) record that males prefer the challenge and uncertainties of games and are attracted by the competition, while females prefer to emphasise the importance of narratives and storytelling sections of games.

A comparative study of three (3) SGs based on game type and gender disclosed that there were demographic differences in both positive and negative results of all three games for females, showing a more positive attitude and higher levels of perceptions of affective quality in comparison to males (Riemer and Schrader 2015). Thus, in order to cultivate positive attitudes, the selection of serious games for both male and female mixed classes need due attention from game designers and teachers using serious games-assisted learning.

Game design should combine the elements of fantasy and game play conventions of the Real-Time Strategy (RTS) genre with numbers, resources and situations based on research about a real-world topic (Bellotti et al., 2013 p 7). This method should be able to interest the learner into attempting to solve the game while learning alongside. Bellotti et al., (2013) categorise SGs design based on various classifications including knowledge acquisition, skill acquisition (decomposed into perceptual and cognitive skills, motor skills and soft/social skills), affective, motivational and physiological outcomes and finally, behaviour change outcomes.

Various methods and techniques have been used to assess the effectiveness of serious games as well as examine the overall validity of GBL. Numerous industries especially in health, business and social studies, have also adopted the use of GBL as part of their learning approach, because learners find it motivating and enjoyable (Connolly et al., 2012). In evaluating the effectiveness of SGs, recent studies have established that learning is more effective when it is interactive, problem-based and offers immediate feedback (Boyle, Connolly and Hainey, 2011; Connolly *et. al.,* 2012). The concept of flow in SGs has also been explored as a method of evaluating player's enjoyment (Cowley et al., 2008; Sweetser and Wyeth, 2005; Bellotti *et. al.,* 2013). The "flow state" measures the balance between player's skill level and challenges, which could result in emotions such as boredom, anxiety, loss of confidence or enjoyment (Buzady, 2017; Csikszentmihalyi, 1l91, 2003).

2.2.2.1. <u>Assessment in SGs</u>: Assessment in higher education fulfils a variety of functions. Serious games assessment describes the process of using data to demonstrate that students' specified goals and objectives are currently being achieved (Asghar, 2010; Chin et al*.,* 2009). Assessment is a complement to purpose and it is commonly employed by learning institutions, regardless of the teaching methods used and whether or not the students actually learn something (Bellotti *et.al.,* 2014). The method of learning through serious games remains

a goal-oriented process with well specified and measurable results (Oliveira and Pimentel, 2019). Adequate and immediate assessment functions need to be incorporated in the digital game-based learning environment.

Generally, assessment can be described as either formative or summative. Formative assessment involves gathering learner's data which is used to adapt teaching and learning to meet learner's needs (Dixson and Worrell 2016). It is closely connected with instructional practices. Formative assessment helps learners become aware of any gaps that exist between their desired goal and their current knowledge, understanding or skill and data from learners that would be used as feedback to modify teaching and learning activities (Black and William, 2010, p. 82; Boston, 2002).

In contrast to formative assessment, summative assessment is conducted in the end of a learning process to test the overall achievements (Bellotti et al., 2014). This type of assessment is used for providing feedback to students and teachers. Summative assessment is commonly accomplished with the use of pre- and post-testing assessments and are used to get a final assessment of how much learning has occurred—that is, how much information was retained by the learner (Gardner, 2010). With respect to serious games, it has been suggested that formative assessment is extremely beneficial and should be included, provided that such assessment can be integrated into a serious game and become an integral part of the experience, through effective user feedback (Bellotti et al., 2013).

2.2.2.2. <u>Feedback in SGs</u>: Higher education assessment requires multidimensional performance (Yorke, 2003). Thus, it is critical that feedback can interpret the performance of the learner effectively. However, feedback is offered as part of the evaluation process, using both partially explained criteria and expert judgement (O'Donovan et al., 2008). Whereas the feedback's forensic position highlights the role of feedback to diagnose a difference between

what a learner learns and the predicted level of performance (Price et al., 2010), the feedback capacity to identify and fill the gap depends on the nature of the gap. For instance, if the difference applies to the curriculum of a course, feedback may help specify the knowledge that needs to be covered (Price et al., 2010). Feedback plays a significant role in Game-Based Learning environments, since it improves mental organisation, while enhancing knowledge and efficiency for learners (Ifenthaler et al., 2012).

2.2.2.3. <u>The Role of SG in Deep Learning</u>: Deep Learning does not entail training alone, it is a process that encourages learners or participants to refine, broaden and acquire knowledge. DL also involves developing forward-thinking skills which can be applied and are transferable to new valid innovative situations (Marda, et al*.,* 2018, Bellotti et al., 2014). Pellegrino and Hilton (2012) define deep learning as the process of establishing durable and transferable knowledge that can be applied in new situations. Similarly, Marda (2020) states that DL relates with conscious efforts for authentic learning and understanding which links to previous knowledge.

Laird et al., (2008) research findings showed that students who implemented the DL concept acquired knowledge which influenced their performance positivity as well as enabled the transfer of information to a higher level of understanding. Furthermore, DL develops deeper and functional understanding, thereby, enabling students and learners to view deep relationships and establish wider connections among meanings (Fullan et al., 2018, Marda et al., 2018). In conclusion, DL has pedagogical significance relative to development of analytical skill, cross-referencing, imaginative reconstruction and independent thinking in discovering hidden concepts (Warburton, 2003). However, Pellegrino and Hilton (2012) mentioned that DL tends to be irrelevant when the aim of instruction is prepared ahead which influences students to complete tasks or solve problems exactly as the instruction has been addressed.

There is increase in competitive demand for high-earned good jobs. Machine learning and process automation advancements are creating new ways for work and there are required skills for learners to take on these types of jobs. However, the importance of incorporating SGs to teaching provides learners with the capability of achieving DL, thereby, applying acquired advanced skills to ascertain high qualification and in that way attract employers in the work force. In the same way, to encourage and guide students to achieve ambitious standards, advanced pedagogy technologies as SGs, when applied with teaching approaches, instructional strategies and learning processes, can influence achievement of DL (Dede et al., 2017; Michael and Chen, 2006).

The outlined values of DL include such values as its ability to implement across all levels of learning, subject areas and programs, whereas the ability to go above basic instruction enables students to refine, enlarge and extend their understanding (Oblinger, 2004, Lameras, 2017). Subsequently, there appears to be a novel and authentic way to contribute to the programming of SGs for the support of DL. The next segment elaborates on the effects of DGBL on DL and its comparison to gamification.

2.2.3. ***DIGITAL GAME-BASED LEARNING***

DGBL, which is an advancement of GBL, is a pedagogical method that merges digital SGs as educational tools (Erhel and Jamet, 2013). DGBL is a part of SGs, which incorporates education / learning as its main purpose. The criteria for an intrinsically motivating game are largely similar to those for an intrinsically motivating learning environment that challenges curiosity, fantasy and control Rieber (1996). Cordova and Lepper (1996) demonstrated in their

study that contextualisation, personalisation and choice positively influence a learner's intrinsic motivation, depth of engagement in learning and learning performance.

If you look at these obvious parallels between games and learning, it becomes clear that games have great potential as tools and environment for learning, in addition, to learning being essential for gaming. Although playing and learning share major attributes, their meaningful integration for specific educational purposes is non-trivial. Due to the availability of studies to prove the potential of SGs in learning, most of the studies are focused on how to implement and apply digital games in a learning setting to make the most of DGBL. Randomised control trials evaluating the effectiveness of SGs for knowledge acquisition were reported across diverse subject disciplines and they tended to report that playing the game led to better performance than the control condition (Boyle et al., 2016).

2.2.4. GAME-BASED LEARNING VERSUS GAMIFICATION

GBL is one of the learning methodologies which have been developed over time, due to the evolution of Information and Communication Technologies (ICTs). The use of GBLs has also benefited from the use of educational technologies to redesign face-to-face GBLs into digital-based SGs (Padrós et al., 2011). The term gamification revolves around two key concepts which include increased use of video games and acceptance by the society, and the impact that game and gaming elements have on influencing our daily lives and experiences.

SGs and gamification share a common toolkit of game elements. However, they differ in the sense that SGs are typically designed to fulfil the role of an instructor by providing instructional content to learners, whereas gamification is designed to augment or support pre-existing instructional content. While SGs incorporate all game elements in varying degrees,

gamification involves the extraction and application of particular elements or meaningful combinations of elements to non-game processes (Landers, 2014). SGs have to be interactive in the sense of being usable, useful and desirable (Law et al., 2011). They are particularly successful when learners have great loyalty in engaging in daily life. These goals are achieved by creating incentives for gameplays, thereby, making the target tasks more exciting (Koivisto and Hamari, 2014).

Today's technologies have expanded the immersive and interactive nature of learning; hence, educators and game designers have embraced the trend to create a more exciting, and engaging learning environment with higher quality learning outcomes that better fits the dynamics of the 21st century. To encourage learning, (Gee, 2009) argues that introducing a SG would make people want to learn how to play. This is because it is believed that learning to play would involve content, skills, values, and conceptual understandings that are considered important. Secondly, Girard et al., (2013) contend that cognitive engagement in the training, coupled with affective engagement and motivation can be a factor that impacts learning effectiveness. Citing Annetta et al., (2009, p. 75), Girard et al., (2013) further opine: "the fact that subjects are engaged and motivated by the game, it makes learners / students train for longer than using traditional materials and hence, makes a positive contribution to their progress in learning". SGs link game studies to a greater scientific capability that has the potential to help us model and better understand the learning behaviours of individuals and groups in-game environments and how games and play work help people learn (de Freitas, 2018).

An analysis of 46 empirical tests revealed that serious games have been reported to help learners develop cognitive abilities and improve the positive effect of learning. The militant use of games is not new (Michael and Chen, 2006). It is not shocking that SGs have been substantially incorporated into business training and military universities, especially suited for

risk management situations (Popescu, Romero and Usart, 2012). The most popular military SG, “America’s Army” was released in 2002. Compared to similar military SG, “America’s army” was the closest to real combat situations (Grossman, 2005). The U.S. Army also helped address one of the greatest challenges of the U.S. military which was in recruiting soldiers (Grossman, 2005) and currently still used for recruitment (De Gloria, et al., 2014).

In healthcare, SGs are used in training health professionals by simulating real-life scenarios that would help in reducing medical errors, faster emergency response time, and subsequently help reduce healthcare costs (Makhlysheva, et al., 2015). Many studies have identified the benefits of using SGs in rehabilitation and therapy where the main aim of the game is to improve cognitive and motor skills of the patients by making exercise more engaging and entertaining. In summary, the application of serious games in DL aids in improving the educational process and it is often used in medical, military, science, management etc.

2.2.5. ***GAMING MOTIVATION***

According to Berelson and Stonier (1964), motivation is the inner state that directs or channels behaviour toward learning and achieving goals. It could be conscious or subconscious and it prompts action. Learners’ psychological and cognitive states affect learners will in acquiring new knowledge and skills (Bandura, 1986). Several studies have shown that motivated learners are more likely to engage, participate in challenging activities, and demonstrate improved performance and outcomes. (Chan and Ahern, 1999; Schunk, Pintrich and Meece, 2008). The Octalysis Framework further explains the structure for analysing the driving forces behind human motivation. The framework suggests that unless there is motivation and core drives, no

behaviour will occur. This is based on the assumption that almost all games appeal to certain core drives within us and motivate us towards a variety of decisions and activities (Chou, 2015).

Psychologists have put forth two types of motivation theories: dualism and the multifaceted theories (Reiss, 2004). The dualistic theory splits human motivation into intrinsic or extrinsic motivation (Reiss, 2004; Reiss, 2012). In contrast, the multifaceted theory of motivation acknowledges a number of generally distinct motives. Teachers can take several steps, when teaching students about the multifaceted nature of motivation, to enhance the understanding of their students' understanding in this understudied area of psychology (Reiss, 2004).

Intrinsic Motivation is when players are engaged in a game, they willingly immerse themselves in virtual challenges for the purpose of achieving excitement. This kind of motivation has to do with elements deeply rooted in human beings. Intrinsically motivated activities are the activities individuals find interesting to indulge in without any condition but by mere willingness to participate (Reiss, 2012); Francisco-Aparicio et al., 2013). In Extrinsic Motivation, extrinsically motivated individuals do not engage in the activity for the inherent pleasure they may experience while performing it, but rather in order to receive something positive, a reward or to avoid something negative once the activity is terminated (Deci, 1975; Kruglanski, 1978; Vallerand, 1997).

2.3. TEACHING METHODS

Studies indicate that there is a strong association between student learning methods and teacher education approaches (Usdan et al., 2001, Trigwell, 1999). A teacher-centred approach where the teacher becomes the primary controller is more general in the concept of learning. In the classroom, students are mere listeners and remain passive in the whole duration of the

discussion (Mapesos and Rechell Mae, 2017). This is also referred to as the traditional approach. There is a direct knowledge flow from the teacher to the learners, but what appears as excellent teaching actually turns out to be a facilitated pattern-matching. Papert (1993) considers traditional learning methods to be a saving bank where knowledge is dumped for impending usage. There is absolutely no guarantee that the student internalises what is taught into what is learnt (Heron, 2018).

Students and teachers may have different expectations and views on how to learn and what to teach, which can create a gap between teaching methods and student learning styles (Hedin, 2006). Therefore, to narrow this gap as it can affect the quality of learning, it is vital to consider both the teachers' and the students' needs (Akrawi, 2011). Technology has been used in education with evidences of the advantages it gives to adult learners. From computing and learning analytics to games, researchers have agreed that SGs have several educational benefits to learners (Morgan, 2015; Luckin et al., 2012; Hover, 2011).

SGs do not only give access to knowledge but also changes perspective and understanding. The use of SG puts learners in the anywhere-anytime position to relate with what information they access and use in education or training in a professional environment. The apparent advantage is that learners are in the know of when, where and how to access SGs for DL. Students are at the advantage of reaching information where they have stored it. On the other hand, customarily, tutor time was considered as time to learn, which students only learnt when been taught by a teacher. Teaching methods require 'tutorial time' for learners to access learning materials and gain knowledge (Bouki and Economou, 2015; Klya and Bouki, 2014). For instance, at the workplace, HR professionals can use SGs designs for training and development of employees. SGs pedagogical role character, challenges and rewards aid employees to acquire knowledge and develop their skills thereby improving productivity and

self-development at any time without the need of HR professionals giving tutor time and lectures. In conclusion, SGs provide unlimited access to acquiring DL, based on its enormous advantage for students at any time. The following subsection will highlight the customary method of teaching and how it influenced learning. Furthermore, it compares the present-day practices for learners achieving meaningful learning experience.

2.4. TRADITIONAL ANDRAGOGY

A traditional methodology focuses on teaching not learning, with a misguided assumption that whatever a teacher teaches, a student will learn (Raja, 2018). The true nature of learning and the emphasis on understanding students' learning experiences have been overlooked in favour of rote memorisation, while teachers concentrate on the results they need to "teach" their students with little concern for the rest of the curriculum and the meaning of true learning or the skills they need in life. First realised in medical education, the teaching of processes (piano playing, brain surgery, home decorating) cannot be accomplished this way (Raja, 2018). Learning by rote memorisation, according to Bloom's Taxonomy (Bloom, 1984; 1956), is the lowest level of cognition, remembering that it requires only the ability to recall knowledge students fail to use this knowledge when they require, even in problem solving scenarios (Heron, 2018).

Within today's competence and global economy, where emphasis is on critical thinking and other higher-level skills, this is inadequate (Heron, 2018). Recent studies have challenged the efficacy of this teaching model and, at the same time, addressed the need for learners to develop knowledge themselves. Thus, approaches focused on active methodologies have been brought into the mainstream (Freeman et al., 2014). Active learning is the technical term for a set of

pedagogical practices that address the students' learning process by allowing learners to engage in meaningful learning experiences and think about what they are doing (Bonwell, and Eison, 1991; Konopka et al., 2015; Gudwin, 2015; Prince, 2004). The next section outlines active learning approaches and its significance to DL.

2.5. ACTIVE LEARNING

The engagement and direct involvement of students in learning processes are essential elements of the active learning approach, which involves participation and direct involvement of students in the learning processes. For comparative purposes only, this teaching approach is contrasted with traditional teaching approaches in which students passively obtain knowledge from teachers who are more suited to helping students gain full knowledge of the subject, skills and attitudes, thereby, promoting DL (Konopka et al., 2015).

Active learning helps students to reflect on their understanding by encouraging them to make connections between their prior knowledge and new concepts; therefore, suggesting that active learning strategies can positively influence DL (Marda, 2018; Cherney, 2008). Active learning activities also challenge students to make their thoughts clear, which often allows teachers to evaluate student performance. Although pedagogical research has focused on STEM disciplines, there has been considerable research to confirm that active learning may benefit any student in any field. Freeman et al., (2014) compared student performance taught by active learning methods in STEM disciplines to that of students taught using the traditional teaching methodology.

These authors published the largest meta-analysis data from 225 studies that compared the failure rates among students between 1942 and 2010. Their analyses revealed mean scores 6% higher in students from active learning courses in comparison to those taught using the

traditional system. In addition, the failure of traditional class students was 55% higher than that of active methodology students. Eddy et al., (2015) have developed a measurement framework for the use of active higher education methodologies, called PORTAAL (Practical Observation Rubric to Assess Active Learning). They concluded that both active methodologies and evidence-based teaching practices would soon become the primary teaching method at any institution.

In summary, the review around theoretical methods and the pedagogical framework on SG design aids DL. This section compared the past teaching method with the present pedagogical practices, such as the SGs and highlights the effect on learners in achieving DL. It also analysed and emphasised the advantage of SGs designed for continuous education/training for effective learning. The following section is on flow theory, understanding the way individuals feel when they are enjoying themselves and why, while participating in activities.

2.6. THE FLOW THEORY

According to Csikszentmihalyi (1975), when people feel a deep sense of satisfaction, their description of the feeling are very similar. Csikszentmihalyi had interviews with test subjects that described the emotions experienced during situations where they were at their peak concentration as a feeling flowing effortlessly that is likened to being carried away by a river and loaded with a feeling of enjoyment. Csikszentmihalyi (1991, 2003), focused his research on creativity and happiness and called this consistent peak state "flow" defined as "a state in which a person performs an activity with a fully immersed feeling of energised focus, full participation and enjoyment (Buzady, 2017; Csikszentmihalyi, 1991, 2003).

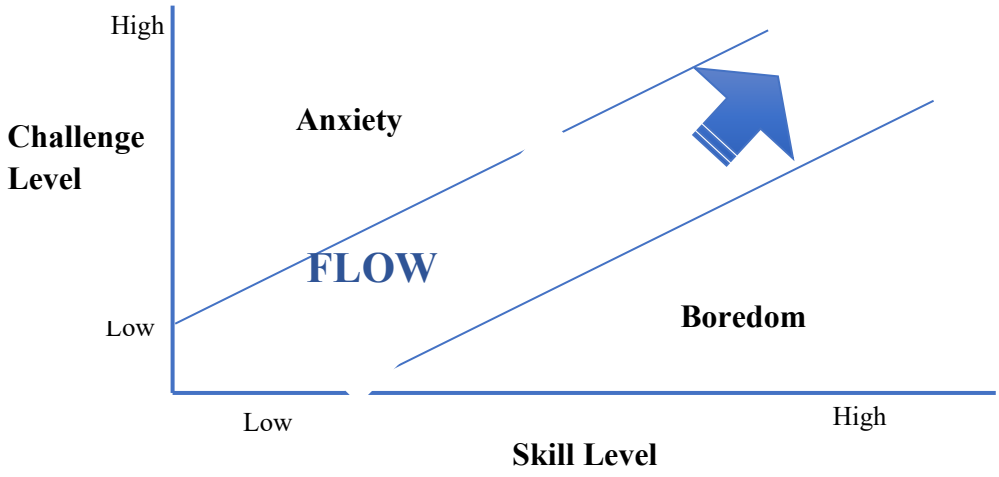

Figure 0.4. *The state of Flow*

The Flow state, as captured in Figure 2.4 above, is said to be present in any activity that involves meaningful work. This experience is noticeable in athletes, painters, engineers, scientists and also occurs in game players. A flow state is attained when a player becomes hyper-focused and completely engaged and when there exists a balance between the challenge and skill level of the player. Therefore, according to the Flow Theory Chart, if a game has a low challenge level and the player's skill level is high, it could lead to anxiety and possibly boredom. This would therefore, mean that the game is too easy for the player; there would be no drive to continue the game. In comparison, if the game's challenge level is high compared to the player's skill level, the player can lose confidence, feel discouraged, and even avoid playing the game.

Buzady (2017 p., 205-206) identified eight characteristics or preconditions which a SG game player must possess or attain, in order to experience a flow state. These include: a balance between challenges and skills; clear goals; immediate, clear and constructive feedback; intense concentration; effortless action; loss of ego; sense of control; distortion of temporal experience (unaware of time, space, noise, hunger); and doing an activity because it "feels good" in and of itself, not in expectation of any external reward (Csikszentmihalyi, 2003, pp. 42-56). When

these elements are combined, it provides a rewarding sense of satisfaction and in that way, players feel the need to continue playing till a task is accomplished. The Flow theory mostly apply to goal-oriented activities or tasks and it must be intrinsically rewarding (Sweetser and Wyeth, 2005).

Taking the role of a character in a virtual system, interaction of virtual characters, making decisions and experiencing consequences of choice made, learners participate in SG and DL (Devlin-Scherer and Sardon, 2010). To trigger learner's interest to continue playing to the point of DL, SG must correspond with learners' behaviour, feelings and thoughts. Also, SG must take into consideration the analytic level of the learners. Their level of reasoning affects their performance and knowledge acquired by the learner. In addition, other components that support SG learning interaction are: firstly, multi-modal. This is establishing interaction and communication between learners and games through sounds, graphics and stories. Secondly, tasks, with a progressive pattern of achievement motivates learners to have the desire to keep learning and engaging through SG. Finally, feedback which can be direct or indirect for learners to be aware of their progress in learning (Tan et al*.,* 2007).

SGs involve the balance learning and gaming fundamentals that are essential for entertaining and educating, hence establishing DL (Bellotti et al., 2014). To obtain this balance, designers are to ensure that the main goal of SG design is to educate and improve knowledge. In their study, Tan et al., (2007) proposed a well-designed game to include such features as story line, objective, challenge, reward to keep learners motivated to engage. This study speculates that these features, if incorporated in a SG, can improve HR professional practices.

2.7. CHALLENGES IN HUMAN RESOURCES

In line with the objectives of this study and to provide empirical validation to the set hypotheses, we require a field that encapsulates adults as learners, with challenges that require an optimised method of learning deeply. In light of this, the study chose, as an area of experimentation, the challenges of HR in corporate settings. Some of the challenges include the issues of compliance, bribery, fraud suspicion and reporting, security, equality, diversity, harassment and inclusion.

2.7.1. ***EQUALITY***

Gender inequality is a complex phenomenon that is seen in most organisational structures, processes, and practices. For women, some of the most harmful gender biased rules and regulations are enacted within HR practices. Some examples of how workplace discrimination negatively affects women's earnings and opportunities are the gender wage gaps, the dearth of women in leadership (Eagly and Carli, 2007), and the longer time required for women (as opposed to men) to advance in their careers (Blau and DeVaro, 2007).

A meta-analysis of experimental studies reveals that women in leadership positions receive lower performance evaluations than matched men. Women hold 13.7% of chair positions and 25.8% of directorships, representing 17.1% of CEOs and 30.5% of key management personnel (WEGA, 2019). Also, 35.2% of boards and governing bodies have no female directors and by contrast, only 0.9% had no male directors (WGEA, 2019).

This SG scenario teaches equality in the workplace. Players are presented with a narrative on different personas and asked their opinion on the individuals' information. A detailed script of the scenario following this challenge can be seen in Appendix D of this research.

2.7.2. ***SECURITY***

Most organisations have completely overlooked the value of a comprehensive structure for controlling the flow of data through the organisation. There is no accountability for the data collected. It is also hard to establish clear standards for data privacy. In many cases, technology infrastructures no longer have sufficient or appropriate security for sensitive data (Accenture, 2010).

The European Union (EU) GDPR is built based on the concept of privacy as a fundamental human right (Goddard, 2017). The GDPR was introduced as a result of the rapid growth of digital technology; the need for a stronger legal framework at the organisational level to protect personal data as well as the size and pace at which personal data are collected, used and distributed, thereby, elevating individual rights (Dove, 2018; Goddard, 2017).

Statistics reveal that 93% of major corporations and 76% of small businesses have suffered security breach in the last year (Price et al., 2012). About half of all data breaches in an organisation are due to failures of employees to adhere to the protection policies of their organisations and this is a major vulnerability in their information security (Stanton et al., 2005; Blythe, 2013). The HRD plays an increasingly significant role in the safety and protection of an organisation's data.

This SG scenario teaches security risk in a workplace. Players will be presented with a workstation and asked to identify the potential risks. Items on the workstation include computer monitor with unlocked screen, documents, and documents on the printer tray. After the scene is complete, players are given explanations on why some items on the workstation pose a risk. A detailed script of the scenario following this challenge can be seen in Appendix D of this research.

2.7.3. ***DIVERSITY***

Businesses began to care more about diversity after a series of high-profile cases rocked the banking sector. In the late 1990s and early 2000s, Morgan Stanley paid $54 million—and Smith Barney and Merrill Lynch were paid more than $100 million each, to settle gender discrimination lawsuits. In 2007, Morgan grappled with a major class action costing the company $46 million. In 2013, Bank of America and Merrill Lynch settled a $160 million race discrimination suit (Dobbin and Kalev, 2016). While continuously grouped together with inclusion, they connote very different definitions.

Diversity is defined as the degree to which an organisation is represented by people of various social and cultural affiliations (Cox, 1994). It refers to both numerical compositions of an organisation and inclusive behaviour of its members (Dike, 2013). Rapid population transition and ethno-cultural convergence due to globalisation have played a significant role, and in a variety of ways, a new collection of problems for business enterprises. The population transition contributed, secondly, to a change in representation in the workforce. The estimated immigrant population in the United States reached 40 million in 2010, with 14 million new immigrants coming between 2000 and 2010, comprising 13% of the total population (Camarota, 2011). HR Managers find it difficult identifying the factors that contribute to effective diversity management or the exact leadership tasks that can be achieved to effectively and efficiently deal with issues related to workplace diversity (Dike, 2013).

This SG scenario teaches diversity in hiring in the workplace. Players listen to a conversation between colleagues and then give their opinion on the decision to take based on the information. A detailed script of the scenario following this challenge can be seen in Appendix D of this research.

2.7.4. ***INCLUSION***

Diversity without inclusion is not enough. Diversity and inclusion are vital to success, and unless a person believes like they can be their true self at work, their imagination, dedication and communication will be stifled (Leone, 2020). Society for Human Resource Management (SHRM, 2019) defines inclusion separately from diversity as "the achievement of a work environment in which all individuals are treated fairly and respectfully, have equal access to opportunities and resources, and can contribute fully to the organisation's success". Their efforts are respected, and they feel comfortable and free to share their thoughts and views even when they are contradictory (Leone, 2020). Inclusion is not only important to sustainable diversity efforts; it will also be advantageous towards employee commitment and competitiveness to create an inclusive community.

These SG scenarios teach inclusion in the workplace. Players are set in a scene where colleagues with different views about the end of year holiday discuss their opinions. A detailed script of both scenarios can be seen in the Appendix D of this research.

2.7.5. ***COMPLIANCE***

America has experienced a silent shift in corporate governance. Much of its crucial concept and management of internal business is overshadowed by compliance—autonomous department within firms to detect and deter violations of law and policy (Griffith, 2015). The introduction of compliance-oriented governance structures is an innovative exercise intended to modify how the organisation performs its business. Compliance sets internal prevention and detection mechanisms, and that way, enforcement officers develop and execute services to combat money laundering and extortion etc (Griffith, 2015). Despite the regulatory constraints

put on companies in many sectors, research is still important in the field of employee compliance with organisational protection and privacy laws (Choi, 2017).

This scenario introduces the player to the SG and focuses on helping the player learn about GDPR compliance. The player must meet his colleague onboarding a new recruit and is met with a situation where his colleague gives information that isn't accurate and needs correction. The player is presented with options to choose from on how to go about managing the situation. A detailed script of this scenario can be seen in the Appendix D.

2.7.6. ***HARASSMENT***

In the workplace, there is a mix of people with diverse cultures and a combination of individuals, yet the social climate may have both positive and negative effects on workers. Among the most severe adverse effects are those triggered by abuse, described as behavioural conduct aimed at purposely hurting another worker in the workplace (Bowling and Beehr, 2006).

Harassment is when "conduct is unwanted or unwelcome, and which has the purpose or effect of being intimidating, hostile, degrading, humiliating or offensive." (McDonald, 2012, p. 2). Harassment could be sexual and be based on race or disability. Empirical research in Europe reveal that, millions of women suffer from harassment in their work lives, while American records indicate that 40–75% of women and 13–31% of men have experienced workplace harassment (Aggarwal and Gupta 2000; Quick, 2016). Harassment is one of several abusive or counterproductive activities in the workplace that takes away the identity of an employee, decreases the quality of work life, establishes obstacles in the workplace and imposes costs on organisations (Fredman 1997; McCann 2005; McDonald's 2012).

This SG scenario teaches sexual harassment in the workplace. Players are asked to decide on the subject based on their colleagues' behaviours. A detailed script of this scenario can be seen in the Appendix D.

2.8. REVISITING THE EMPIRICAL AND THEORETICAL LITERATURE

This research draws inspiration from a number of studies that dwell on gamification, SGs and traditional andragogy, as it relates particularly to active and deep learning. Landers and Armstrong (2017) for example, applied gamification model and the Technology-Enhanced Training Effectiveness Model (TETEM) to investigate the potential of enhancing instructional outcomes. They compared the success of the TETEM method and the Traditional Learning tools like PowerPoint, while also drawing attention to participants' experience in and attitude towards various games.

Landers and Armstrong (2017) ultimately establish the relative success and advantage of the use of gamification over traditional education tools by participants with a high experience in games, thereby, highlighting the importance of assessing participants prior to any implementation of gamification. This position is similar to the arguments on gamification strategy put forward by Landers and Callan (2011) and Kapp (2012). Landers and Armstrong (2017) cite the key roles of game experience and attitudes to game-based learning, taking into account the demographics of their participant population.

These points were especially informative in appraising the sample for this study. An inclusion of college students studying human resource development was also encouraged, in order to explore a younger demographic. However, Landers and Armstrong (2017) were less-focused on game elements, which increased learning levels, but were more focused on what contributed

to a successful implementation of gamification, and left much to be explored regarding its long-term benefits.

High level of knowledge, capabilities and skills are essential for working and living in a world of fast-growing technology. This enhances the importance of establishing soft learning skills to stimulate DL as an ongoing developing ability in adult learning. The conventional view of teaching for acquisition of knowledge can be backed up by the developing of technology and digital mediums (Educause, 2001).

Teaching methodology is not only complex but it is also an evolving phenomenon that constantly tilts towards embracing new technological approaches. Farashahi and Tajeddin (2018) broadly categorised teaching methodology into traditional and modern. They see the traditional methodology as an integrative process, which relies on functional procedure in which delivery of knowledge is teacher-centred, whereas modern methodology adopts teaching approaches that are student-centred. In this case, the responsibility of the teacher in the learning process is to facilitate learners to learn through participation, interaction, talk and critical analysis. Therefore, whatever approach is used, it should underscore the fact that a good methodology ought to "improve skills, not test memory" (Farashahi and Tajeddin, 2018, p. 131).

The integration of game-based and virtual reality (VR) into learning process have enhanced methodologies for training in different fields. Checa and Bustillo (2020) opine that learning approaches can be categorised in two, namely; the traditional and virtual reality. The traditional approach is an oral-based teaching method, which delivers abstract knowledge resulting in weaker understanding of the topic. On the contrary, the virtual approach, unlike the traditional, is an assisted learning through virtual reality in an immersive environment. This is made possible through the emergence of educational software programmes, which allow user

interaction with the virtual environment, which consequently led to the design and development of SGs.

Games have been recognised as one of the expedient ways to achieve interactivity (Checa and Bustillo, 2020). Therefore, SGs are designed to create activities where users are entertained, trained and educated in specific areas or tasks. This differs from the traditional teaching where the teacher determines the learning process. Nevertheless, in SG, the process is learner-centred and at the time allows the trainee to be immersed in interactive and critical learning environment (Checa and Bustillo, 2020, pp. 5501-5502). Although, SG is expected to facilitate interactive user experience, immersion and knowledge acquisition, that can only be achieved based on the efficiency of how the game is designed for practical skills and decision-making capacity. Thus, SGs by their potentials are replacing the traditional learning and training approaches (2020, p. 5513).

Active learning is a method of instruction where learners interact with the study materials through activities such as listening, reading, talking, writing, and reflective analysis. Therefore, active learning is construed as a participatory student-centred learning. Ultimately, the essence of active learning is the promotion of learning through cognitive responsibilities, which requires the learner's direct engagement with the course content (p. 8). Some of the advantages of active learning shows improvement in learners' attention, critical thinking, communication and cooperative learning skills (Sivarajah, et al., 2019, p. 109).

Also, on teaching methodologies, Ciobanu (2018, p. 70-71) states that historically, didactic methods are largely divided into the traditional classical and modern methods. In traditional, the learning happens through conversation, observation, exercise, exposure and demonstration. While the modern methods encompass simulation exercise, project research, case study and brainstorming. There is a new trend in the use of technologies for learning and teaching with

the incorporation of techniques and strategies for active learning (Armellini and Rodriguez, 2021, pp. 2-3). As a constructivist approach, the active learning approach places emphasis on the learner, instead of the teacher. Active learning is a pedagogical approach, which encompasses concepts such as but not limited to problem-based, experiential, collaborative, team-based and flipped classroom learning (Armellini and Rodriguez, 2021, pp. 2-3).

In addition, active learning entails letting learners to be the central actors in the process. The learners expectedly, perform activities that result in critical thinking, problem solving, analysis and teamwork. Some complex techniques used in active learning include project-based learning, cooperative-based learning, problem-based learning, team-based learning, competence-based learning and challenge-based learning (Hernández-de-Menéndez et al. 2019).

There is an increasing departure from the traditional and classical teaching methodology and the rise of digital games for educational and training purposes. For example, SGs provide engaging and interactive experiences for learners. SGs, as a pedagogical approach, brings together the idea of entertainment and training in what is described as the GBL that is derived from the expediency of the use play or game as a means of learning. It allows learners to learn skills and being entertained simultaneously. SGs have been alleged to increase the knowledge absorption of the learners, compared to the traditional methods (Anastasiadis, et al., 2018, pp 138-139).

Characteristically, SGs leverage on instructional content and present them in combination with elements of entertainment showcasing interest and engagement. Thus, become enjoyable, attention catching as well as effective and efficient. Despite the numerous benefits of SGs and other DGBL, Theofylaktosv (2005) admits that combining the SG with other methodologies

and approaches such as problem-based, project-based and cooperative learning will further enhance learning (Anastasiadis, et al., 2018, pp 140).

According to Nath et al., (2020) the idea of active learning gained prominence in the 1980s and was largely centred on the use of concept learning and queries (Nath, et al., 2020, p. 2534). In active learning, the process creates the integration of the course content and the learner's personal experiences thereby enhancing problem-solving skills. Therefore, this process results in DL (Purinton and Burke, 2020, p. 32). There are several dimensions to the use of SGs. Its application ranges from learning, advocacy, awareness and training. It provides simulated experience likened to real-world immersion (Taillandier and Adam, 2018, p. 2). Traditional teaching methods are hinged on a learner listening to the instructor and writing down notes. The traditional approach has been criticised for lack of satisfaction on the side of the learner and not being flexible for application in non-educational settings. Therefore, with the help of technology and other integrative innovations, transformative learning permeating different sectors from educational to non-educational learning environment (Mohamed and Lamia, 2018).

Both traditional teaching methods and online trainings have experienced significant changes. Advancement in technology has induced changes in educational learning system and professional training programs. Accessibility and application of computer and internet technologies in teaching has seen great changes (Cole, et al., 2017). Notwithstanding the many advantages attributed to digital learning, there are learners who prefer the traditional approach of learning.

The challenges associated with digital learning are the lack of opportunity to ask questions or respond to question(s). Issues such as nonverbal expressions in peers learning are absent. However, there are reasons to believe that the benefits of technology are enormous. Some of

the benefits of technology learning processes are the fact that they are more enjoyable and increase motivation for learning unlike in the traditional methods (Wasserman and Migdal, 2019).

The greatest challenge of teaching and learning is the pedagogical approach especially for soft skills training in a workplace environment. According to Cooke and Zaby (2015), soft skills are competences related to the personality, motivation, attitude and interpersonal interaction with others. Bolli and Renold (2017), added that, soft skills include array of skills such as communication, teamwork, problem solving, critical thinking, sensitivity, diversity, leadership, stress management, negotiation, self-motivation and creativity skills. The skills culminate into the ability to manage one's self and others (Laker and Powell, 2011). Therefore, soft skills are utilised by corporate organisations for staff capacity building and development. The process could take place in either the traditional or modern learning approaches. However, recent trend indicates that soft skills trainings are delivered in a more digitalised mode. This indicates the importance of digital learning in staff capacity building (Martin, 2019).

Theoretically, the pedagogy for soft skills is based on constructivism, which is based on the learner-centred model. This approach stresses the importance of illustrative and experiential learning. Thus, soft skills learning is such a critical tool for HR (p. 47). The increased successes attributed to the learner-centred instructional process have seen the rise in the debate about the efficacy of the traditional approach. More organisations are taking departure from the traditional approach and embracing technological approach that allow generic workspace competence development which will contribute to cognitive, deeper and explorative process for staff (Hartikainen, et al., 2019).

In traditional learning, the teacher provides the most explicit agency in the learning process. This has been criticised. However, a good teacher can also support learner's agency in an active

learning environment (Lombardi and Shipley, 2021, p. 19). Therefore, active learning is a term generally used to refer to as an alternative to traditional learning process that transcends teacher-centred approach to an interactive learning illustrated as "dialoguing substantively on the same topic, and not ignoring a partner's contributions" resulting in metacognition and self-regulated learning (Chi, 2009, p. 77).

Educational digital games have been found to be very useful in sustainably engaging learners. The rise of DGBL has opened new frontiers in learning. DGBL refers to the integration of games into learning for educational purpose such as assessment and instruction. This has given birth to rise of commercial and educational games. For instance, in the US, 155 million people played video games. Therefore, Digital Educational Games (DEGs) has gained traction and provides options for instruction. It has been touted to have the potentials to exert the attention of the learner and enhance memory retention (Bawa, 2019, pp. 1-2). DEG is a digital game which represents a technology-based approach to learning where learners are engaged in game-generated process in a fusion of entertainment and learning. Central to the idea of DEGs is its ability to provide the learner the opportunity to strategically and critically think as they play the game (Pivec, et al., 2003, p. 217).

Featherstone, Aston and Houghton (2013) alleged that evidence emerging from GBL suggests great improvement in learning motivation and engagement. This and other claims expose the researcher and readers alike to a study gap, which underscore how SGs can influence the performance and outcome of learners. Particularly, Kahoot, as an educational game, has been played 14 million times across 100 countries in just one month alone, precisely in January 2015 (Featherstone, Aston and Houghton, 2013, p.3). The number demonstrates the capacity to reach many learners within a short time across geographical locations. Therefore, DGBL learning environment creates a learning context where course design enhances the learner's problem-

solving capacity (Nadolny and Halabi, 2005). Kahoot is a web-based game software designed for entertainment and educational purposes. The software allows instructional content such as gameplay, quiz-like and construct be integrated into the course design. Teachers use Kahoot to create games using images, videos and diagrams and learners are tested through multiple choice questions (Featherstone, Aston and Houghton, 2013, p. 3-5).

Also, media, a didactic learning methodology, plays an important role in the modern learning process. Its effectiveness and efficiency as a learning too has been recognised as strategic and increase the motivation of learners when appropriately used (Puspitarini and Hanif, 2019, p. 54). Musfiqon (2012), defined learning media as a form of non-physical and physical learning environment where materials are used for the delivery of learning with the help of media tools. In traditional approach, learning occurs in a convergence of several elements such as humans, equipment, facilities, materials and procedure. Specifically, in media learning, it involves the use of any electronic and visual element for the transmission of knowledge intended to stimulate cognitive learning (Hamalik, 2014).

Media learning is distinct from SGs. According to Anitah (2009) there are different types of media learning processes such as non-projected visual media, projected visual media, audio media, audio-visual media and multimedia. In non-projected visual media, charts, illustrations and caricature, maps, diagrams and graphs are utilised. Projected visual media consists of overhead projector, film, slide and opaque projector. Audio media include tapes, telephones and radio. Audio-visual voice slides and television while multimedia comprise virtual reality, interactive media and hypermedia. It is therefore realistic to say that the SG can be situated under the interactive media learning approach.

With particular reference to Kahoot being an educational game with wide ‘playership’, the available literature reinforces a study gap that exposes researchers to the extent in which SG

can influence learners' performance and outcome. The game demonstrates its capacity to reach many learners within a short time across geographical locations. This result or discovery further brings to the fore the question of which more effectively generates DL in adults, between the DGB andragogy using SG as teaching tool and the traditional mode.

2.8.1 RELEVANCE OF THE GAME ELC+ FRAMEWORK

This PhD research thesis suggests that applying the Game ELC+ framework by measuring the quality of adult education (andragogy) will determine the achievement of DL.

Deep Learning based on Ruskov Theory: The question of what constitutes DL is also influenced by Ruskov (2014); likewise, the adoption of a design-research methodology with reflective contributions based on participant feedback. Ruskov's (2014) employment of the SOLO taxonomy, content analysis and thematic analysis in assessing deep learning in participants' responses makes for an admittedly uphill task, particularly when looking at answers from pre and post-tests learning outcomes. Additionally, Ruskov's admission regarding limited external validity ultimately informed the decision to incorporate an established DL assessment tool like Bloom's Taxonomy into the design of this study's assessment.

Deep Learning based on DeLEC Framework: The DeLEC framework uses Bloom's Learning for Mastery (LFM) educational model to support learners to achieve DL, using SG. It suggests an iterative process where repetition of instruction and assessments are required to reach mastery in learning. This framework has two phases; the instruction and the creative phases (Marda, 2020). The DeLEC framework is an extension and transformation of the LFM model and integrates the elements of empathy and creativity in the learning process to become a solution for achieving deeper learning with SGs. However, though the ELC+ and the DeLEC framework are focused on helping learners achieve deeper learning, this research finds the

DeLEC framework as more restrictive, because it factored in a small number of the game elements considered as inadequately robust to intensify learner engagement.

To guide the design and development of SGs to support adult DL, this research adopted the 'Game ELC+' framework which combines four learning theories coalesced to support learners in achieving DL by providing a means of quantifying and measuring DL and guiding the design of SGs to facilitate DL.

2.9.Chapter Summary

In conclusion, this chapter reviewed theoretical literature associated with this research on the practices of SGs to achieving DL within adult learners in HRD. It begins with examining teaching methods and traditional andragogy's influence in learning environments. The chapter further introduces frameworks and components of SGs designs and its effectiveness in achieving DL citing various examples and comparisons for more clarity in relation to HR conducts and practices at a workplace. The chapter furthermore analyses the role of SGs in andragogy, examining past research findings on SGs designs inspiring knowledge acquisition, skills, engagement and motivations to achieve DL. The following chapter elaborates on the Game ELC+ Framework to achieve the aim and objective of this research.

CHAPTER 3 RESEARCH METHODOLOGY FOR ANDROLOGICAL FRAMEWORK

3.1: INTRODUCTION

SG is one of the most notable technological developments for human engagement. Over the years, it has been adopted in different contexts and for a variety of purposes. It is used as a driver to promote fundamental things like learning, employee performance, customer engagement, and even crowdsourcing initiatives. Gartner Inc. (2017) rightly remarks that its widespread interest lies in its potential to strengthen engagement, change behaviours, and support innovation. This is evidenced in the use of gamification in improving learning experiences, drawing from elements such as points, prizes, badges, leaderboards, scoreboards, challenges, levels, and feedback (Huotari and Hamari, 2012; Barata, 2013; Kim, Rothrock, and Freivalds, 2016; Yildirim, 2017).

Equally notable, SGs harness the motivational potential of games and the talents that use them, by transferring game design elements to non-game environments (Deterding, Khaled, Nacke and Dixon, 2011). The mode of application to learning includes the adoption of gaming elements such as achievement symbols, status points, levels, progress bars and other elements. The outcome of such implementation depends on the context of its use.

This chapter outlines and describes the process followed in creating the teaching framework. It states the problem that the study intends to address through enquiry-based research and explains the methodological approach that is applied to assist this process. The chapter then focuses on the technological implications and design issues in creating this framework. This is followed by discussing the three main phases of the framework — selection, andragogy, and evaluation — before discussing the scoring algorithm created as an accompanying metric for

evaluation. It concludes by discussing the participant profiles, as well as the sources and process of recruitment.

3.2: METHODOLOGICAL APPROACH TO FRAMEWORK

The research focuses on measuring the quality of adult education (andragogy) using the Game ELC+ framework to explore whether DL can be achieved using SGs. This is done by contrasting the effectiveness of SG for andragogy in HRD that has been built on the Game ELC+ framework, with conventional online digital material. In this section, the study explains the design of the Game ELC+ framework by discussing the theoretical perspectives incorporated the development of the framework and the elements of the game.

3.2.1: *GAME ELC+ FRAMEWORK DEVELOPMENT*

Yu Kai Chou's Octalysis framework: This framework mainly centres on the motivational process in humans and as such advances "a human-focused design as opposed to function-focused design to get the job done quickly" (Sorden, 2017). Using relevant motivational forces like gaming elements and a balanced white/black, this approach optimises learner engagement and provides the most potential for DL occurrence.

Bloom's Taxonomy: This offers a foundational framework for grouping learners into different levels of cognitive development, ranging from basic comprehension and remembering specific facts, to more advanced levels of knowledge synthesis (Ruskov, 2014).

CTML: This is based on three cognitive science principles of learning: the dual-channel assumption, the limited-capacity assumption, and the active processing assumption (Freitas, 2018). It focuses on learning channels and uses cognitive research to establish concrete

associations between words and pictures in ways that maximize learning effectiveness (Mayer, 2003).

Ruskov's four evidences of DL: Proposes that SGs are capable of improving learning, particularly in a mixed setting (Ruskov, 2014). The research reflects his theory on different levels of abstraction and involvement, including pedagogical principles like variation theory, and engagement principles like immersion, achievement, and socialisation.

3.2.2: *GAME ELC+ FRAMEWORK DESIGN*

The framework design for this research proceeds in 3 phases — selection, andragogy, and evaluation. These are described below and also depicted in Figure 3.1.

***Selection Phase*:** Drawing from Bloom's taxonomy, the first phase of the framework defines the demography of adult learners who will be selected for the study. This process starts with the selection of the relevant sample size of adult learners to be taught. Following the teaching, the selected participants are given a prequalifying test using questionnaires. The results of this test are then analysed, after which selected participants are provided feedback on their performance. Following the completion of the prequalifying test, the sample size is split into two groups based on their knowledge of the topic. That is, participants who score above 50% are placed in the Control Group (C) while those who score below 49.9 % are placed in the Experimental Group (E). Creating these groups will allow for an analysis of the learning outcomes of adult learners who used SG, once their full participation in the study process is reviewed.

Andragogy Phase: The EG will be further divided into two groups — E_1 and E_2 and taught the same subject. Using conventional digital learning methods, E_2 will learn traditionally (eLearning), while E_1 will learn by playing SG. The educational content for learning is focused

on teaching a soft skill (decision making) in HR. This will be based on correctly identifying issues related to the workplace, referencing topics such as GDPR compliance, bribery, fraud suspicion and reporting, security practices, equality, diversity, sexual harassment, and inclusion. The teaching process will be divided into levels of difficulty in relation to Bloom's taxonomy. Participants will be presented with relatable workplace scenarios, each representing a level of learning from Bloom's taxonomy. The purpose of this is to ensure that participants learn through every stage of the learning hierarchy, which is listed as follows;

- ***remembering*** is the basic level that involves recognition and recall of relevant information.
- ***Understanding*** refers to being able to interpret, summarise, predict, and execute what was read in one's own explanation.
- ***applying*** refers to the use of information gained by classifying, constructing, and experimenting with it.
- ***analysing*** demonstrates that one can break down knowledge into segments and process how each segment relates to one another.
- ***evaluating*** refers to a person's ability to assess processed knowledge.
- ***Creating*** refers to learners demonstrating the ability to combine different segments of knowledge to make it into a whole by generating, planning and producing information.

Evaluation Phase: This phase of the research requires the segmentation of evaluation into two stages. Evaluation stage 1 involves creating 6 scenarios, each representing one level of learning from Bloom's taxonomy, to test the learning of the participants at every stage of the learning pyramid. Evaluation stage 2 involves creating four scenarios, each representing one evidence of DL from Ruskov's theory. Three sets of comparative analyses are conducted in this phase of the study. First, the test scores of E_1 and E_2 will be comparatively analysed followed by a

comparative analysis of the test scores of E_1 and C. The third analysis will compare the post-learning scores and retention scores of E_1 (rE_1). Results from these stages of analysis will demonstrate the impact of the Game ELC+ framework and prove or disprove the hypotheses of the research. Figure 3.1 presents a visual representation of the 3 different phases of the framework discussed above and how they are connected.

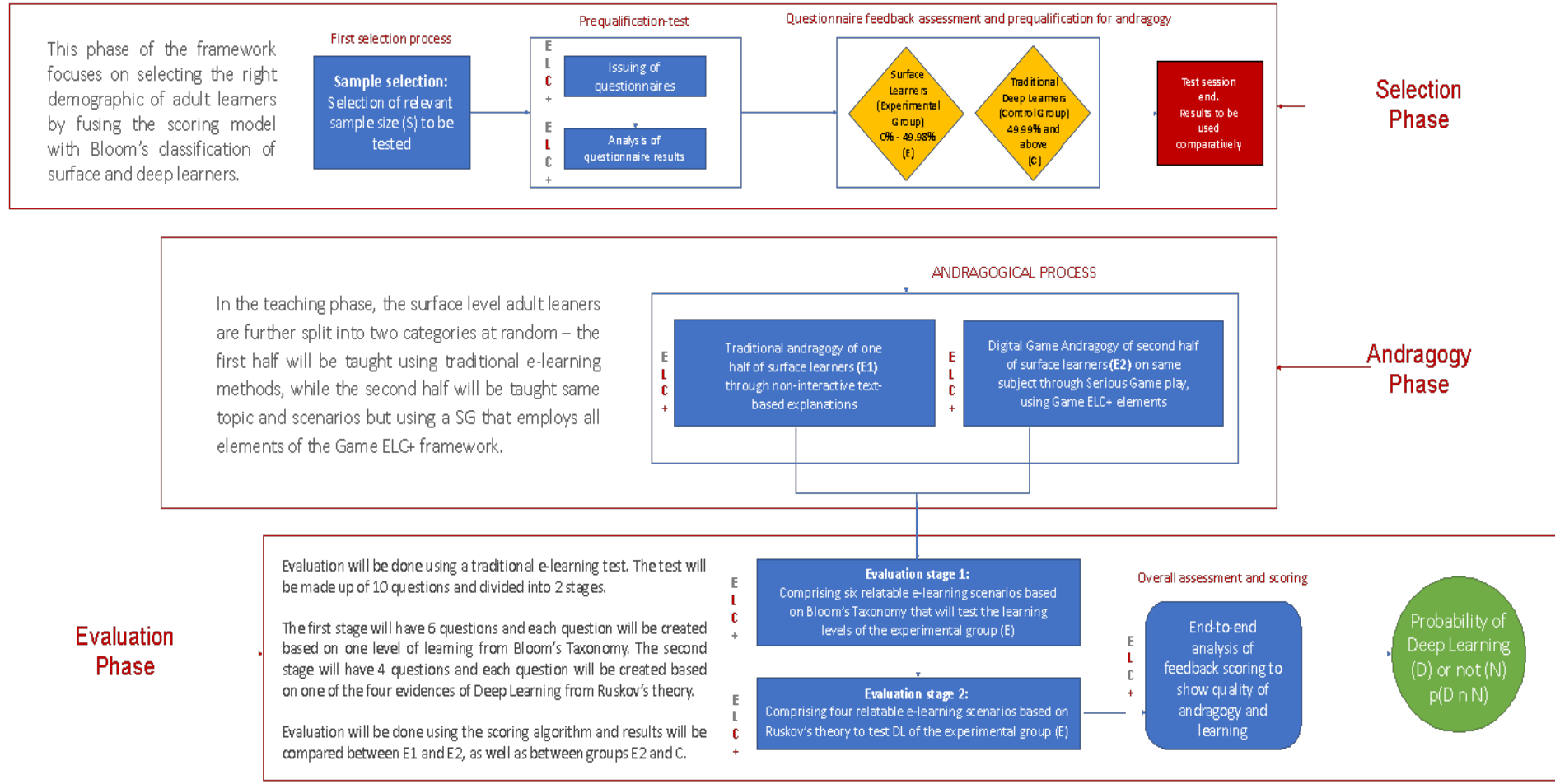

Figure 0.1. *Game ELC+ Framework*

3.2.3: *GAME ELC+ FRAMEWORK SCORING ALGORITHM*

In order to measure the presence of DL or lack thereof, the study proposes a unique scoring algorithm, which ascribes a number value to each learning level from Bloom's taxonomy and Ruskov's theory. This algorithm is applied in a game that consist of 6 scenarios representing each level of Bloom's Taxonomy, and 4 scenarios representing evidence of DL from Ruskov's theory. To represent this, the research adopted a weighted scoring system. This was done by dividing 100% into 6 equal parts, resulting in 16.66% each. This would be the score awarded to a participant for each question rightly answered in the first 6 scenarios, each of which is based on one level of Bloom's taxonomy.

i.e. s1%+s2%+s3%+s4%+s5%+s6% = **learning level %** (Bloom's taxonomy) 6

Similarly, another 100% is evenly divided into 4 to create a score of 25% for every question rightly answered per scenario, with each based on one of Ruskov's evidences of DL.

i.e. s7%+8%+s9%+s10% = **DL %** (Ruskov's theory) 4

The participant's scores from each scenario will be summed up and divided by 2 to get an overall percentage that will show the learning level of the participant.

i.e. learning level % + DL % = **overall DL by SG %** 2

To determine what level of learning participants taking part in the study fit into, another simple algorithm was created. This research adopted an arithmetic progression scoring system where again 100% is divided into 6 equal parts, resulting in a base first term (a) as 16.66%. The learning levels being incremental meant a correlating increment (arithmetic progression) in the score per level. The common difference (d) was set as 16.66% as well. Hence, the base level - remembering - was attributed 16.66%, and the next learning level - comprehension - was

attributed an incremental value of 33.32% ($a + 2d$). Following this logic, the sixth and top most learning level - creation - has a score of 99.96% ($a + 5d$) as shown in Figure 3.2.

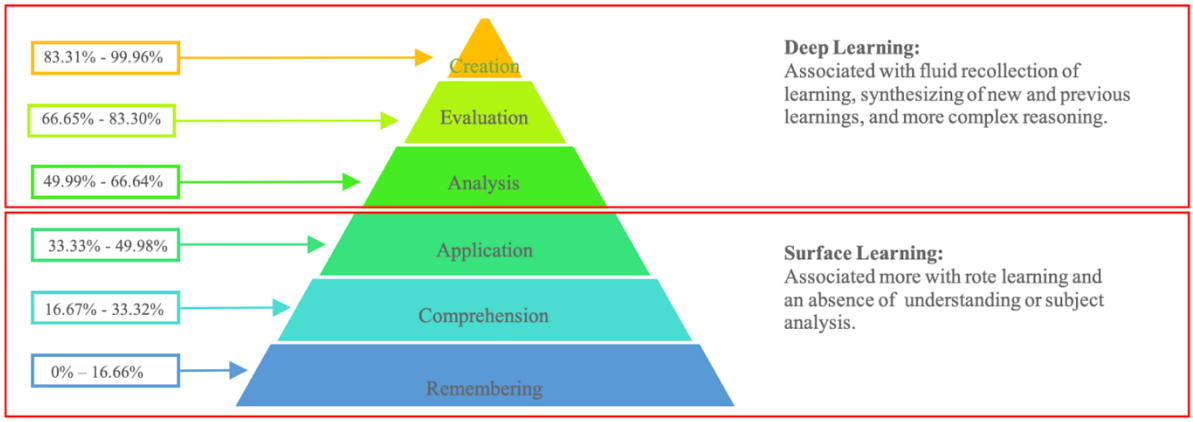

Figure 0.2. *Illustration of scoring algorithm in relation to Bloom's learning levels*

DL will only be said to have occurred if there has been a rise in the percentages between pre-teaching and post-teaching tests, showing advancement in learning level from any lower level to the level of creating, and the percentage from the 4 final scenarios goes to above 49.98% score.

3.2.4: ***FURTHER METHODOLOGICAL CONSIDERATIONS***

Werbach and Hunter (2012) agree that designing SG should include 3 fundamental parts — components, mechanics and dynamics. While components refer to the resources used to design the gaming activity such as avatars, points, badges, levels and leader boards, mechanics refer to the operating rules and can be types of collection, cooperation, competition, challenges, rewards, or feedback. Dynamics or the way the mechanics are launched allude to the contexts within which gamification develops, including the narrative, progression, and social interaction. To develop the design, components such as avatars and levels have been used to design the activity, while mechanics such as competition, challenges, rewards, and feedback

have been incorporated to make it more engaging and cautious of the user activity. In terms of the dynamics involved, narrative, progression and social interaction have been carefully thought out to ensure a design that can produce results that improve the knowledge in using SG for DL.

According to Werbach and Hunter (2012), most gamification systems use reinforcement elements (points, levels, badges, leader-boards, etc) to promote engagement and motivation in users (Subhash and Cudney, 2018; Dicheva et al., 2015). In this sense, the system follows a behaviourist approach, since it impinges on people's behaviour through rewards, reinforcement, and immediate feedback at the right time, just like in a Programmed Instruction (Skinner, 1958) aimed at enhancing second language learning. Gamification also creates dynamic environments in which people can feel a sense of progression. Kapp (2012) states that gamifying activities are a way to incorporate DGBL strategies and provide players (learners) with "the sense of engagement, immediate feedback, feeling of accomplishment, and success of striving against a challenge and overcoming it" (Figueroa Flores, 2015). In order to produce all these motivating experiences, gamified activities should follow a progressive system with sequenced levels through which players can advance at their own pace.

In game design, there are frameworks which can help a designer to understand the strengths and weaknesses of the design process. One of them is Mechanics, Dynamics and Aesthetics (MDA), which was proposed by Hunicke, et al., (2004) and introduced for the first time at the Game Developer Conference, San Jose 2001-2004. MDA is a formal approach for analysing game design by breaking them into three distinct components: mechanics, dynamics and aesthetics. Designers tend to see from mechanics to dynamics to aesthetics, while players tend to see from aesthetics to dynamics to mechanics. This is discussed further in this research in Chapter 5.6.

Mechanics are related to the game's components, control, and courses (Ruhi, 2015). They describe rules or components implemented in games, including basic action, algorithm, game engine, game elements, and data structure, which fully support dynamics in gameplay. For example, in shooting games, the mechanics are the weapons, the ammunition, and spawn points or in basketball games, the mechanics include balls, fouls, dribbling, and shooting.

Dynamics are related to the game's context, constraints, choices, chance, consequences, completion, continuation, competition, and cooperation (Ruhi, 2015). Dynamics describes how mechanics run in games, based on player input and its relationship with other mechanics. Dynamics can create aesthetics for whoever played the game. For example, a challenge can be created by elements like 'compete with others' combined with 'time pressure'.

Aesthetics are related to the game's challenge, commendation, confidence, cognisance, creativity, contribution, community, and compliance. Aesthetics describes players' feelings as they play the game. According to Hunicke, et al., (2004), there are 8 aspects derived from the normal "fun", especially because "fun" is too broad for explaining players' feelings related to the game. Thus, according to Hunicke, et al., (2004), aesthetics describes the desirable emotional responses evoked in the player in the following ways:

- Sensation: Game as sense-pleasure
- Fantasy: Game as make-believe
- Narrative: Game as drama
- Challenge: Game as obstacle course
- Fellowship: Game as social framework
- Discovery: Game as uncharted territory
- Expression: Game as self-discovery
- Submission: Game as a pastime.

There is the psychological importance of game elements in supporting adult learning, stimulating user engagement, and enabling intrinsic motivation (Alexiou and Schippers, 2018). For example, Narrative elements aid player emotional engagement through empathy. The next section discusses in detail the game elements used in this research, describing their role in the changing experience of the game.

3.2.5: *RESEARCH GAME ELEMENTS*

This section presents the game elements that are used in the design of SG to support a greater experience. While the design of the SG is elaborated in Chapter 5.4, in this subsection the study clarifies the game element used in the design. These elements are narrative, avatar, status points, timer, virtual goods, progress bars, levels, feedback, unpredictability and curiosity.

Narrative: A storyline that catches the player's interest. The aim of this element is to put the learning experience into a compelling narrative setting and add characters, conflicts, and resolution to immerse the learner and learner choices into the storyline. Naul and Liu (2020) provide a good example of where the narrative condition used in the Crystal Island game helped to support the curriculum. Students' reported presence was significantly higher than in the minimal-narrative condition when they played Crystal Island.

Avatar: In Computer science and games, an avatar is a graphical representation of a user/player or the user's/player's character or persona in the game world. Avatars can be either a two-dimensional form (also known as a profile picture or user pic) or a three-dimensional form, as in games or virtual worlds. This element involves selecting and customising a player's character and choosing the look-and-feel options to represent the player in the game by accommodating individual preferences. There is considerable research on the importance of avatars in games, virtual worlds, and social spaces for social presence, communication, and

interaction (Economou, 2001). Many Massively Multiplayer Online Games (MMOGs) also include customisable avatars; however, the levels of customisation differ between games (Praetorius and Görlich 2020). For example, the EVE Online game allows players to wholly customise portraits and allows several changes to the facial structure as well as pre-set hairstyles, and skin tones. According to Praetorius and Görlich (2020), self-similarity can lead to a higher personal relevance of the avatar and facilitate a mental rapprochement between user and avatar.

Status Points: Points are defined as numerical values that are used to evaluate individuals' performance metrics in both game and non-game contexts (Brewer et al., 2013). Many previous studies have addressed the potential of a point-based system increasing students' motivation, particularly when performing computational tasks (Diniz et al., 2017; Wang and Lieberoth, 2016).

Timer: In game design, time is one of many ways to increase the difficulty, add a sense of urgency, or pressure to the player by a "scarcity" mechanic. Also, it works as a complementary element to the scoring and aids the evaluation of success or failure. A timer also serves as a symbolic element of the inevitability of the game's end. Every time a user engages in a task, they will have a timer to track how long it takes to complete the task. If the task is completed within a given time frame (based on the average time taken by all users) then the user will be awarded bonus points. The game player's experience and level of flow can be directly affected by structural characteristics such as the timer game element (Nuyens et al., 2020).

Virtual goods: These are non-physical objects and money purchased in online communities or online games. They are elements that users can buy with the score achieved during play, therefore rewarding their efforts. Virtual goods can sometimes be converted into real goods,

like coupons, travel points, etc. Acquiring virtual goods in games can give an unfair competitive advantage thus making the game character stronger (Hamari and Keronen, 2017)

Progress bars: These are graphic bars that show the progression of a player's journey and current position, giving an idea of how far they've come. They are also used to give information about how much more needs to be done to finish a journey, thereby motivating the user to complete it. Working in tandem with the Timer element, the Progress Bar can reduce the player's pressure of waiting and increase their tolerance, while improving their gaming experience (Li et al., 2020; Tinedi, Yohandri and Djamas 2018).

Levels (milestone unlocks): The levels-based system is used commonly to categorise a player's progress into stages, based on the difficulties, challenges, or questions they need to complete in order to get to the next stage. The lower the level a player needs to achieve, the less difficult the task will be. However, the higher the level a player needs to achieve, the more effort and time will be needed (Nah et al., 2014). This game element was used for this study because it holds significant relevance to measuring DL. In using levels to learn, each of the levels remains locked until a player completes the previous level. To pass from one level to another, players need to accomplish specific tasks related to the activities. The use of levels makes it easier for users to engage from the first glance. More so, the accomplishment of 'missions' in short tasks smoothens the learning journey and promotes a sense of mastery among users.

Feedback: The ability to continuously provide information or make the player aware of the 'state' of any task or process is one of the pillars of adaptive learning. Games do this for players through simple metrics, as well as through complex algorithms. Providing both immediate and delayed feedback for choices is one of the hallmarks of great games. In order to build an effective andragogical system within the game, players need to receive feedback

at every step of their interaction to indicate if the decisions they are making per time are right or wrong and more importantly, why (Nikolayev et al., 2020).

Unpredictability and curiosity: Unpredictability as a game element thrives on a sense of mystery and feeds into the curiosity of the player, creating a compelling urge to explore more and find out what lies beyond each point. For example, asking a player to choose one of 3 doors to reveal a surprise will engage a player more than asking which of the doors has a gold coin hidden behind it. Mahapruksarut and Kaewpijit (2020) describe the mystery factor in the game called Eater of Souls, which uses the negative experience derived from uncontrollable situations to provoke participants' curiosity. It is also possible that the newness of the game is what creates that curiosity.

3.3. PARTICIPANT RECRUITMENT

300 participants were informed of the purpose of the study and invited to take part through emails and face-to-face conversations. Following this initial contact, an email was sent to all participants detailing the different phases of the experiment. With a response rate of 38%, 114 participants consented to participate in the study. Given the objectives of this study, participants were recruited based on the under listed factors.

Source: Participants were chosen through a LinkedIn search using keywords such as “HR”, “Head of People”, and “HR manager”. As mentioned in Chapter 2, there were several diverse reasons for concentrating on HR personnel, including the nature of their job, the impact they make on deciding the quality of talents they bring into organisations, and more importantly, their contribution promises a more robust analysis of the game testing process.

Focus area: As a starting point and to narrow the sample choice, tech companies are selected to provide a dynamic area to establish this research. The research chose this focus area due to the fast-paced nature and often challenging needs of tech organisations in the recruitment of new employees.

Age demographic: Participants are shortlisted based on people between the ages of 25 - 55. While the LinkedIn search provided a wide array of options, these age groups are necessary to allow for the inclusion of early, mid, and advanced career HR people to contribute to the testing of the game.

Race demographic: To decide finally, a filter process that responsibly selected from Black/African, Asian and Caucasian HR participants. This is important to capture the reality of our world and to ensure that the game testing was conscious of how a diversified pick can lead to a richer outcome.

Ethics consideration: The guidelines on the Ethics Form are thoroughly followed and for contacted HR people that are not interested in being involved in the test, the focus will shift to new participants.

A breakdown of the flow of the study process is shown in Figure 6.1 of Chapter 6. Babei et al. (2000) proposed that 30-32 users can generate efficient data if the recruiter ensures that they capture a diverse set of needs that encourages improvement for the game testing. Thus to achieve the aim of this study, the participants are separated into two groups, one of which is taught through the traditional eLearning approach and the other through the digital SG developed using the Game ELC+ Framework.

Traditional eLearning	30 participants
SG-based learning	30 participants

Table 0.1. *Number of participants for traditional learning and SG*

3.3.1. *DATA COLLECTION METHODS*

At the data collection stage, learners are separated into two groups to ensure a thorough and detailed analysis of the data collected. Figure 3.1 shows the data collection points in this study. Once the participants are recruited, an informal interview process is used to determine their pre-learning capability. This is to gain insight into the level of knowledge they have about the test subjects. Participants are divided into groups C and E based on their scores in the test, with those who score 50% and above placed in group C and those who score 49.9% and below are placed in group E. At the analysis stage, this division will enable that the ability of these users to use SG's and their analytical understanding of the outcome is monitored and analysed separately.

According to Pappas (2020), SG cements pre-existing knowledge and refreshes memories. In the game scenarios, the participant's choice of answers will determine their decision making and knowledge level and this will be used in analysing their use of SG and its outcome.

Methodology Stages	Research instrument	Data collected
Experimental group 1		
Pre-learning stage	Questionnaire	Pre-learning score
Learning stage	Serious Game	Score per scenario Overall score Qualitative data
Testing Stage	eLearning application	Score per scenario

		Overall score Qualitative data
Retention Stage	Serious Game	Overall Score
Experimental group 2		
Pre-learning stage	Questionnaire	Pre-learning score
Learning stage	eLearning application	Score per scenario Overall score
Testing Stage	eLearning application	Score per scenario Overall score

Table 0.2. Summary of data collected by the experimental and control groups

3.4. DATA ANALYSIS

Two sets of data were gathered for this study—qualitative and quantitative. The quantitative data was derived from observations carried out by the researcher as participants undertook to learn using SGs and the traditional eLearning platform. The objectives of the observations extend beyond capturing the experiences of users while playing the games, to include making sure that the testing phase runs smoothly. However, it did provide important insights, as further discussed in Chapter 6, that were analysed using content and thematic analysis.

The quantitative component of the data was analysed using ANOVA test. Kenton and Waters (2021) explain that the ANOVA test allows a researcher to determine the significance of a survey or experiment. Put differently, it is an approach to data analyses that facilitates the decision to either accept an alternative hypothesis or reject the null hypothesis. In simpler terms, it allows for the comparison of two groups in order to determine if differences exist between them or if one group is better than the other. Following this analytical approach, the data analysis was done using Excel as discussed in details in Chapter 6.

3.5. ETHICAL CONSIDERATION

Each participant followed the processes before they participated. All participants were made to receive a wholesome background information about the experiment and were allowed to signify interest with evidence of signing the ethics form (see Appendix A) before they were allowed to participate in the research.

Participants were asked to thoroughly review the ethics form and sign a consent form that allows the use of results from their participation in the game. Participants that were uncomfortable with any aspect of the process were not forced to participate. Those involved in the generation of results have consented to participate and be part of the anonymous data collection process. Each participant acts as an independent anonymous actor, whose participation was analysed based on the needs of the research.

3.6. CHAPTER SUMMARY

The core of this chapter addresses the methodological process and components in building the Game ELC+ framework, by discussing the four theories fused to create it, the phases involved in its execution, and the unique scoring algorithm created for the framework. Also, the chapter identified the utility of the framework and addressed the technological impact of the framework as well as the constraints in its design. Subsequently, this chapter discussed the selection of participants to contribute to the outcome of this thesis. Outlining organisational roles, age groups, ethnicity and pre-learning level. These factors determine how the final game players are selected to contribute to the results obtained. It also takes into consideration that groups would be divided and how the need for this division will contribute to data analysis. It then identified the method for data collection and analysis. Finally, the chapter discusses the ethical considerations in the implementation of the framework.

With this, the next chapter proceeds to present and expatiate the details of the Game ELC+ framework, drilling into each of the component theories, how they are relevant individually and collectively to the framework and research questions, and what challenges each has.

CHAPTER 4 EXPLAINING THE GAME ELC + FRAMEWORK

4.1. INTRODUCTION

This chapter describes in detail the Game ELC+ framework, which fuses four learning theories to explain how learners can achieve DL. The chapter highlights the relevance of the Game ELC+ framework, especially its dual purpose of providing a means of quantifying and measuring DL and guiding the design of SGs to facilitate DL. It also explores technological implications and how the data will be analysed after the data collection process. This chapter considers the elements that impact learning, the channels that lead to effective learning, the stages that learners go through to acquire new knowledge, and how DL can be supported among learners. The chapter highlights the Game ELC+ framework's potential for resolving the research problem discussed in Chapter 2, which revolves around the lack of a framework to lead the design of SG to support DL in andragogy.

This chapter expands on the four theories that synthesise the Game ELC+ framework. First is the Octalysis Framework and the elements within this theory that aid content development within the Game ELC+ framework. The second theory – Blooms taxonomy – outlines the levels of learning and how it feeds into creating sophisticated understanding and deeper learning for adults through the Game ELC+ framework. Third, the CTML is explored as a tool for combining audio with visual elements in teaching, to heighten a learner's understanding of what is being taught. Fourth and finally, Ruskov's Four Evidence of DL — change in the complexity of reasoning, considering new concepts, relating new to previous knowledge, and adopting the vocabulary of what is learned — provides a compelling backdrop through which we can build on to achieve the objectives of this research.

4.2. INTRODUCTION TO GAME ELC+ FRAMEWORK

Previous research showed that DL requires an understanding of competencies and the learner's participation to yield results. Knowles (2015) particularly encourages an experiential, self-motivated, and problem-centred approach that influences the development of learning content, applying it to use, and exploring its outcome on the user while Smith (2018) encourages integrating an intentional development of systems that consider problem-solving and keen participation. The following sections detail the use and impact of theoretical models discussed in Chapter 2. They equally provide a justification for the development and design of the Game ELC+ framework as a tool to facilitate DL of soft skills through SG. Figure 4.1 below depicts the components of the Game ELC+ framework derived from the respective learning model/framework. The outer circle shows the theories supporting the respective components of the Game ELC+ framework, while the inner circle represents the framework components.

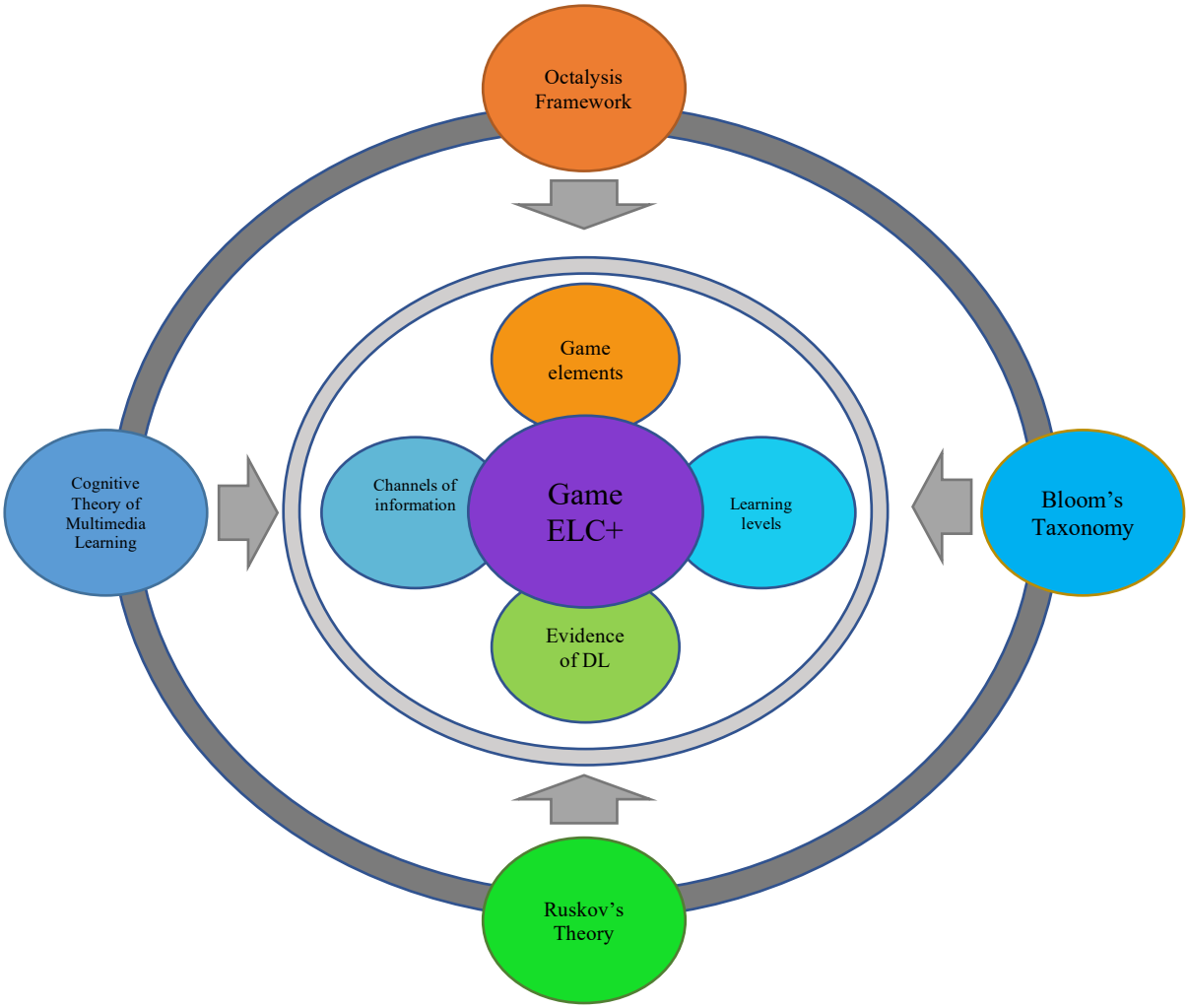

Figure 0.1. *Illustration of concepts and theories that feed in the Game ELC+ framework*

4.3: THE OCTALYSIS FRAMEWORK

4.3.1. *ELEMENTS-OCTALYSIS FRAMEWORK*

The Yu Kai Chou's Octalysis Framework is a human-centred gamification design framework that outlines eight core drivers of human motivation (Chou, 2015). This framework is based on the premise that systems, similar to a factory process, are function-driven, designed to complete a task as quickly as possible. In other words, the Octalysis Framework mainly centres on the motivational process in humans, and essentially, puts on a human-focused design, as opposed

to a function-focused design to get the job done quickly (Matos, 2018). The framework assumes workers will complete their tasks in a timely manner since they are required to do so.

However, human-focused design acknowledges that people, unlike machines in a system, have feelings, uncertainties, as well as reasons why they want or do not want to participate in certain things and consequently, optimises for their feelings, motivations and engagement. The Framework explains the structure for analysing the driving forces behind human motivation. It is the process of utilising the core behaviour drives that inspire a user to efficiently finalise a task through an interactive experience (Coronado et al., 2014). In addition to education and training, the Octalysis Framework is used in healthcare, fitness, company and product design to intensify use engagement and motivation (Daphne, et al., 2015) The framework suggests that unless there is motivation and core drives, no behaviour will occur. This is based on the assumption that almost all games appeal to certain core drives within us and motivate us towards a variety of decisions and activities. These motivations are divided into eight core drives, namely: the epic meaning and calling, development and accomplishment, empowerment of creativity and feedback, ownership and possession, social influence and relatedness, scarcity and impatience, unpredictability and curiosity, loss and avoidance (Chou, 2015).

The Octalysis framework suggests that these core drives represent the different types of incentives that motivate and engage humans to complete a game (see Figure 4.2). They are presented in an octagon shape and "are also based on how they are linked to the origin and the type of motivations" (Ewais and Alluhaidan 2015, p. 89). The core drives are also categorised into the left and right brain. The left-brain drives are more relevant to extrinsic motivation because they are external focuses such as goals and awards that affect player intension, while the right brain drives are mostly intrinsic or internal human factors such as creativity (Yfantis

and Tseles, 2017). In other words, they are not triggered externally. Intrinsic motivation refers to the intention of implementation of action due to players' enjoyment, while extrinsic motivation pursues actions due to an external factor such as money or deadlines (Mekler, 2015). Gamification merges these two types of motivation with the game elements in these 8 core drives (Richter, et al., 2015; Chou 2015).

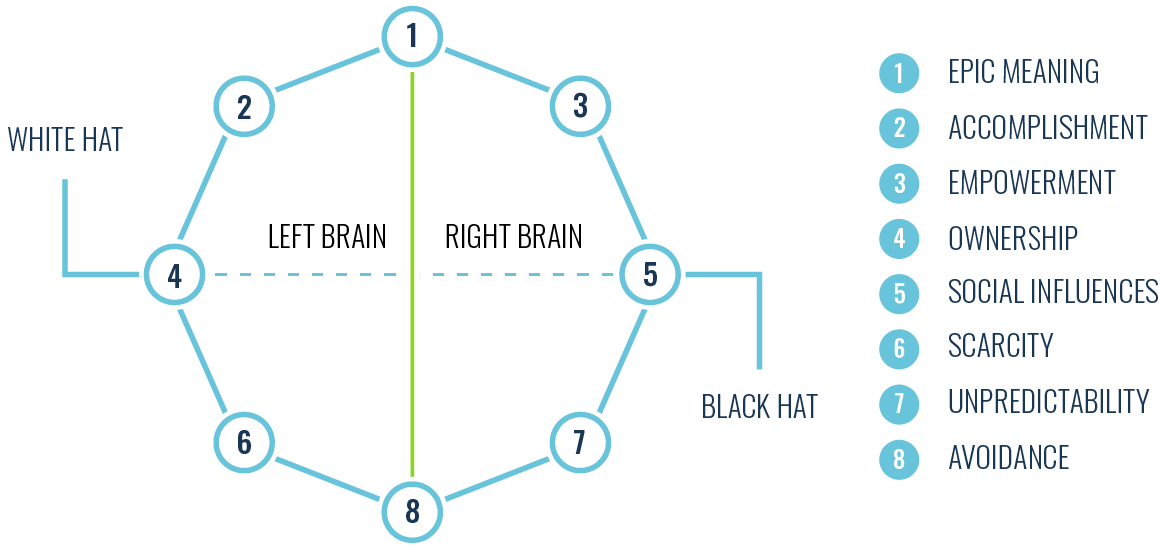

Figure 0.2. *The Octalysis Framework illustrated by the Brain Science Network (2021).*

The eight core drives as identified by Chou (2015) are:

- Epic Meaning and Calling, which comes into play when players believe that they are chosen to do something greater than themselves.
- Development and Accomplishment, which is an internal drive for accomplishing challenges and making progress. This drive pushes players by a sense of growth toward a goal and accomplishing it.
- Empowerment of Creativity and Feedback is a core drive that is expressed when users are involved in a creative process where they recurrently figure out new things and try

out different combinations. In this drive, people need ways to express their creativity as well as to see the results of their creativity, receive feedback and adjust in sequence.

- Ownership and Possession, which is where players are far motivated because they feel a sense of ownership. People would naturally want to increase and improve what they own when they feel a sense of ownership.
- Social Influence and Relatedness is a core drive that incorporates all social elements — mentorship, social acceptance, companionship, competition and even envy — that motivate people. This drive reminds one of how or what would naturally draw him or her closer to people, places or events that people can relate to, thus, turning into a spot premium motivator.
- Scarcity and Impatience is the core drive of wanting something just because it is very rare, exclusive, or not easily attainable. Many games have within them torture breaks or appointment dynamics. The fact that people cannot get something or a product immediately motivates them to return to check its availability (Wu, et al., (2012).
- Unpredictability and Curiosity is the core drive of continually being engaged because you do not know what will happen next. Your brain gets into high gear and pays attention to the unforeseen when something does not fall into your regular pattern recognition cycles. This core drive is primarily why people get addicted to gambling. This is also present in every lottery program that companies run.
- Loss and Avoidance is the core drive that motivates players to avoid negative things from happening. On a small scale, this could be to avoid losing previous work or changing one's behaviour, while on a larger scale, it could be to avoid admitting that everything you did up to this point was useless because you are now quitting. Fading opportunities have a strong use of this core drive. This is because people feel if they did not act immediately, they would lose the opportunity to act forever. This is generally

described as “fear of missing out” and can often be seen in marketing promotions with limited time periods, or in speculative investments where any delay may lead to missing out on a once-in-a-lifetime opportunity.

These eight core drives capture everything players do. Whatever we do is based on one or more of these core drives. In a situation where none of them is present, motivation is at zero level, and as such, no action takes place. Moreover, each of these drives has within them different natures. While some make the user feel powerful but does not create any urgency, others create urgency, obsession, and even addiction, thereby making the user feel bad. Some are more extrinsically focused and of short-term, while others are more long-term intrinsically focused. Elements of extrinsic motivation include rewards, money, milestones, points, goals, and recognition badges. On the other hand, intrinsic motivation comprises the elements of creativity, self-expression and social dynamics. One essential task is for game players to balance intrinsic and extrinsic core drives. As shown in research, extrinsic motivation impairs intrinsic motivation. The reason is that once the companies stop offering the extrinsic motivator, user motivation will drop to a level much lower than when the extrinsic motivator was first introduced.

4.3.2: *RELEVANCE OF OCTALYSIS FRAMEWORK TO GAME ELC+ FRAMEWORK*

Since this study is interested in forging stronger patterns and attitude towards learning, the relevance of the Octalysis Framework on Game ELC+ is multipronged. To begin with, this research has identified that the motivation that drives action in the classroom can be divided into different sections, and these are determined by the individual intent of being in class. Chou (2015) has noted that humans have an innate desire to learn; therefore, interest should be made engaging for optimal results. It is to this end that the Octalysis Framework serves as a tool that prioritises motivation and human design as a gateway for making learning more engaging.

Through its Intrinsic/Extrinsic hat approach, the Octalysis Framework arguably stimulates interest, creativity, understanding and participation. All these factors could lead to highly meaningful results within the learning environment (Ouarichi, Li, and Elving, 2020). This framework emphasises inventive development of content in such a way that value is placed on several activities that intrigue the human mind.

Previous research works, it has been shown that the Octalysis framework has contributed to improved understanding of content (Freitas, 2018). It has also motivated curiosity that has boosted learners' productivity from learners (Economou et al., 2015), thereby supercharging their interest to further develop their skills in a particular field. To add on this, further research argues that the framework leads to more competencies for learners. According to Salonen and Mohammed (2017), learners are more encouraged to aim for further development, because the process intrigues their ability to get to the next stage. The competency developed during the Octalysis process has been linked to a learner's ability to 'continue trying till they get better at it' (Salonen and Mohammed, 2017; Toasa, Celi and Herrera, 2020).

In documenting the Octalysis Framework, Chou (2017) also notes that when an action lacks motivation, it would rarely lead to behavioural changes. In line with the goal to teach soft skills in ways that ensures DL, placing emphasis on clear motivational patterns can lead to such behavioural changes. Furthermore, since learning is a life-long process, adopting the Octalysis Framework will serve the purpose of improving the interest and competency of learners. In conclusion, paying attention to these developmental patterns can play a core role in improving creativity, encouraging creativity and other social aspects of a learner's life as proposed by Chou (2017). Using relevant motivational forces and a balanced white/black hat approach to show how they are all intertwined, the Octalysis Framework is expected to optimise a learner's engagement and provide the most potential for DL occurrence. It also aids in identifying how

people's motivation can be achieved through the successful implementation thus, making the framework a perfect fit.

4.3.3: CONTEXTUAL CHALLENGES OF THE OCTALYSIS FRAMEWORK

While it has been shown that learners may find some core drives more interesting, it is also important to consider how effective they are in helping learners to achieve higher educational achievements. For instance, the proponent of this theory suggests that some students have shown more interest in core drives such as ownership and scarcity, while others are curious about empowerment (Chou, 2017). This means that these core drives are more effective based on the needs that motivate these learners to engage within a learning setting, while others may prioritise attention on some areas over others. Although this may not be a drastic situation that completely transforms the experience, it is important to note how this may influence the adoption of this framework.

To improve interest across the above-mentioned core drive, scholars have proposed that the framework is adopted alongside other theories for a balanced use (Castro, 2019; Garduno, 2019). To also improve the outcome of the use of this framework, Latjman et al., (2017) suggest that the framework can be utilised for in-class and out of class tasks for learners. In this way, they can bolster their need for ownership while also seeking meanings for the things that intrigue them.

4.4. LEARNING LEVELS – BLOOM'S TAXONOMY OF LEARNING

Bloom's Taxonomy, created by Benjamin Bloom, an American educational psychologist, is a classification of levels of thinking (Bloom *et al.,* 1956). Bloom's Taxonomy, otherwise,

referred to as Bloom's LFM is an educational strategy effective for gaining mastery in learning and improve learning achievement (Guskey, 2007). Bloom observed that teachers apply the same approaches for teaching all students, regardless of their differences in skills and abilities and allocate the same time for learning. Bloom further observed that such approaches created a significant variation in the performance of students, and that students who consider this as an appropriate teaching approach perform higher than students who find this teaching approach less appropriate. Therefore, Bloom suggested the LFM as an educational approach that supports a learning process where students can achieve better results and reduce variations of performance among them. Teachers may achieve this by adopting a different type of instruction (Guskey, 2007) providing different time and means of learning to better meet students' individual learning needs and help them achieve mastery.

The Bloom's framework influences educators and it is useful if and when educators can find practical applications to their classroom instruction. Within the Bloom's Taxonomy are six levels of thinking that are divided into two categories: low and high level. While low level thinking guides students to high-level thinking and also build a foundation of understanding, high-level thinking develops a deeper understanding of content and is necessary to solve problems. Bloom's Taxonomy is the widely accepted hierarchy of low and high levels of thinking. Bloom's Taxonomy is useful in so many ways. It is useful to teachers during guided practice, when students work in pairs while the teacher challenges, reviews or re-teaches the lesson. Bloom's Taxonomy is also relevant to writing lesson plan objectives or learning outcomes for each step of the gradual release of responsibility. An effective teacher considers Bloom's Taxonomy as critical for deepening student's thinking, as it can be applied to questioning techniques and also guide the selection of the appropriate action verbs in lesson planning.

The initial purpose of Bloom's taxonomy was to classify educational goals to aid the evaluation of student performance (Bloom et al., 1956). Bloom's taxonomy categorises cognitive learning into hierarchies in order to determine intellectual and behavioural skills that are important to learning (Guskey, 2007). However, Bloom's Taxonomy currently explores areas such as a learner's knowledge of facts and conventions, to their ability to analyse, synthesise, and evaluate knowledge (Coffey, 2017). In the original documentation for this framework, Bloom (1956) lists the various levels of learning to include:

- **Knowledge**: Remembering of previously taught materials. Define, describe, label, and identify constituted this level of learning.
- **Comprehension:** The ability to grasp. Defend, distinguish, estimate, or generalise constituted this level of learning.
- **Application:** The ability to use learned material in new situations. The application of rules, methods, principles, and theories guided this level of learning.
- **Analysis:** The ability to break down what is taught into smaller parts. Breakdown, diagram, differentiate, identify constituted this level.
- **Synthesis:** The ability to put parts together and identify contradictions. Categorise, compose, create, design and explain constituted this level.
- **Evaluation:** The ability to judge compiled materials. Appraise, compare, and conclude constituted this level.

In a revised writing of Bloom's taxonomy, many educators and psychologists' direct attention to the static representation of the above mentioned 'educational objectives' and propose a more inventive classification (Anderson et al., 2001). In line with this, Bloom's taxonomy is improved to include 'action words' that describe the cognitive processes that are usually

encountered by thinkers. Below, the Bloom taxonomy is revised, with consideration for a more nuanced approach at adapting the process for learners.

4.4.1: *REVISED LEVELS OF BLOOM'S TAXONOMY LEARNING RANKING*

- **Remember:** Recognising and recalling
- **Understand:** Interpreting, exemplifying, inferring, classifying, summarising, and explaining
- **Apply:** Executing and implementing
- **Analyse:** Differentiating, organising, and attributing
- **Evaluate:** Critiquing
- **Create:** Generating, planning, and producing

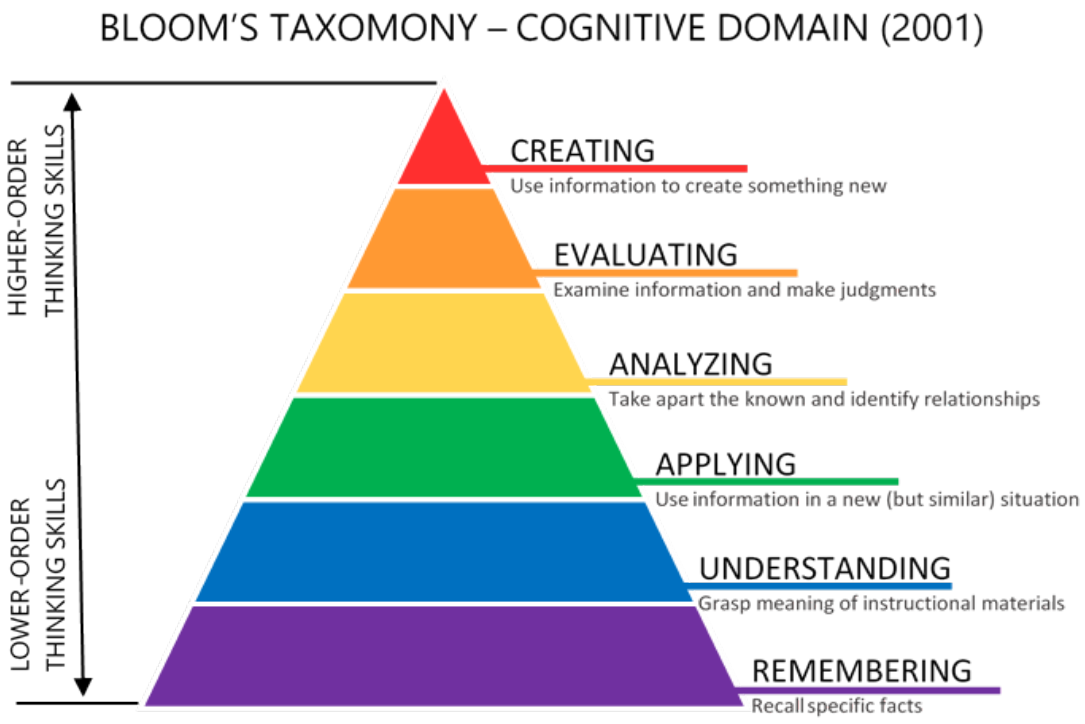

Figure 0.3. *The diagram summarises the levels of adapting the model to learning (Education Technology, 2001).*

4.4.2: *RELEVANCE OF BLOOM'S TAXONOMY TO THE GAME ELC+ FRAMEWORK*

When applied to the Game ELC+ framework, Bloom's taxonomy structures a space of cognitive and behavioural exchange between teacher and student by providing avenues for both to understand the intention behind their exchange. By outlining and clarifying what each 'action word' seeks to contribute to the learning process, it will guide the delivery of appropriate instruction and support the design of assessment that impacts users towards DL. Through such clear outline of the steps that aid cognitive learning, the objectives of each process and the outcome can be strategically mapped and analysed during the process.

4.4.3: *CONTEXTUAL CHALLENGES OF BLOOM'S TAXONOMY*

As illustrated in the Game ELC+ framework diagram in Figure 3.1, without a thorough adaptation of the process, the Bloom taxonomy process may appear complex to apply in the framework. Although several researchers have shown successful outcomes of this process, it requires intricate attention in the development and distribution of its core levels. This entails a clear understanding of what is required from the teacher and the learners. In processes where clear communication has not been properly implemented, the outcome for both parties have often diverted from the main goal of the framework. To circumvent these challenges, it is important to outline, in clear terms, how a sophisticated understanding and application of each level of the Bloom taxonomy would lead to deeper learning.

4.5: CHANNELS – COGNITIVE THEORY OF MULTIMEDIA LEARNING

The CTML seeks to explain the processes that take place in the learners' minds during meaningful learning from multimedia instruction. This theory prioritises the channels or

mediums that are accessible to learners. This principle, which is also called “multimedia principle”, emphasises that learners learn thoroughly from words and pictures than from the use of words alone (Mayer, 2002). Multimedia is the use of words and verbal and visual pictures (Meyer and Moreno, 2003). The theory specifies five cognitive processes that occur in multimedia learning. The processes include selecting relevant words from the presented text or narration, selecting relevant images from the presented graphics, organising the selected words into a coherent verbal and pictorial representation or organising selected images.

The CTML has implications for instructional design to simplify multimedia learning, particularly for how to avoid cognitive overload. Underlying the CTML are three key assumptions (Meyer and Moreno, 2003; Meyer, 2010). First, the CTML proposes that there are two separate channels (auditory and visual) for processing information from sensory memory. An example is the Dual-Coding theory. The second assumption is that each channel has a limited working memory capacity. Examples include the cognitive load theory and working memory theory. The third assumption is that multimedia learning is an active process of selecting words and images, organising words and images as well as integrating them together with prior knowledge from long-term memory. The generative learning theory and active learning theory are all examples here. For clarity, the three key assumptions of CTML is further illustrated within the diagram in Figure 4.4 below.

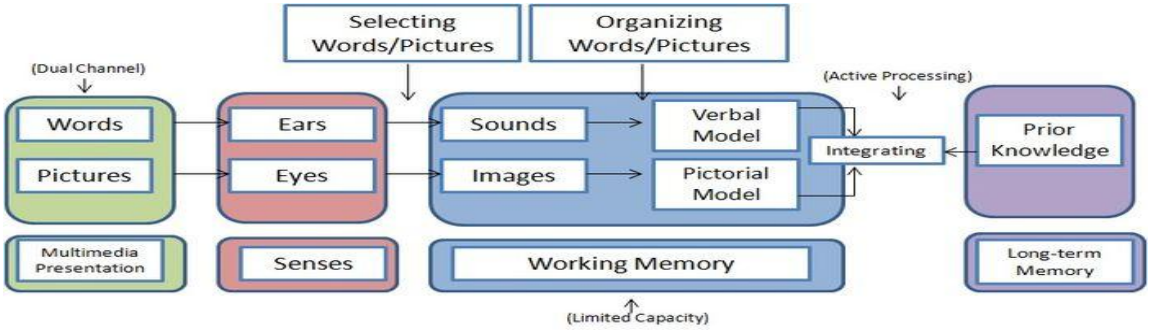

Figure 0.4. *The diagram depicts the model for processing information learned through the auditory and visual dual channels (Mayer, 2010).*

Mayer (2002) insists that simply including words to pictures does not satisfy this theory of learning. Instead, teaching should be approached as instructional media that mirrors how the human mind operates, because this can lead to more meaningful learning. To exemplify this, the theory suggests that as human beings learn, they develop mental representations of what is taught and how they aim to apply it. Therefore, Mayer (2002), proposes that diagrams or photos should be curated alongside words, in ways that generate logical meanings for the learner. In summary, it argues that the human mind is more active when it 'hears and sees' rather than when it 'hears' alone.

4.5.1: *RELEVANCE OF CTML TO GAME ELC+ FRAMEWORK*

Mayer's theory aims to serve as a guide on how multimedia applications can be well-designed and utilised to create meaningful learning. Naturally, it provides an important consideration for the Game ELC+ framework since it aims to inspire a more action-based approach to learning. By drawing upon human experiences such as our ability to be more aware when things happen to us, it aims to ensure that the educational process where students repeat what they are told, is eradicated. Mayer's theory also serves as a useful tool for weighting the emotions of the learner. This is because images paint a picture and can form how a learner thinks about the picture and

what they are being told. For instance, a learner may have encountered the image of the letter 'A' before being taught about the letter in class. If their first encounter of the letter was in a traumatising situation, it can impact how they continue to perceive it. However, if their first encounter was in a joyful situation, their emotions may always be tilted to joy whenever they encounter the word.

4.5.2: *CONTEXTUAL CHALLENGES OF CTML*

Students who are unable to navigate the use of Bloom's taxonomy or those in contact with poorly designed multimedia channels will experience extreme frustration and this may cause them to quit. It is also important to consider that there would be users with special needs and those that may require a different channel to understand and apply the designed multimedia to their learning. These challenges may lead to heightened emotions if it is not carefully applied to the Game ELC+ framework.

4.6: EVIDENCE-RUSKOV'S THEORY OF DEEP LEARNING

Ruskov's four evidences of DL proposes that SGs are capable of improving learning, particularly in a mixed setting (Ruskov, 2014). The research reflects his theory on different levels of abstraction and involvement, including pedagogical principles such as variation theory, and engagement principles like immersion, achievement, and socialisation. He employed a design-based research approach to develop a SG, which assessed life-long learning in participants. As part of the design of this study, determining which game elements were most active during successive DL levels was critical. The work of Ruskov (2014) was key to understanding and modifying Chou's Octalysis Framework, especially as it helps redefine user experience based on these game elements, and establish their links to evidence DL. His theory

proposes adapting project management as a learning domain that also includes several other processes for the purpose of DL.

Ruskov (2014) proposes a multi-pronged approach that combines several theories on different levels to benefit the leaner. In this framework, he argues for functional agile methods and the need for generating feedback to ensure improved abilities or to reach desired outcomes via SG. In Ruskov's view, an integrative approach of abstraction, involvement, and pedagogical principles such as the variation theory in necessary (Orgill, 2012, p. 3391). As Orgill (2012) notes, variation theory is a learning and experience theory that explains how learners may come to see, understand, or experience a specific phenomenon. This process can be critical to enhancing learning processes. The need for this is connected to the requirements of knowledge and its use in the twenty-first century. By ensuring that learners are gaining from a wide range of options, the knowledge they obtain becomes useful to the rapid development in today's world and it also benefits their capability to understand how they need to apply it.

4.6.1: *RELEVANCE OF RUSKOV'S THEORY TO GAME ELC+ FRAMEWORK*

Ruskov's theory reflects what the Game ELC+ framework intends to adapt in several ways. First, Ruskov's interest in integrating settings that could prove very useful in advancing the way SG are adapted for use is important. Due to what may appear as the complex positionality of each learner, adapting diverse approaches may help the learner assume a more exploratory understanding of the topic. Secondly, the blend of these approaches will be an expository experiment for the Game ELC+ framework as it would not only advance what Ruskov proposes, but it will enable a documentation of how mixed settings or integration of approaches work.

4.6.2: *CONTEXTUAL CHALLENGES OF RUSKOV'S DEEP LEARNING THEORY*

While a mixed approach can be beneficial, it may also lead to a combination of practices that complicate the development and design of the Game ELC+ framework. This means that if the mixture of these approaches is not well integrated, it may affect the outcome of its use for the leaners involved.

4.7: CHAPTER SUMMARY

This chapter presents the Game ELC+ framework as a rigorous approach to facilitate DL in adults by highlighting the key theoretical underpinning of the framework, their relevance and limitations. As such, the chapter highlighted four learning models relied upon to develop the Game ELC+ Framework, while providing justifications for how each one is applied at different stages of the game design process of a SG that could lead learners to DL. Each of these learning frameworks constitute ways that content, user experience and behavioural design, and a strengthened outcome of learning will be integrated into the Game ELC+ framework.

The next chapter dives into the design of the research instruments of this PhD research, one of which is the SG which is designed following the ELC+ Framework. The chapter explains the scenarios that comprise the game, it demonstrates how the ELC+ Framework has been applied and how the game elements integrated in the game are used to collect data that will assist the analysis related to the participants learning.

CHAPTER 5 RESEARCH INSTRUMENTS

5.1. Introduction

This chapter details the process of designing and developing the research instruments that have been designed to collect data required to address this Ph.D.'s research questions. These instruments include a pre-qualifying test designed as questionnaires to select initial participants for the study, a traditional andragogical test which uses e-Learning materials containing ten different learning scenarios created through input from Dr. Chima Mordi of the Business School Offices at Brunel University, and a digital serious game using exactly the same content and scenarios with the traditional andragogical test. The difference between the last two research instruments is in the design of the learning material to improve learning experience of participants. The scenarios those two last research instruments use are related to: GDPR compliance; bribery; fraud suspicion; fraud reporting; security practices; equality; diversity; sexual harassment and inclusion.

To a large extent, the chapter explains the design elements integrated in the research instruments in order to address the research aims and objectives of capturing how those design decisions impact learning. As such, it expatiates the categorisation of the gaming elements applied in each of the gaming scenarios based on the MDA framework. The chapter rounds off by discussing the development of the game and the challenges that arose in the process, then gives an overview of everything previously discussed and introduces the next chapter.

5.2. PREQUALIFYING QUESTIONNAIRE AND SURVEY

In order to effectively test for andragogical DL, adult learners recruited to participate in the test were expected to have little, or surface knowledge on the subject matter. To get this demographic, a questionnaire containing 20 questions was designed (see Figure 5.1 for an abridge version, and Appendix C for the full questionnaire).[1] The subject matter focused on soft skills judgement and decision making in HR management, which was preferred because it requires to demonstrate a high level of human influence and experience. It suggests that there needs to be a deep level of human understanding of the subject area to optimally manage any group of adults working together in an office environment. Each question is worth 5 points and the overall score of each participant is used to determine their knowledge, using the scoring model developed in Chapter 3. Participants who score 49.9% and below, suggesting signs of surface learning, progress to the experimental group, while participants who score 50 and above — showing signs of DL — are excluded from the experimentation process and used as a control group for comparative analysis at a later stage.

[1] It is also accessible through this url: https://forms.gle/r5kLXgNyfsdx3bax5.

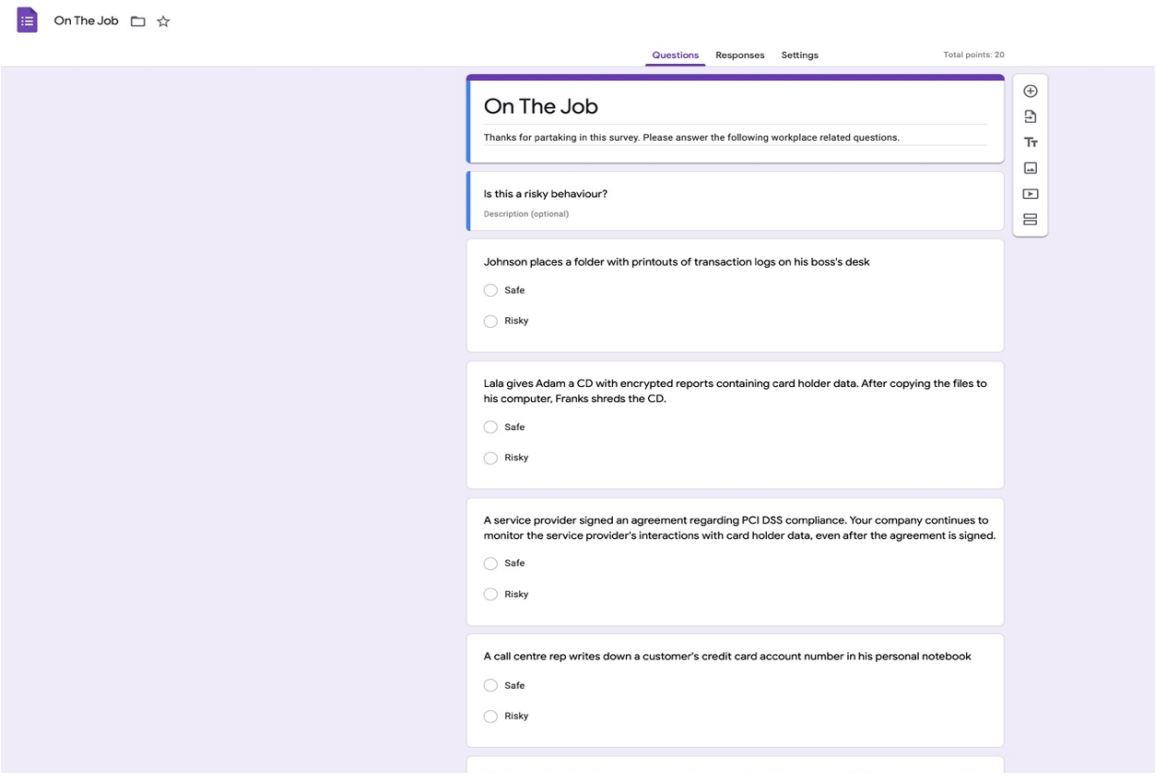

Figure 0.1: *Questionnaire for all Participants for Pre-Learning Evaluation*

5.3. GAME DESIGN

The game design consists of relatable gamified office scenarios that adult players will need to interact with to progress. As discussed previously in Chapter 3.3.5 each game scenario makes use of a combination of specific gaming elements and follows a sequence involving three stages. Each game scenario starts with a page, which introduces the scenario and describes the work situation that the player will be involved in. Here, SG isn't different from traditional eLearning, as users follow a similar sequence. That is, following the introductory page is another page that places the player in the previously described work situation and provides a list of options from which the player chooses his/her preferred

option. The final page provides feedback on the players response; that is, whether the preferred option of the player is the right or wrong answer.

As shown below in Figure 5.2, this sequence — scene introduction, question/decision, and feedback — is repeated throughout the ten scenarios. After completing all the learning scenarios, the player's overall score is revealed to him/her. Players can choose to review their responses across the scenarios, which helps improve learnings, and they can also choose to retake the learning/test exercise.

5.4. GAME FLOW

The game flow is derived directly from the Game ELC+ framework. It is grouped into four stages (as shown in Figure 5.2 below):

- pre-learning;
- learning;
- testing; and
- retention stages.

The pre-learning stage of the game flow is based on the selection phase of the framework, while the learning stage is based on the andragogical phase of the framework. Finally, the testing and retention stages of the game flow are based on the evaluation phase of the framework. The game starts with a customisation screen where players are provided with the option of selecting their preferred personal character, otherwise known as the avatar (see Figure 5.3). The player is then presented with an introduction from a neutral game character that exists throughout the course of the game. In a bid to drive engagement,

besides the player, the narrator and scenario-specific characters, there are other characters in the game that the player can interact with, depending on their level of curiosity (see Figure 5.4).

Following the introduction, the game narrator reappears to set the scene and give context to the scenario to be played (see Figure 5.5). The player then progresses into the first scenario as shown in the top-right corner of Figure 5.6. Here, they are presented with a relatable office situation in which they need to make a decision (see Figure 5.7, 5.8). This is done by selecting the right decision out of multiple options (see Figure 5.9). If the player selects the right option, they are told the answer is right and a brief explanation for this is given by the game narrator (see Figure 5.10). This is similarly the case if the player selects a wrong option. When a player selects the right option, the scenario is passed and will not repeat. However, when a player selects a wrong option, they still progress to the next scenario, but the failed scenario will be repeated at random later as the player progresses in the game, until the player gets all the scenarios right. This is supported by the concept of reinforced adult learning (Wiklund-Hörnqvist, et al., 2014).

Through the course of the game, the player can review their progress to see how far they have come and what tasks are left as shown in Figure 5.11. When the player successfully completes all the game scenarios, they are presented with a screen that shows them a summary of their performance metrics. There won't be any scores shown to the players as this is the teaching stage. However, other metrics such as accuracy of answers are captured behind the scenes for the purpose of comparing the learning outcomes of SG and the traditional method.

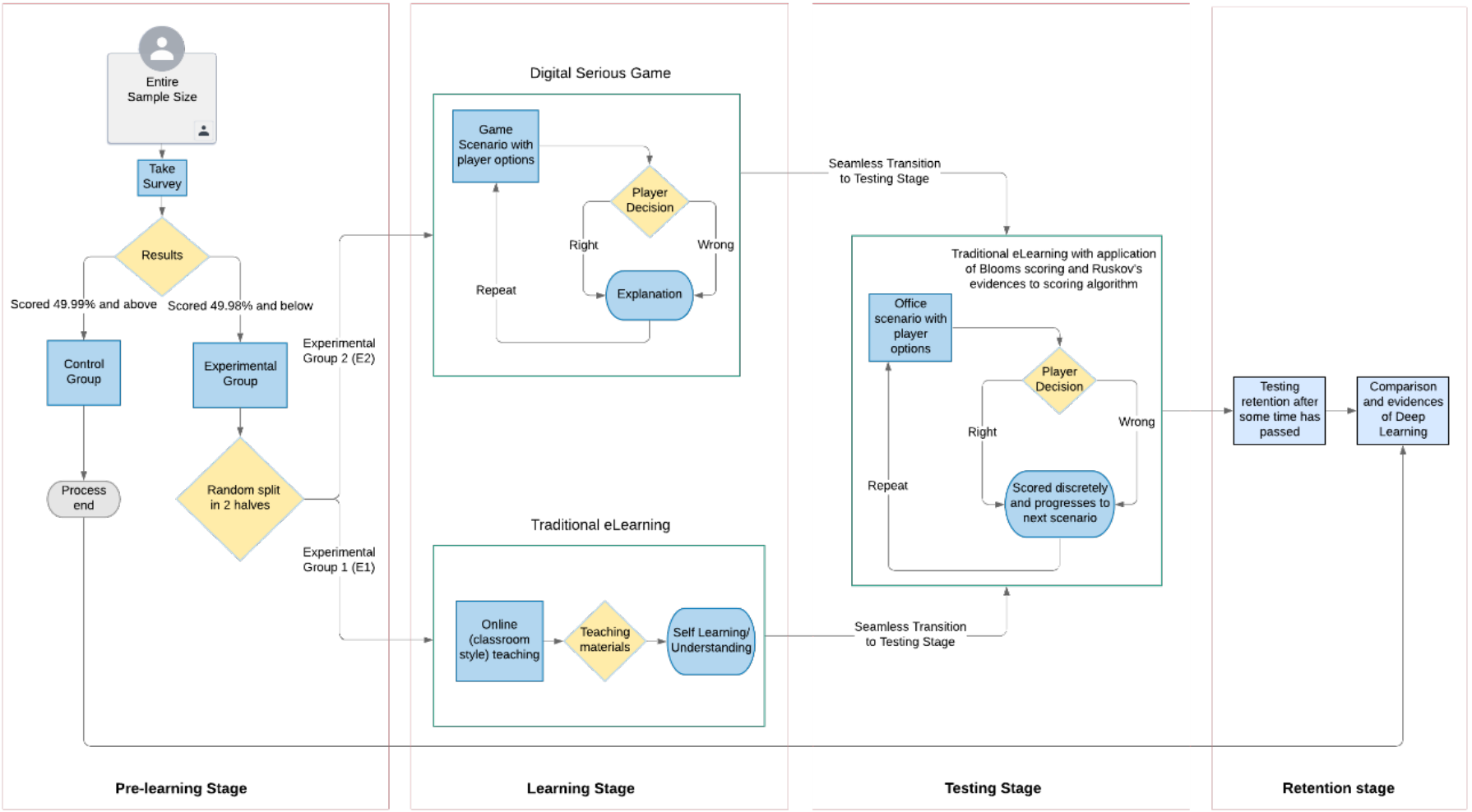

Figure 0.2: *End-to-end flow of ELC+ model showing pre-learning, learning, testing, and retention stages*

Figure 0.3: *Player avatar selection and personalisation screen*

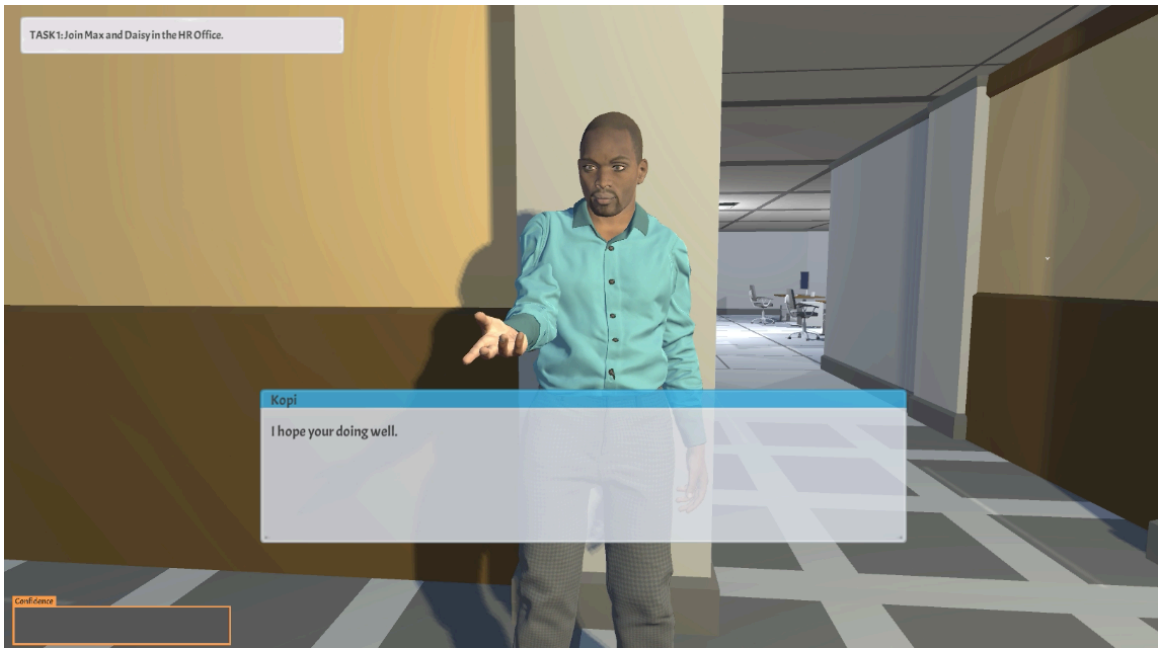

Figure 0.4: *Interaction with other random game characters to drive exploration*

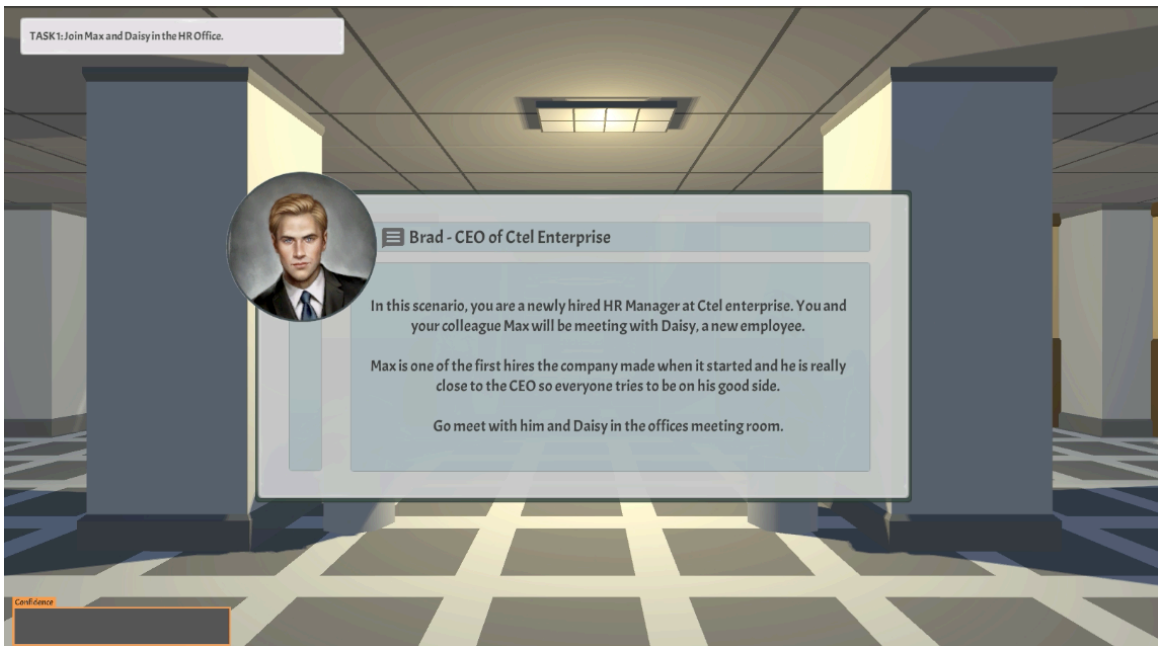

Figure 0.5: *introduction of game scenario by game narrator – Brad*

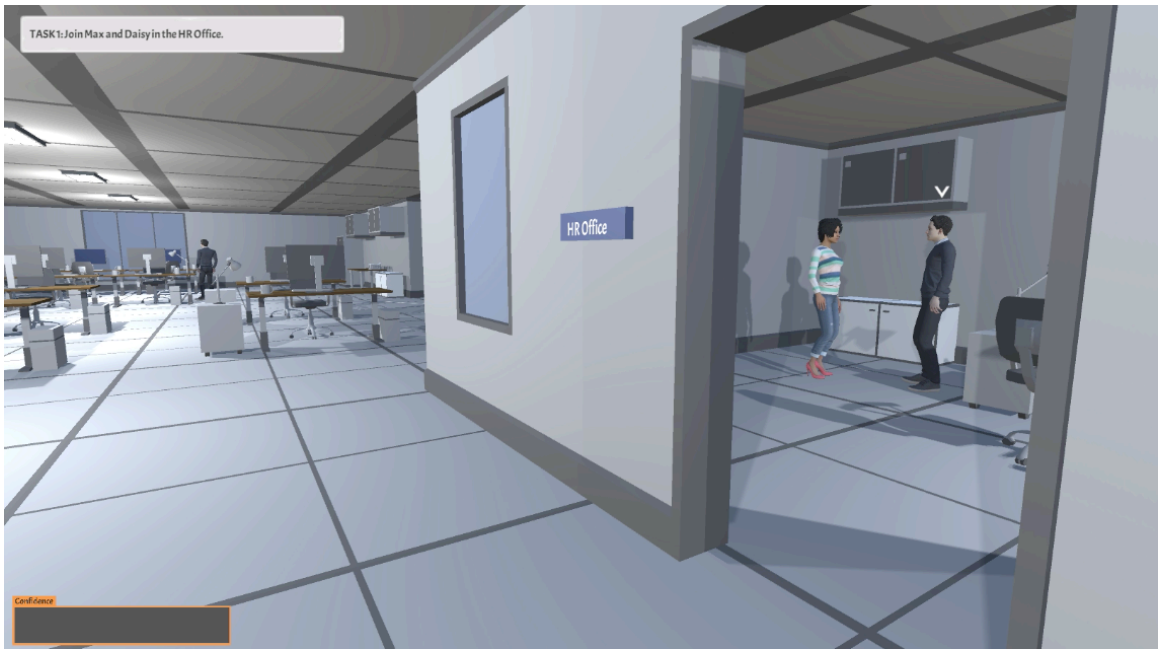

Figure 0.6: *View of office setting showing random and scenario-specific characters*

Figure 0.7: *Player witnessing conversation between new and current colleague - scenario 1*

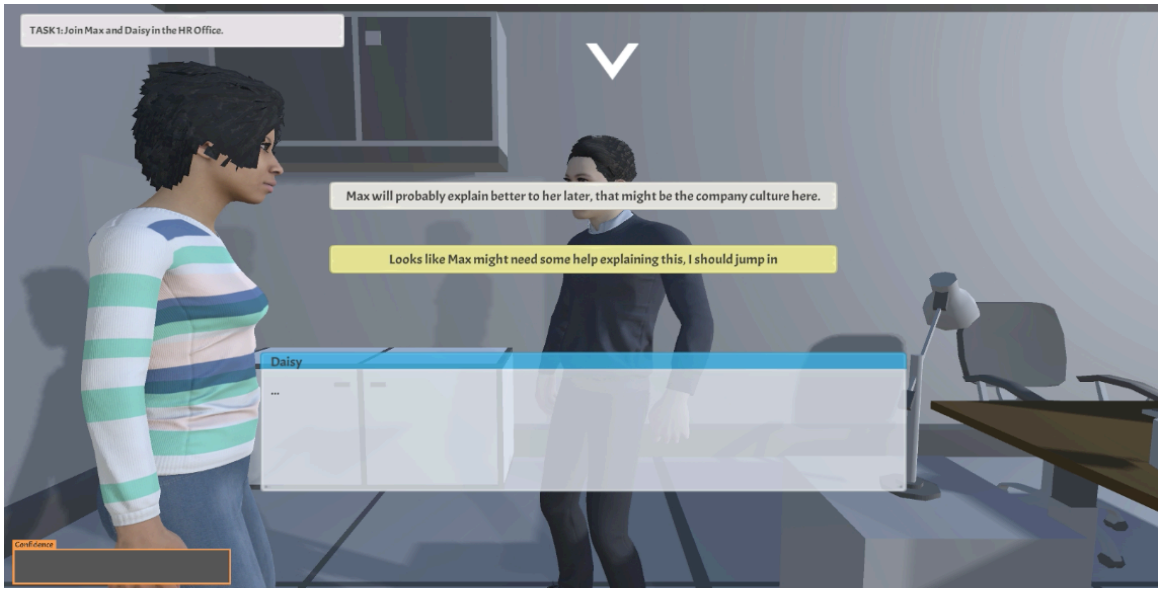

Figure 0.8: *Post-communication context setting before the question is posed to the player*

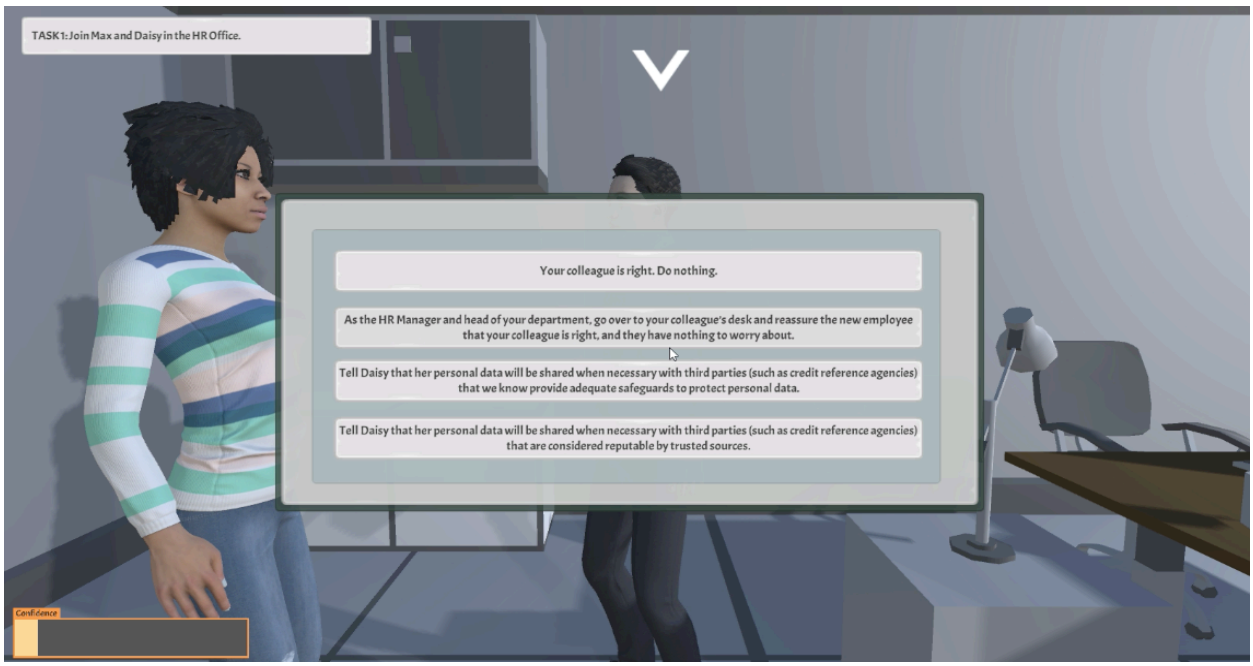

Figure 0.9: *Player presented with options to choose from for decision-making*

Figure 0.10: *Narrator explaining why the answer is right after player chooses*

Figure 0.11: *Player refers to task list during gameplay to see progress*

5. 5. TRADITIONAL E-LEARNING ANDRAGOGY

As the Game ELC+ framework outlined in Figure 5.2 indicates, following the pre-learning stage, participants are randomly selected and allocated to complete the traditional andragogical step (E_2), and the digital SG (E_1). Traditional teaching is conducted using traditional e-Learning material presenting the same scenarios as the ones used in the design of digital SG (see Section 5.2). The digital material was created using an authoring tool suitable for educational material called Articulate Storyline (Donnellan, 2021).[2] This tool allows the creation of material well suited to deliver eLearning content in a multimedia environment with the ability to factor in components like scoring, timing, and gamification. The digital material captures the following elements:

[2] See https://articulate.com/360/storyline for more on Articulate Storyline.

- **Story**

  The traditional game covers nine learning scenarios — GDPR compliance, bribery, fraud suspicion, fraud reporting, security practices, equality, diversity, sexual harassment, and inclusion (see Figure 5.13 and Appendix D).

- **Avatars**

  To contextualise the scenarios, respective avatars have been used to depict the characters in the scenario (see Figure 5.13, 5.15). The user is asked to take the role of characters represented in the game and take decisions on their behalf. The use of the avatars helps the users to empathise with the roles they are asked to adopt.

- **Scoring**

  Each correct answer is given 1 point (see Figure 5.17). The e-Learning material does not integrate any gamification; allowing the traditional teaching method to be compared with the SG, with the only difference being the inclusion of game elements in serious games. The scoring is not considered as assessment feedback rather than a game element. Figure 5.12 to Figure 5.19 below provide screenshots from the traditional eLearning platform depicting how the story unfolds as the learner progresses attempting the different HR scenarios. Figure 5.12 depicts the structure of the digital material. The eLearning material is designed following a linear structure, starting from the first page where the participant is required to enter a username, to the last page where the participant completes the test. The usernames, which are pseudonyms, will serve as identifiers for the participants to facilitate differentiation between participants. Each username that is created

automatically generates a unique ID which is what is ultimately used when reporting research findings. No personal identifiable data is recorded or stored to ensure the material created is aligned with GDPR compliance guidelines.

Following the sequential structure, a scenario is introduced (see Figure 5.15), then a question related to the scenario is presented to the player/learner (see Figure 5.16). Once the player/learners have reached a decision, the system reveals the correct answer and provides further feedback on the correct or incorrect answer; thus, contributing to the learning process (see Figures 5.17, 5.18) (Abdelmalak and Trespalacios, 2013). Once a scenario is completed, participants move to the next scenario, and this is then indicated on the menu. The participants are allowed to randomly access the different scenarios from the menu and are allowed to revisit completed scenarios if they wish (see Figure 5.14). After completing all the learning scenarios, the participant is shown their scores and are directed to review their progress (see Figure 5.19).[3] If the players choose to review the learning exercise, they will be presented with the list of scenario questions that have been asked revealing their answers to review their performance. However, if the player chooses to retry the exercise, they would be taken back to the menu layout screen (see Figure 5.14) to restart the process, but without having to input their usernames all over again. If they attempt the questionnaire a second time the system shows them if they have answered the question correctly. Finally, if the player chooses to submit the results, the scores are logged into the database spreadsheet for further analysis (see Figure 5.20).

[3] See link for traditional eLearning material
https://economda.users.ecs.westminster.ac.uk/Mamfe/story.html

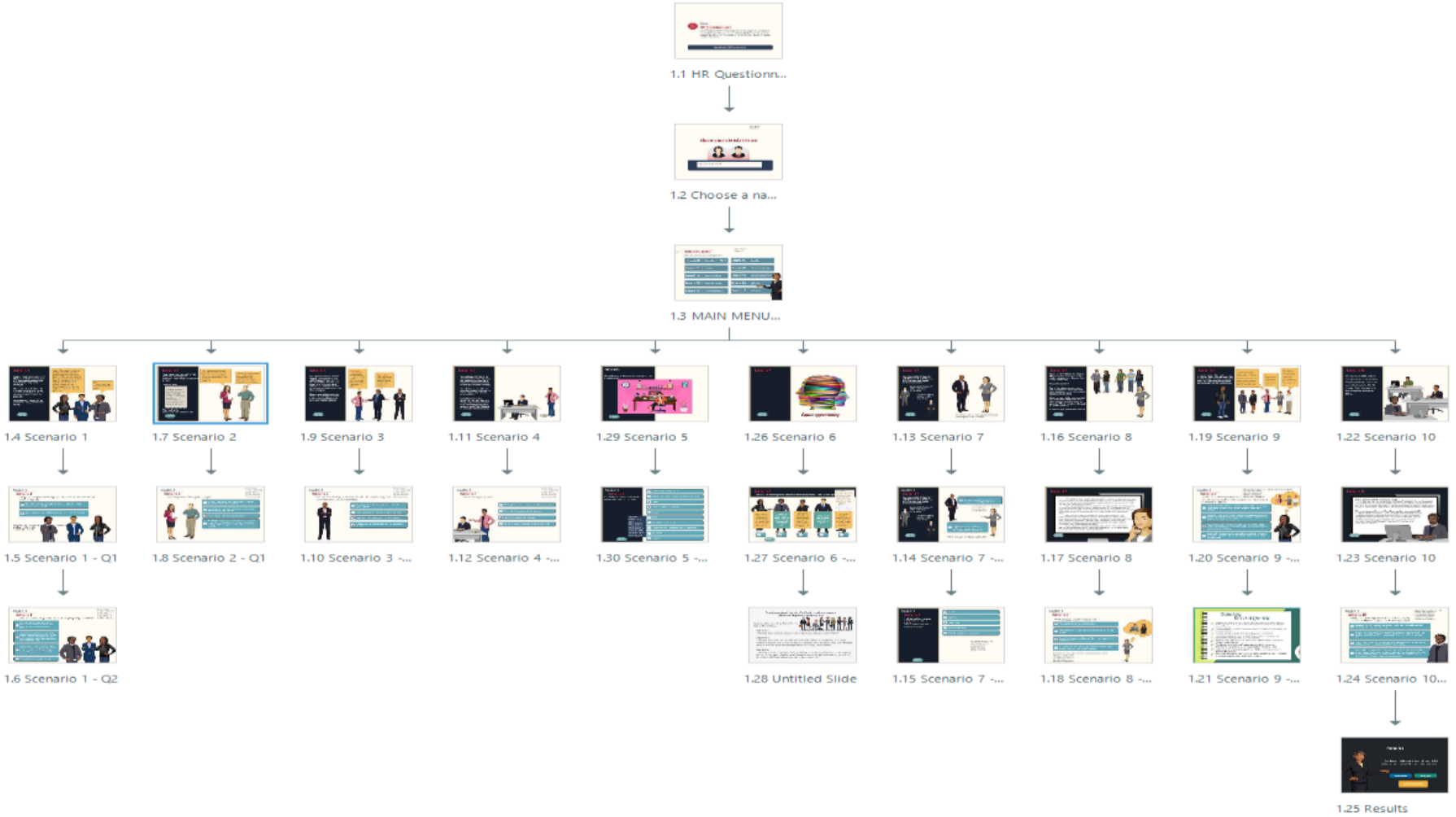

Figure 0.12. *eLearning scenario sequence*

Figure 0.13: *Participant customisation screen*

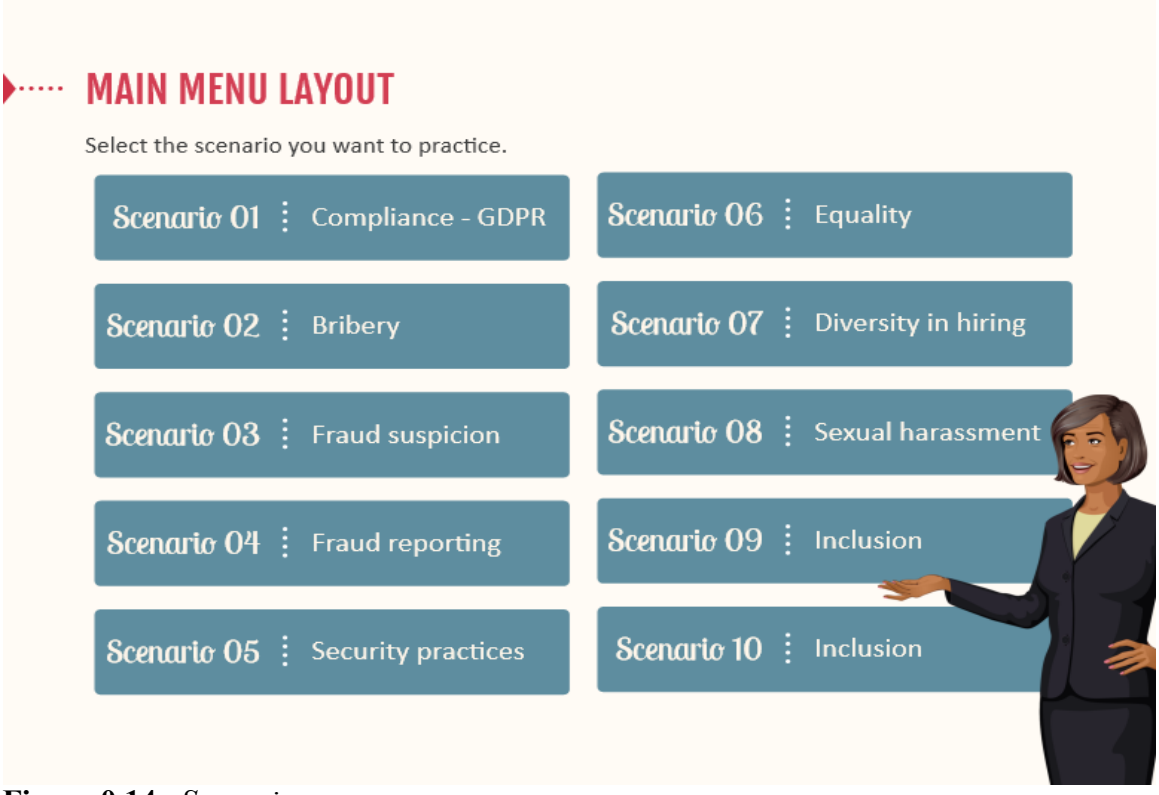

Figure 0.14. *Scenario menu*

Figure 0.15. *Screenshot from scenario 1 – Context setting for scenario*

Figure 0.16. *Screenshot from scenario 1 – Question based on scenario context*

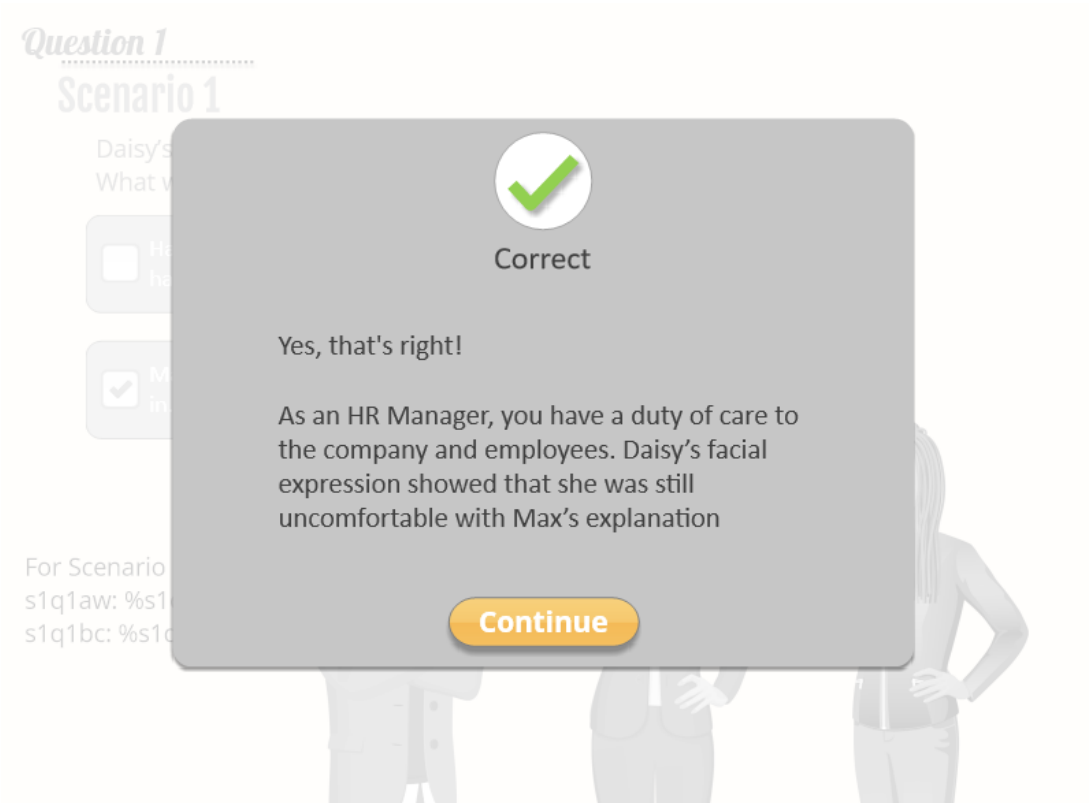

Figure 0.17. *Correct answer feedback for scenario 1*

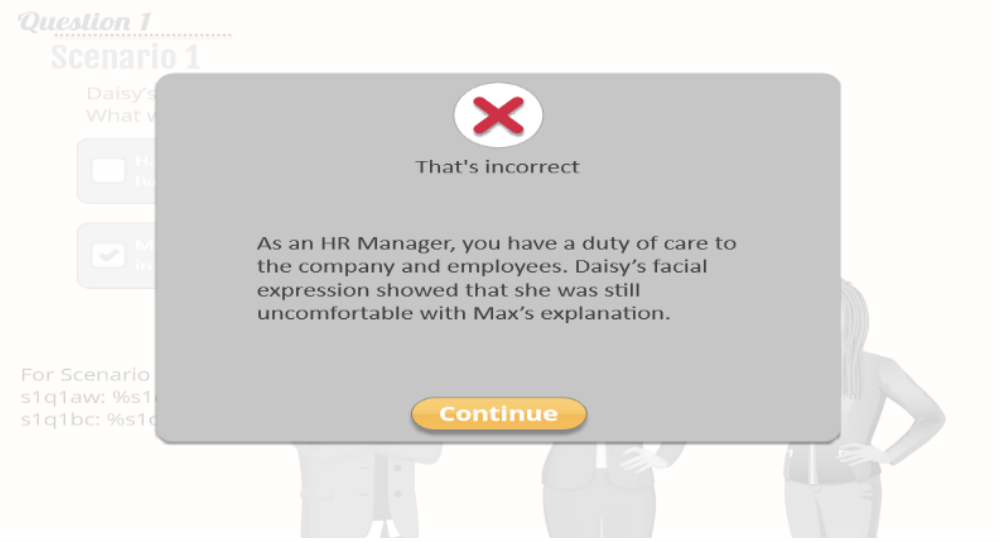

Figure 0.18. *Wrong answer feedback for scenario 1*

Results of player performance (the answers selected) are collected and organised in a spreadsheet (See Appendix F.). A variable is assigned to each possible answer within each scenario using the coding below:

- S1q1aw: scenario 1, question 1, answer a, wrong
- S1q1bc: scenario 1, question 1, answer b, correct

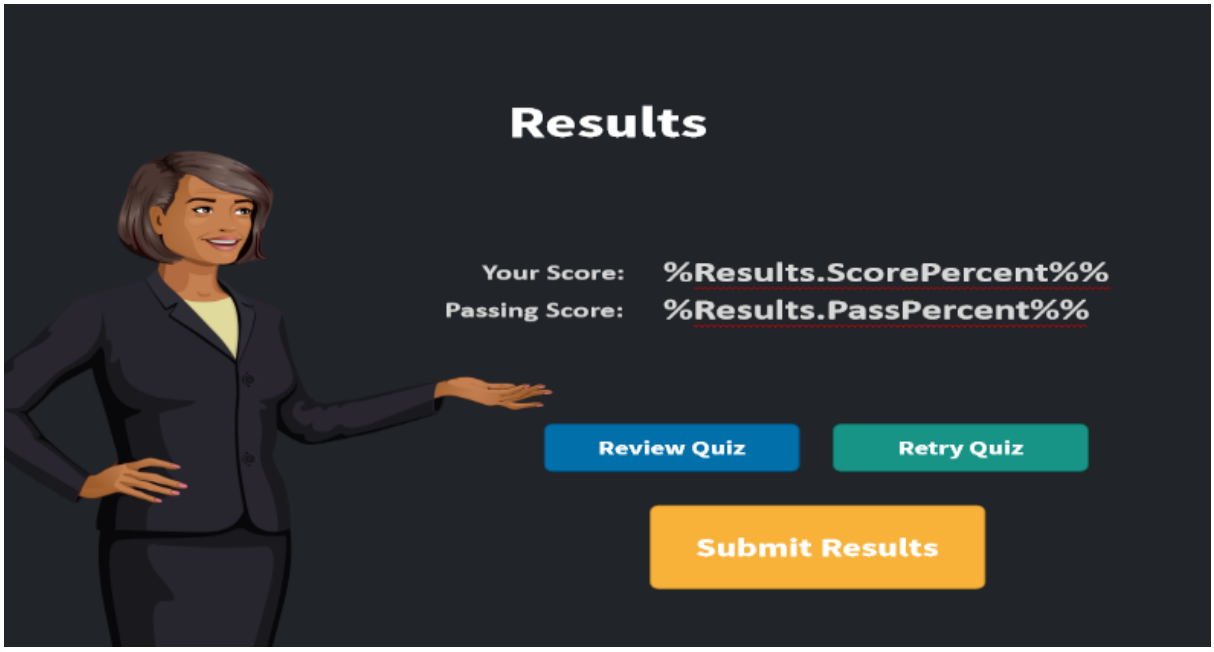

Figure 0.19. *End screen for traditional learning*

Each answer has two values ascribed to it:

- 1, if the answer is selected, and
- 0, if unselected (see Figure 5.20).

By so doing, we can analyse not only if a player answered rightly or wrongly, but also what option was selected in the process. This helps with analysis of player accuracy and can be

paired with time analysis to show possibility of improvement in learning as the player progresses.

date	name	s1q1aw	s1q1bc	s1q2aw	s1q2bc	s1q2cw	s1q2dw	s2q1aw	s2q1bw	s2q1cc	s2q1dw	s3q1aw	s3q1bw	s3q1cc
2021-12-01	Daphne	1	0	0	1	0	0	0	0	1	0	0	0	0
2022-01-10	Andy Madaki	0	0	0	0	0	0	0	0	1	0	1	0	0
2022-01-10	Andy Madaki	0	0	0	0	0	0	0	0	1	0	1	0	0
2022-01-15	Mike	0	1	1	1	0	0	0	0	0	1	0	0	1
2022-01-17	Mahnoor Asif	0	0	0	0	0	0	0	0	0	0	0	0	0
2022-01-17	Mahnoor Asif	0	1	0	1	0	0	0	0	0	1	1	0	0
2022-01-17	Mahnoor Asif	0	0	0	0	0	0	0	1	0	0	1	1	1
2022-01-17	Mahnoor Asif	0	1	1	0	0	0	0	1	1	0	1	1	1
2022-01-17	Mahnoor Asif	0	1	1	1	0	0	0	1	1	0	1	1	1
2022-01-17	Mahnoor Asif	0	1	1	1	0	0	0	1	1	0	1	1	1
2022-01-17	Joyce Akiga	0	1	0	1	1	0	0	0	0	1	0	0	0
2022-01-18	Ovo	0	1	0	1	0	0	0	0	1	0	1	1	0
2022-01-18	Ovo	0	1	0	1	0	0	0	0	1	0	1	1	1
2022-01-19	DCM	0	1	0	1	0	0	0	0	1	0	0	0	0
2022-01-19	Nnena	0	1	0	0	1	0	0	0	0	1	0	0	0
2022-02-08	Mahnoor Asif	0	1	0	1	0	0	0	0	0	1	0	0	0
2022-02-08	Goka	0	0	0	0	0	0	0	0	0	0	0	0	1
2022-02-08	Robby	0	1	0	0	1	0	0	0	1	0	0	0	1

Figure 0.20. *Data collection table from traditional eLearning platform*

5.6. DIGITAL SERIOUS GAME – ON THE JOB

The SG *"On The Job",* a digital game created in a 3D environment, is aimed at engaging adult learners to teach them soft skills. The soft skill being taught by "*On The Job*" borders on judgement and decision making. The game employs carefully selected game elements that strike a balance between engaging the adult learners and effectively communicating new information in a controlled setting that encourages adult DL. The players are allowed to customise their avatars as shown in Figure 5.3 (the game characters they control) and are presented with relatable office scenarios in which they must make important decisions to progress.

Each scenario is timed and details of how the player engages with the scenario are captured, stored and further analysed. The outcomes of the series of decision-based scenarios are secretly scored and after each scenario, a game (character) narrator gives some feedback

to the player. The content of the feedback is dependent on whether the player made the right, or wrong decision. If a player fails a particular scenario question, the scenario is presented later in the game again to the user. After the tenth scenario, the player is shown a summary of their gameplay statistics and the game ends.

5.7. Game Scenarios And Elements Categorisation

As mentioned previously in this chapter, the Traditional Andragogy uses e-learning materials containing ten learning scenarios. These include GDPR compliance; bribery; fraud suspicion; fraud reporting; security practices; equality; diversity; sexual harassment and inclusion. It is within these different scenarios that the game elements are impactful. These elements are designed to encourage users to be more engaged during the gameplay by influencing their activities and actions. The game scenarios are strategically organised to encourage effective decision making and user progression through each scenario. The game-flow across the ten scenarios for both the traditional and digital SG learning phase are depicted in Figure 5.21 and the script for each scene can be accessed in Appendix D. Each one includes a game element classification and a game flow diagram.

The design of the SG scenarios is based on the MDA framework. To several game researchers, the MDA framework, from the point of view of learning and game play experience, critically analyses the choices made during the design process and how this may impact a user (Hunicke, et al., 2015). Fundamental about the MDA framework, as these authors suggest, is the notion that games are more similar to artefacts and their behaviour is the content of the game. Contributing to the MDA framework, Caroll (2015) further argues that it enables a designer to explicitly think about the design goals and to

anticipate the ways in which any changes in aspects of the framework in terms of design decisions taken and elements to be integrated in the design can impact the outcome of its use. In the scenarios depicted, in Figure 5.21, the mechanics have led the thinking of each dynamic, and this in turn contributes to how the aesthetic is developed to provide value to the user/player and to weigh for the outcome from their use of the game.

There are two types of elements in the various game scenarios. They are the Core Elements and the Sub-Elements (see Figure 5.21). Core elements are game elements used throughout the game irrespective of the scenario. The core elements used in this game are:

- progress bar;
- timer;
- status points;
- narrative;
- instant feedback;
- virtual goods;
- avatar;
- curiosity; and
- milestone unlocked.

In contrast, Sub Elements are the game elements that are specific to each scenario, see Figure 5.21. The sub-elements used in this game are:

- unpredictability;
- progress loss;

- scarcity;
- dangling;
- beginners' luck;
- hover effects;
- strategy;
- loss aversion;
- time pressure; and
- social treasure.

As depicted in Figure 5.21, these elements are embedded in four categories, namely:

- mechanics (progress bar, timer, status points, dangling, hover effects, and narrative);
- interaction elements (instant feedback, virtual goods, beginners' luck, strategy and unpredictability);
- system design elements (avatar, curiosity, progress loss, social treasure, loss aversion and time pressure and scarcity) and
- additional elements (*milestone unlocked*).

All the elements used in this research have been explained in Chapter 3.2.5. To recall, the task progress bar represents the position of the user/player, and this enables them to note their progress throughout the game. At this stage, the influence of the Octalysis framework on Game ELC+ is in full effect because the factors that influence a user/player's ability to 'keep moving forward' has been put into consideration in the design (Sorden, 2017).

Furthermore, in the depiction of the game element, a timer which aims to stimulate the pace of the user/player to think and act quickly is included. In this case, the timer has been hidden from the user because several game players have found timers to be intrusive or distracting during play (Roberts 2016). In another case, Palmer (2015) argues that timers can slow a player's motivation whether they are able to beat this at every stage, or if they are unable to meet this at every stage. In the game design herein, the timer will be used to determine the pace of the user/player without interrupting their ability to concentrate on the game. This will help aggregate information on their speed and accuracy in learning.

In Figure 5.21 below, for each scenario using the MDA framework, the game elements are categorised into mechanics, interaction elements, system design elements, and additional elements. Each game element was carefully selected to address a specific Research Question (RQ1, RQ2, or both), or Hypothesis (H1, H2, or both) as outlined in Chapter 1.3. This is further expatiated below:

Scenario 1 – GDPR Compliance

This scenario introduces the player to the SG and focuses on helping the player learn about GDPR compliance. The player must meet his colleague onboarding a new recruit and is met with a situation where his colleague gives information that isn't accurate and needs correction. The player is presented with options to choose from on how to go about managing the situation. A detailed script of scenario 1 can be seen in the Appendix D. The game elements included in this scenario are as follows:

- mechanics (progress bar, timer, status points, and narrative);

- interaction elements (instant feedback, virtual goods, and unpredictability)
- system design elements (avatar, curiosity, progress loss, social treasure and scarcity); and
- additional elements (milestone unlocked).

The game elements in Figure 5.22 corresponds with the legend at the foot of the diagram in Figure 5.21 that captures the research question and hypothesis that the design of this scenario will help investigate. This is consistent across the game element diagrams of all ten scenarios. The purpose of doing this is to demonstrate how the research questions and hypothesises of this Ph.D. research are addressed in each scenario. As represented in Figure 5.22 further down, the game flow is depicted with a Unified modelling language (UML) representation, which highlights character speech, actions, decision, and what happens in each scene. It includes an introductory scene below the legend to show that the user/player would need to sign up and select an optional avatar. The Figure plays to storytelling, but it also embodies an aspect of the dynamics that is representative of the user/player action. Thereafter, another character who serves as a guide throughout the game appears and leads the player to the first scenario. The expectation is that the instructive and interactive features of the game flow elements will motivate learning and support DL.

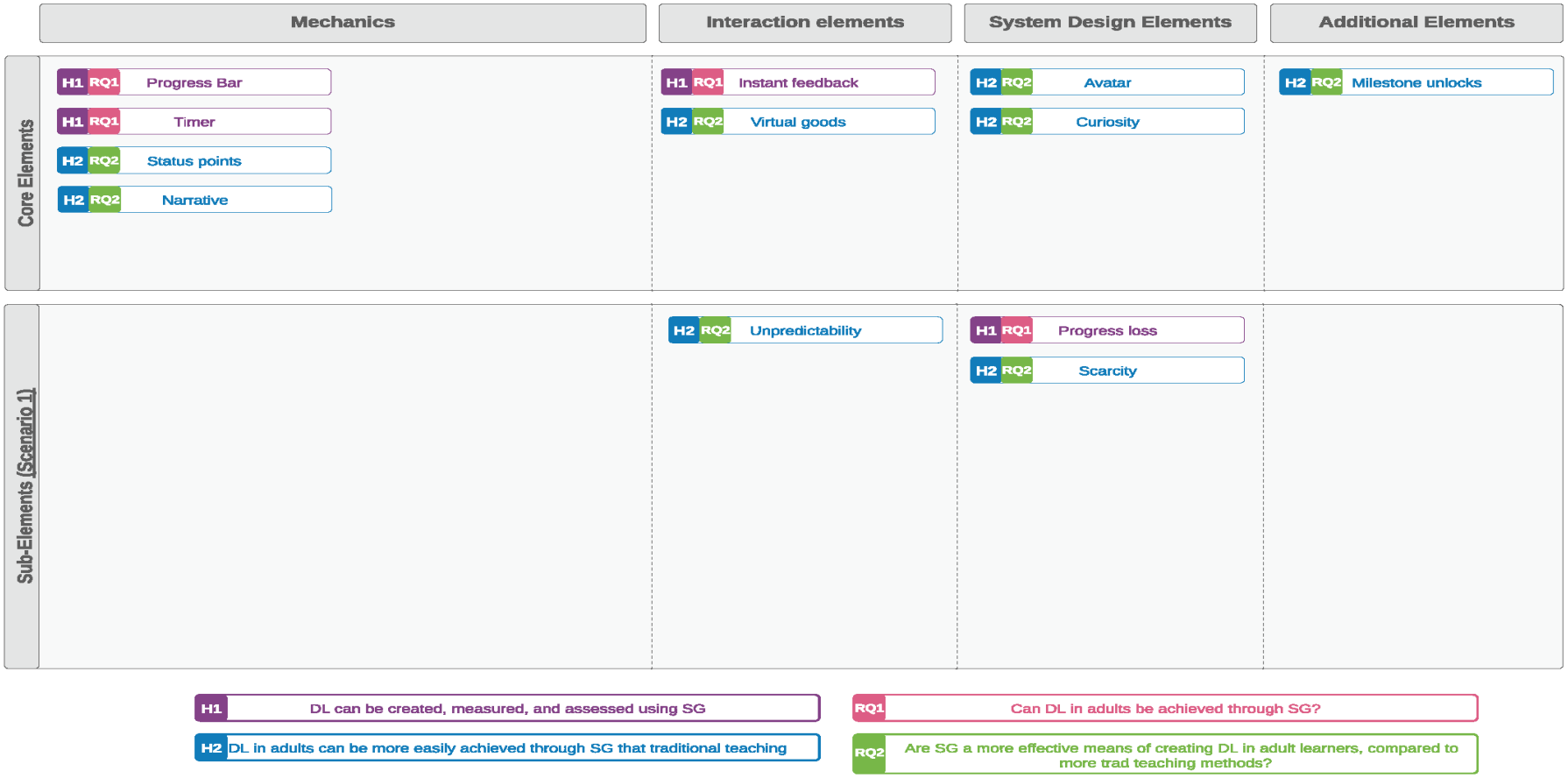

Figure 0.21. *Game element categorisation for scenario 1*

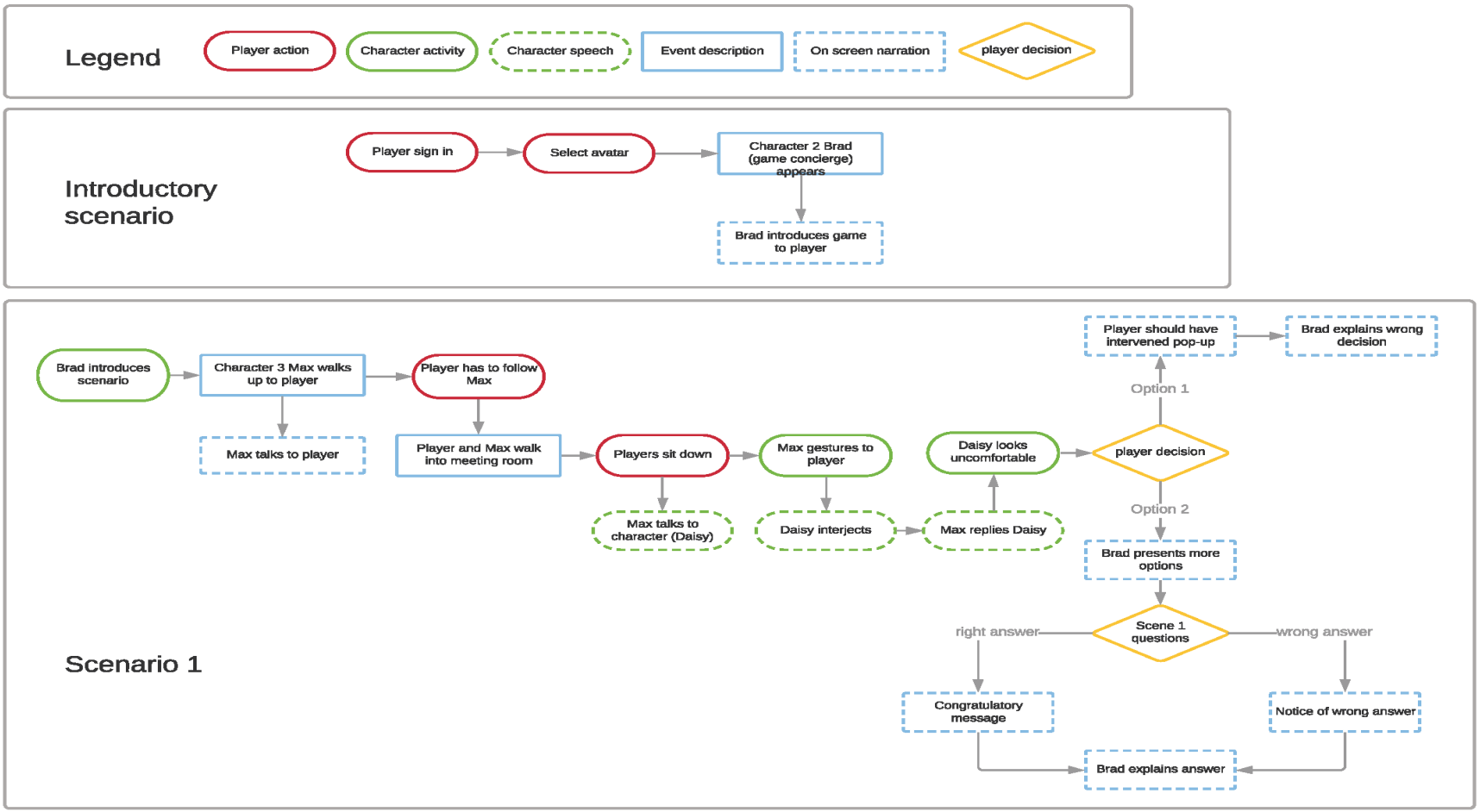

Figure 0.22. *Game flow and legend of introductory scene and scenario 1*

Scenario 2 – Bribery

Scenario 2 is staged based on teachings around the topic of bribery. The player is presented with options to choose from after being offered a gift from a happy client. A detailed script of scenario 2 can be seen in the Appendix D. Like scenario one, the core elements are used again, however *dangling,* and *social treasure* are used to engage the player in this scenario. The game elements included in this scenario are as follows:

- mechanics (progress bar, timer, status points, and narrative)
- interaction elements (instant feedback and virtual goods)
- system design elements (avatar, curiosity, social treasure); and
- additional elements (milestone unlocked).

These elements are linked to H2 and RQ2 as they are game elements which drive engagement and are not achievable in the traditional eLearning platform. Individually, their impact may not be directly measurable, but it can be argued that if adult learners who play the game perform better as a whole, it may be because of these game elements.

Figure 5.23 illustrates the game element categorisation for scenario two being bribery. It captures the core and sub-elements of the various game scenarios, the game elements as well as the core research questions and underpinning hypotheses. It attempts to demonstrate how the interaction of the various game scenarios and game elements respond to the two research questions and hypotheses

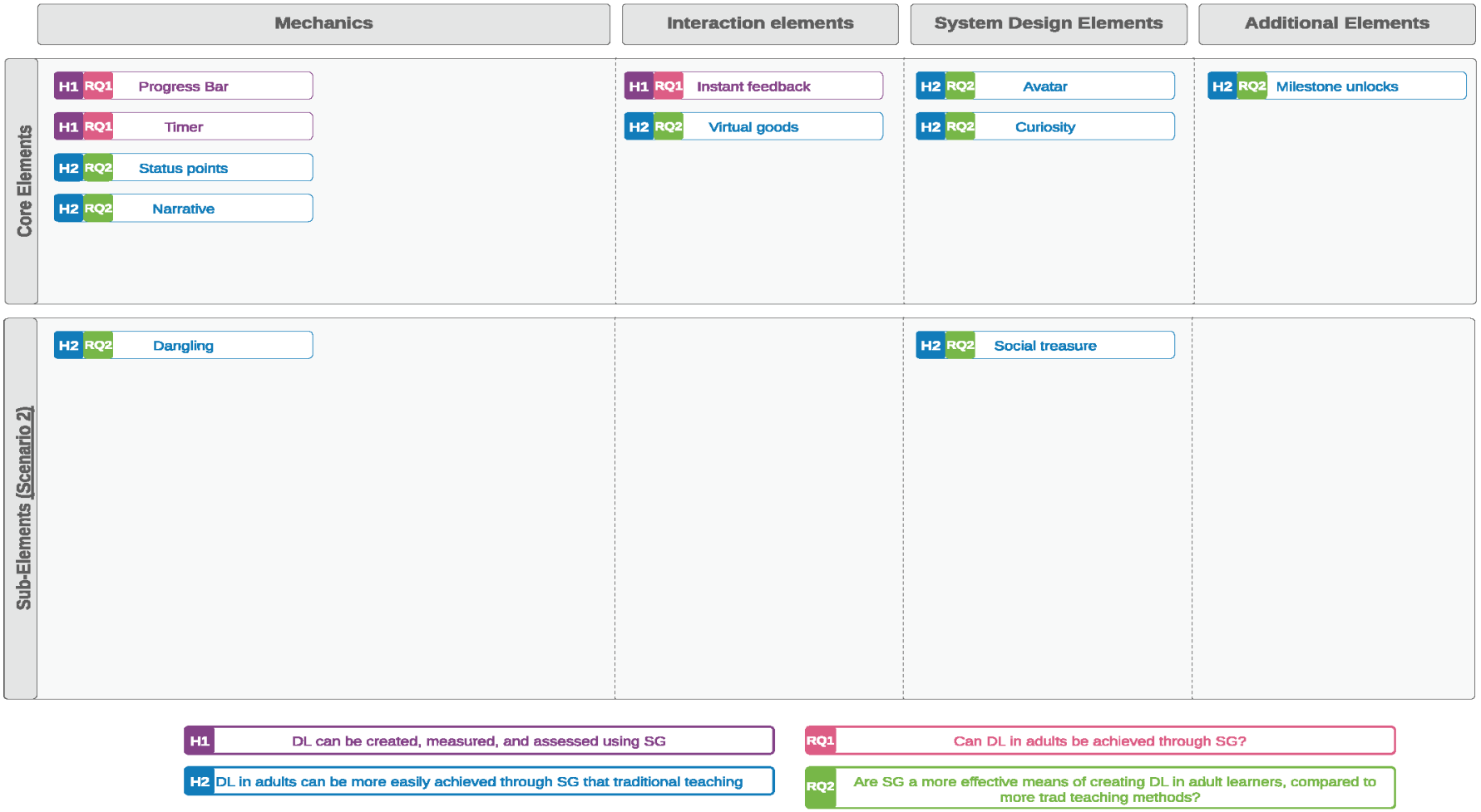

Figure 0.23. *Game element categorisation for scenario 2*

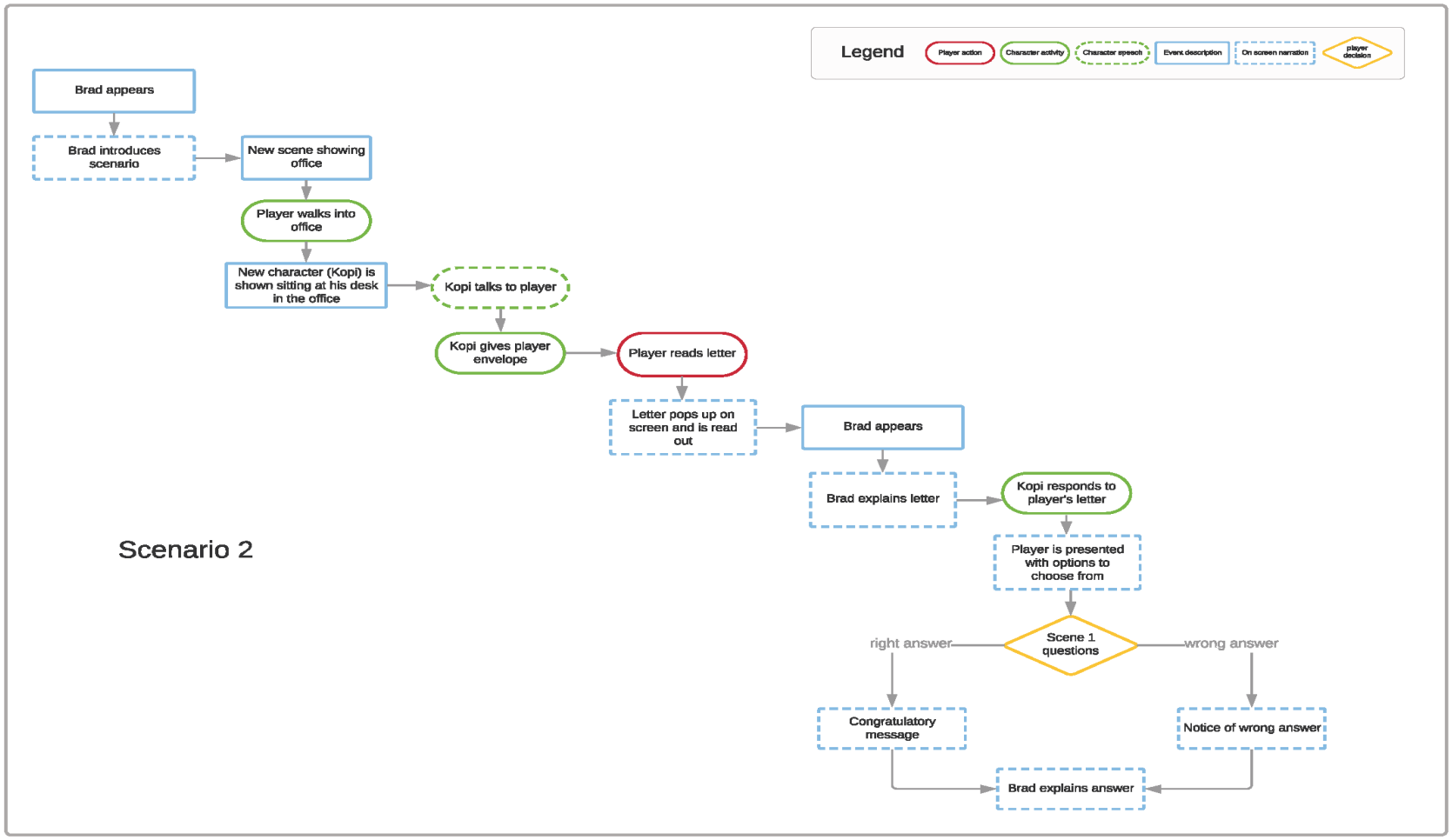

Figure 0.24. *Game flow and legend for scenario 2*

Figure 5.24 shows the game flow of the player's interaction through scenario two, scene one. The figure breaks down the interactive journey between a game player (Brad) and another character (Kopi) in a gamified office setting. The Communication between the game player and the character in the office, as depicted in this scenario and scene, was seemingly effective and seamless.

Scenario 3 – Fraud Suspicion

This scenario teaches the subject of fraud. The player is presented with an office situation where a colleague may have been involved with illegal acts. The player is then asked to choose appropriate options and if they fail, the question will be repeated at a later time in the teaching gameplay. A detailed script of scenario three can be seen in the Appendix D. The game elements included in this scenario only include the core elements. They are included to stimulate the interest and concentration of the learner. They are as follows:

- mechanics (progress bar, timer, status points, and narrative).
- interaction elements (instant feedback and virtual goods).
- system design elements (avatar and curiosity) and
- additional elements (milestone unlocked).

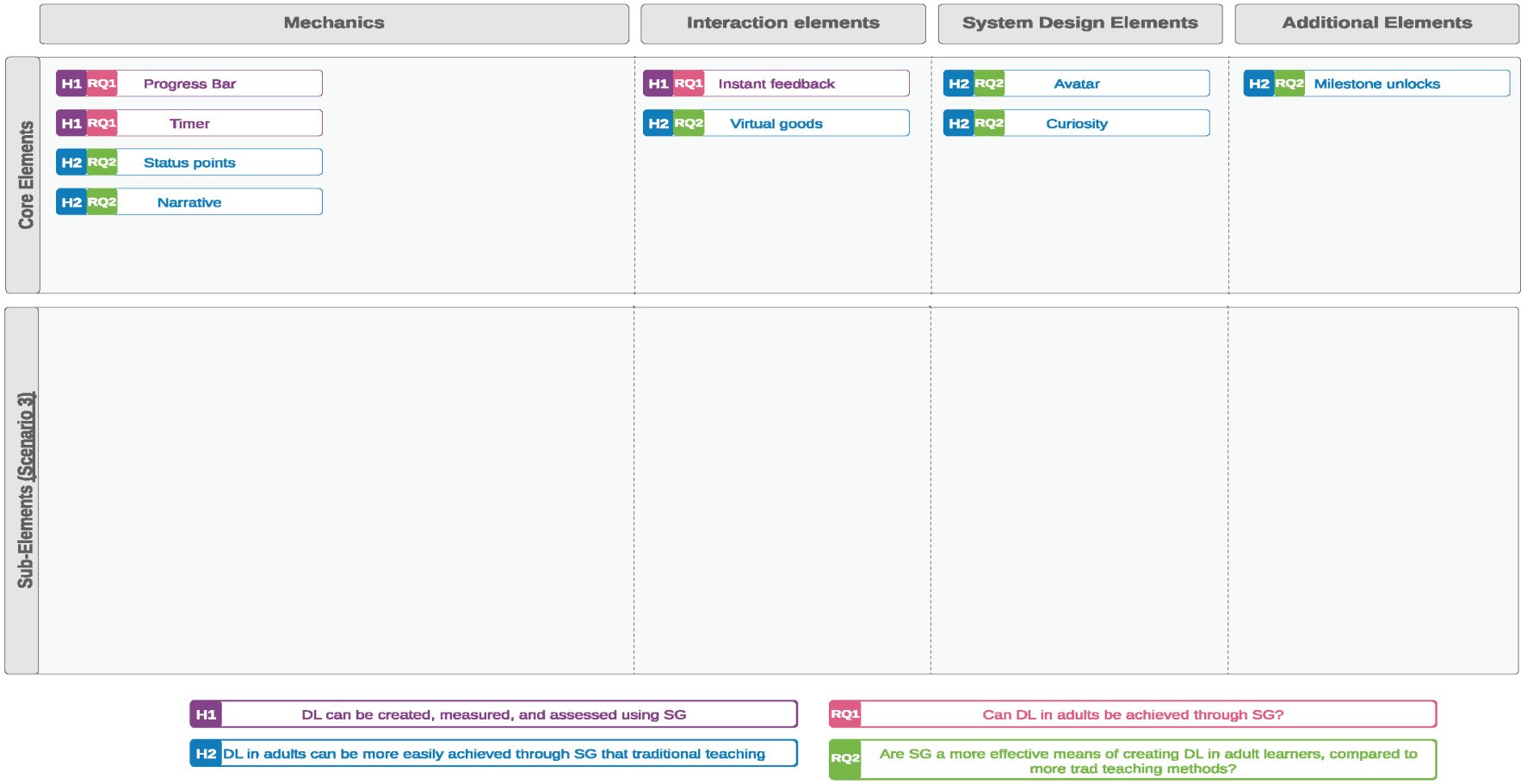

Figure 0.25. *Game element categorisation for scenario 3*

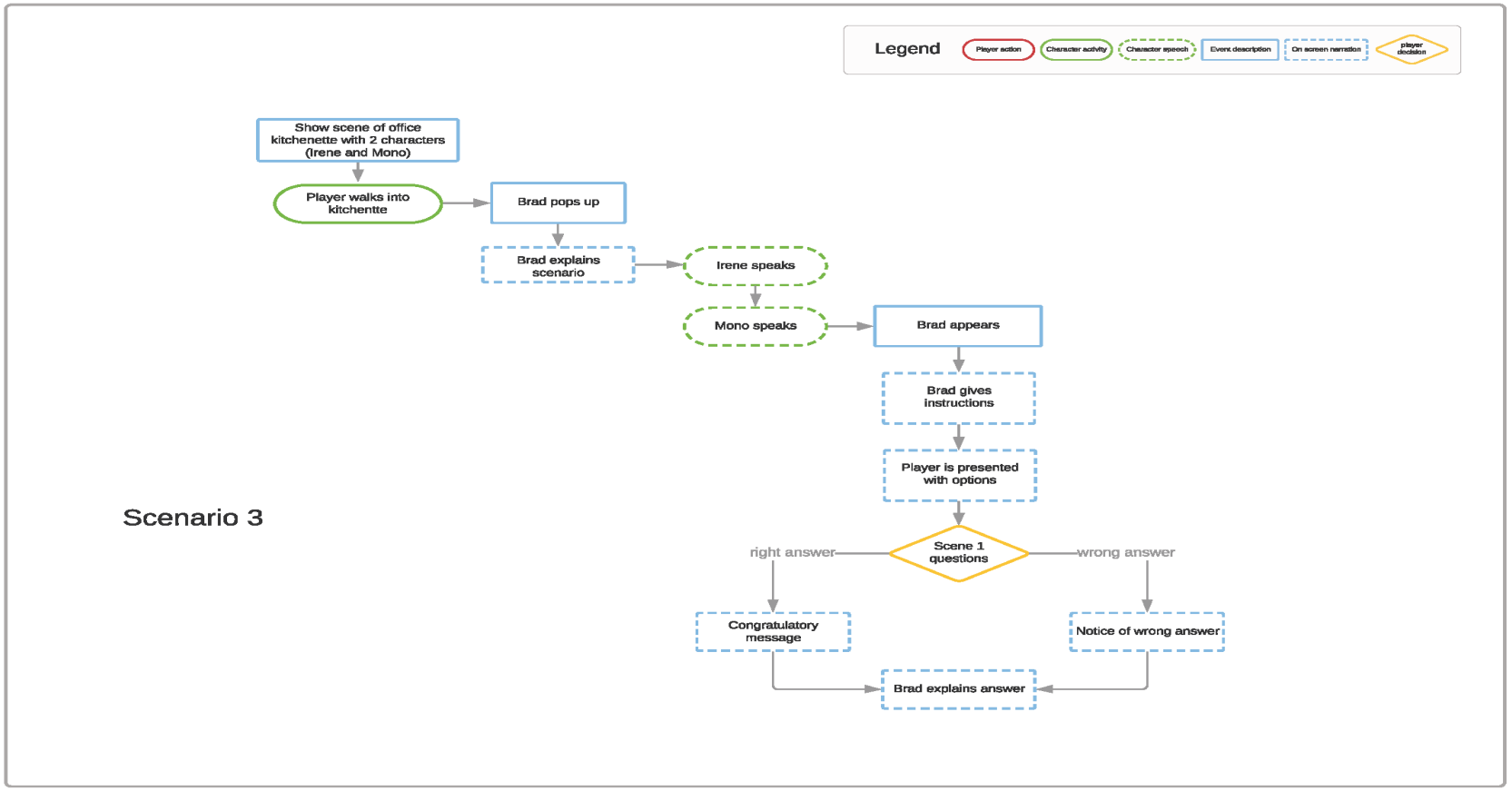

Figure 0.26. *Game flow and legend for scenario 3*

Scenario 4 – Fraud Reporting

Similar to scenario three, this scenario teaches the topic of fraud. This time the player needs to determine what they are witnessing and decide what actions to take based on how a colleague has behaved. The player is then asked to choose appropriate options and if they fail, the question will be repeated later in the teaching gameplay. Also similar to scenario three, the game elements included in this scenario only include the core elements and are as follows:

- mechanics (progress bar, timer, status points, and narrative).
- interaction elements (instant feedback and virtual goods).
- system design elements (avatar and curiosity) and
- additional elements (milestone unlocked).

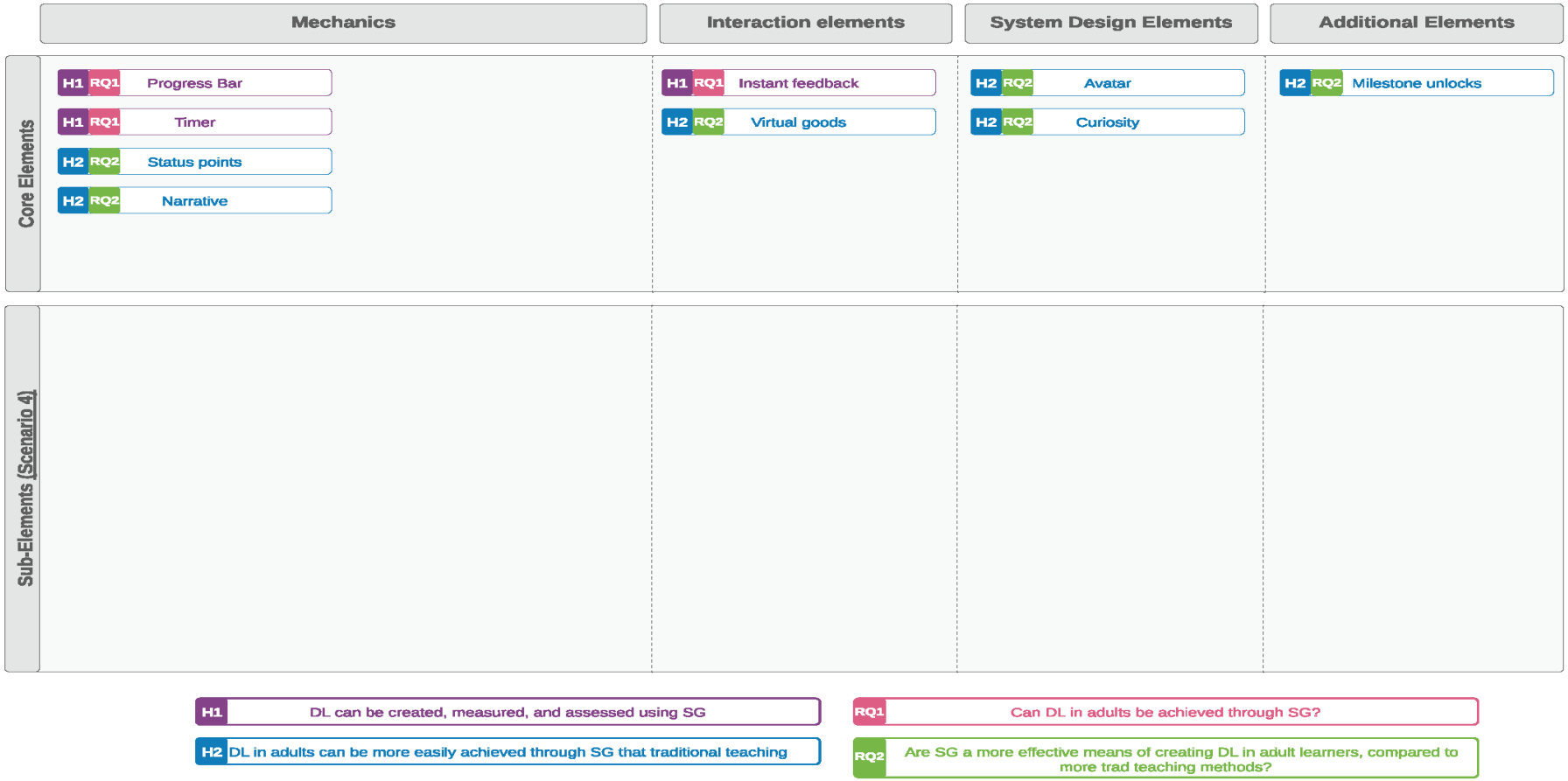

Figure 0.27. *Game element categorisation for scenario 4*

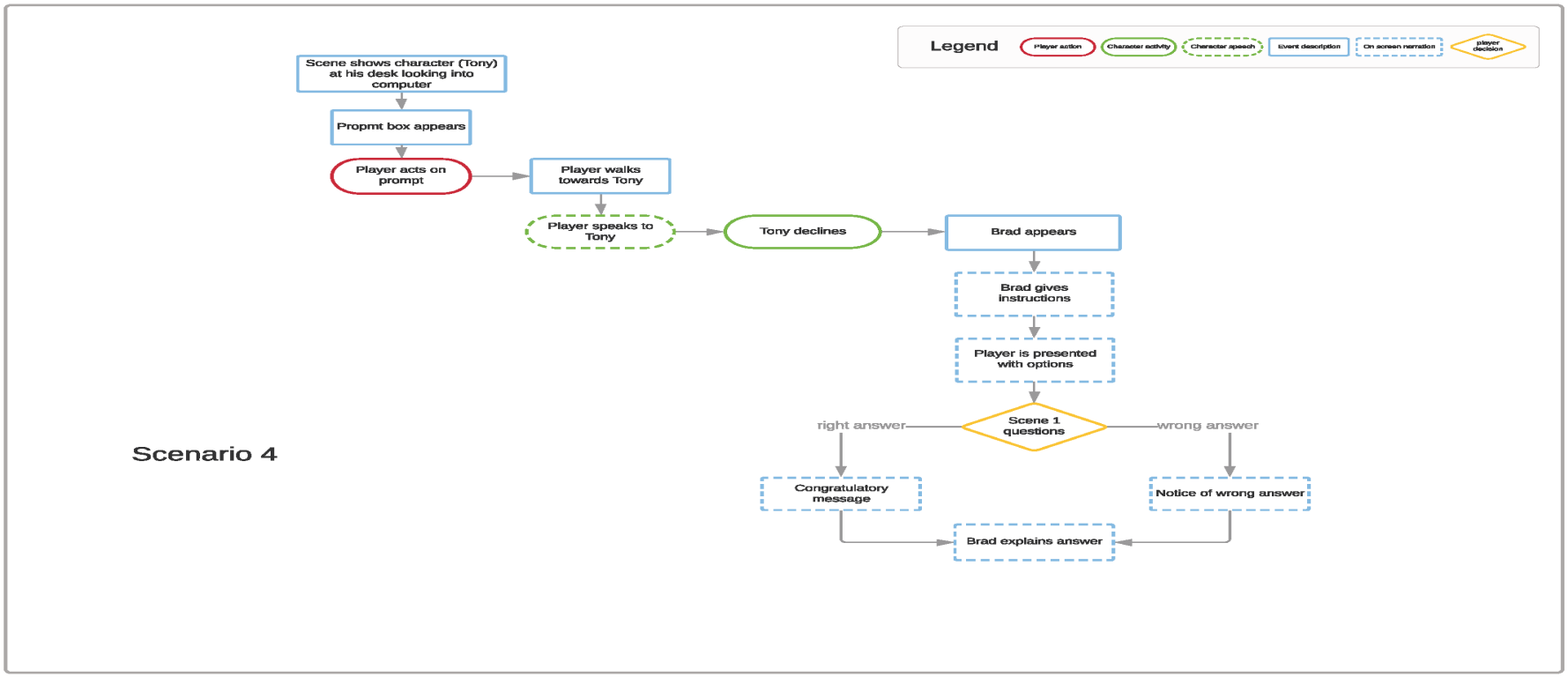

Figure 0.28. *Game flow and legend for scenario 4*

Scenario 5 – Security Practices

This scenario teaches security risk in a workplace. Players will be presented with a workstation and asked to identify the potential risks. Items on the workstation include computer monitor with unlocked screen, documents, and documents on the printer tray. After the scene is complete, players are given explanations on why some items on the workstation pose a risk. In addition to the core elements, scenario 5 uses dangling, unpredictability, and beginners' luck in the scene. The game elements included in this scenario are as follows:

- mechanics (progress bar, timer, status points, dangling, and narrative).
- interaction elements (instant feedback, virtual goods, beginners' luck, strategy and unpredictability).
- system design elements (avatar and curiosity) and
- additional elements (milestone unlocked).

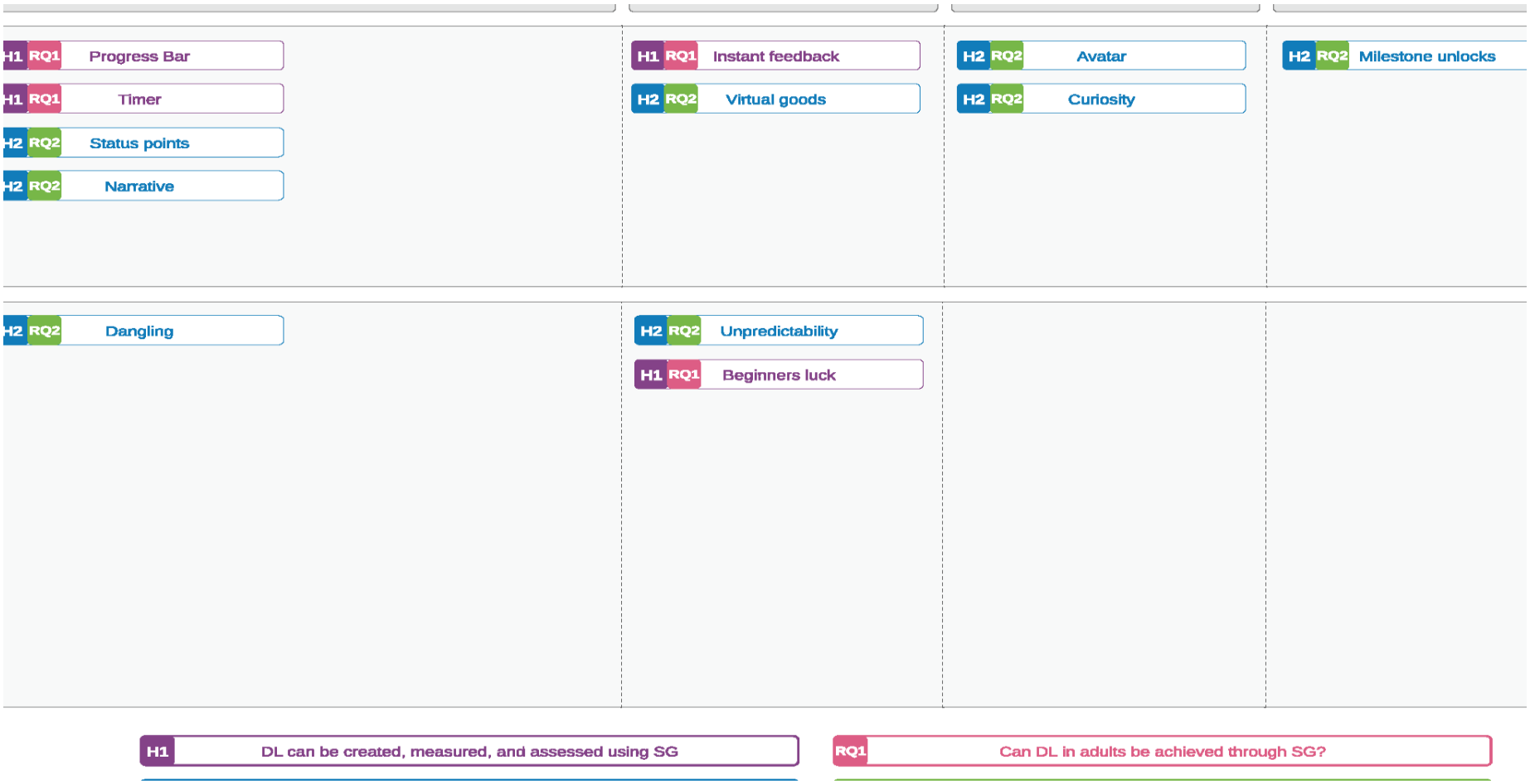

Figure 0.29. *Game element categorisation for scenario 5*

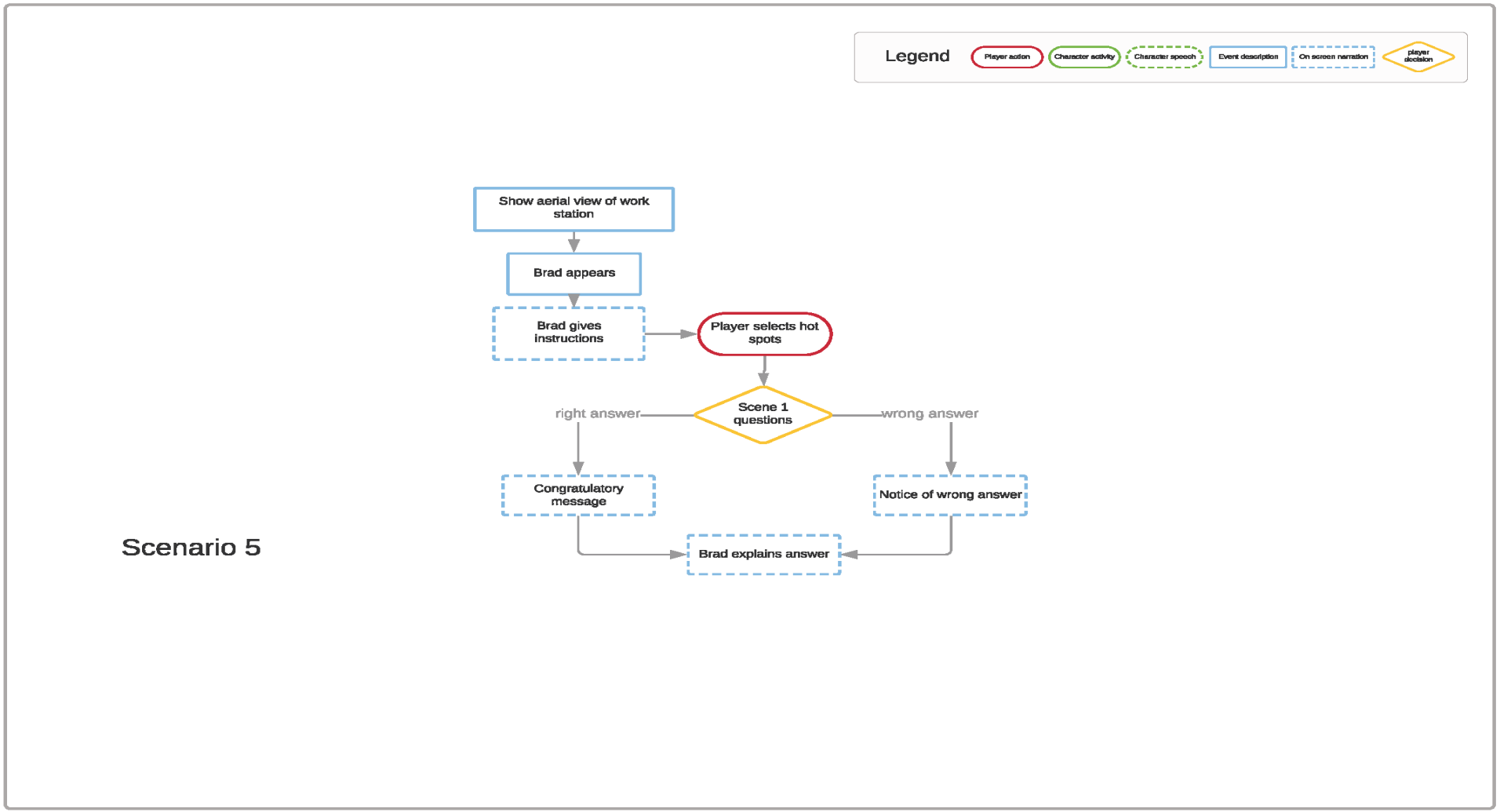

Figure 0.30. *Game flow and legend for scenario 5*

Scenario 6 – Equality

This scenario teaches equality in the workplace. Players are presented with a narrative on different personas and asked their opinion on the individuals' information. A detailed script of scenario 6 can be seen in the Appendix D of this research. In addition to the core elements of the game, scenario 6 uses *unpredictability* game element in the scene. The game flow for scenario 6 can be seen in Figure 5.32 below. The game elements included in this scenario are as follows:

- mechanics (progress bar, timer, status points, and narrative)
- interaction elements (instant feedback and virtual goods)
- system design elements (avatar and curiosity) and
- additional elements (milestone unlocked).

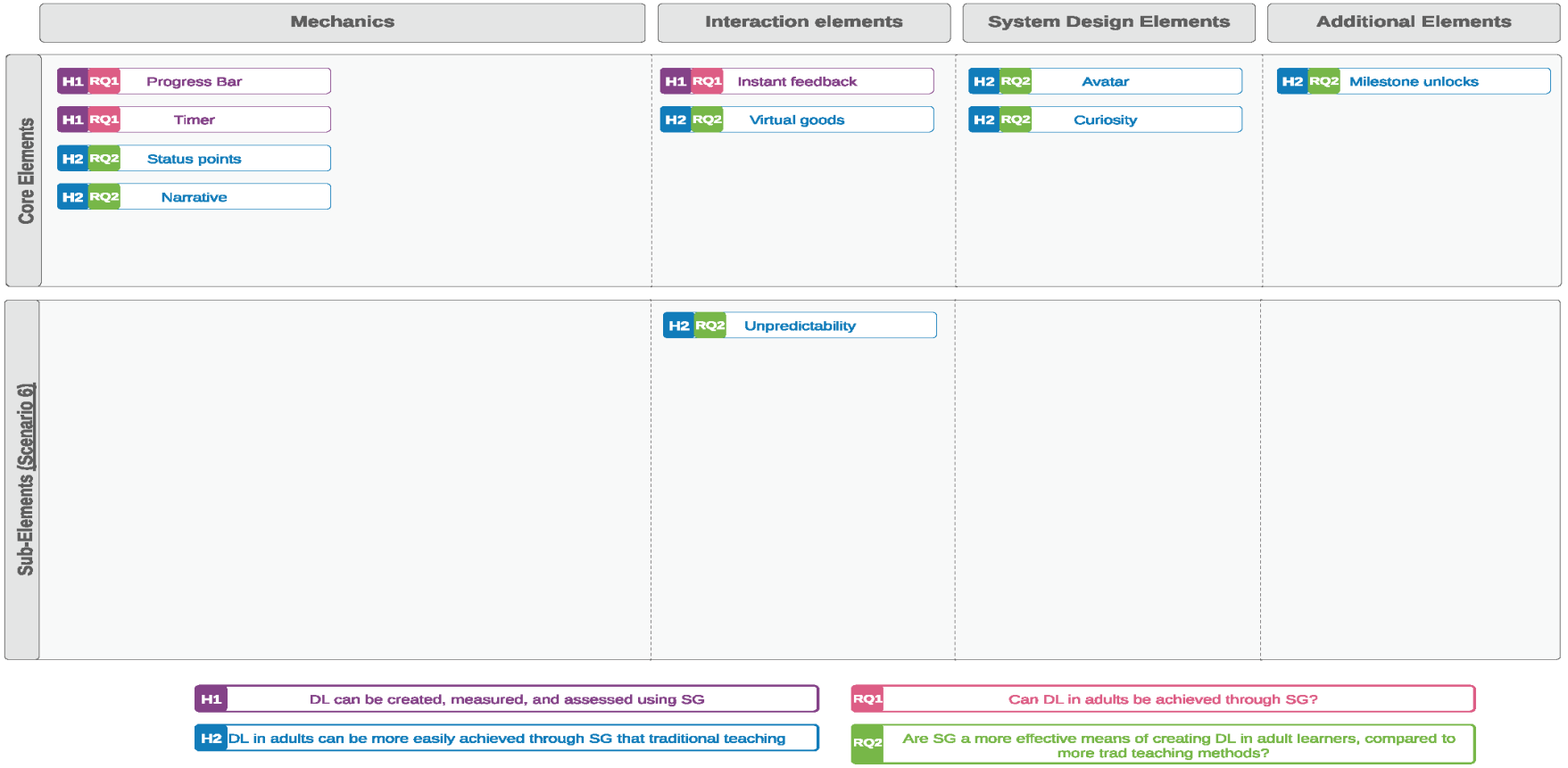

Figure 0.31. *Game element categorisation for scenario 6*

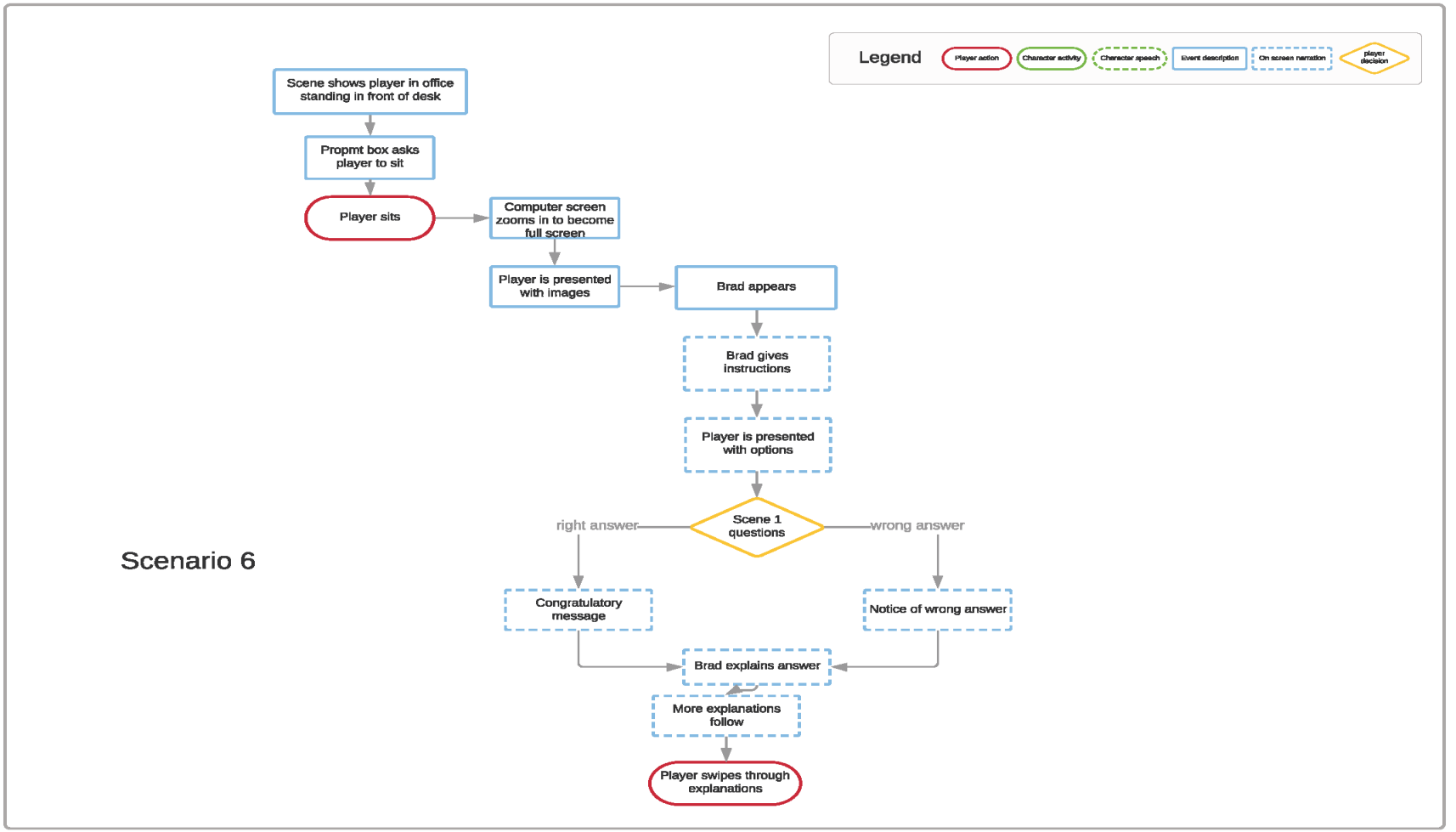

Figure 0.32. *Game flow and legend for scenario 6*

Scenario 7 – Diversity

This scenario teaches diversity in hiring in the workplace. Players listen to a conversation between colleagues and then give their opinion on the decision to take based on the information. A detailed script of scenario 7 can be seen in Appendix D of this research. In addition to the core elements of the game, scenario 7 uses *hover effect* and *unpredictability* game elements in the scene. The game flow for scenario 7 can be seen in Figure 5.34 below. The game elements included in this scenario are as follows:

- mechanics (*progress bar*, *timer, status points, hover effects, and narrative*)
- interaction elements (*instant feedback, virtual goods, and unpredictability)*
- system design elements (*avatar and curiosity)* and
- additional elements (*milestone unlocked*).

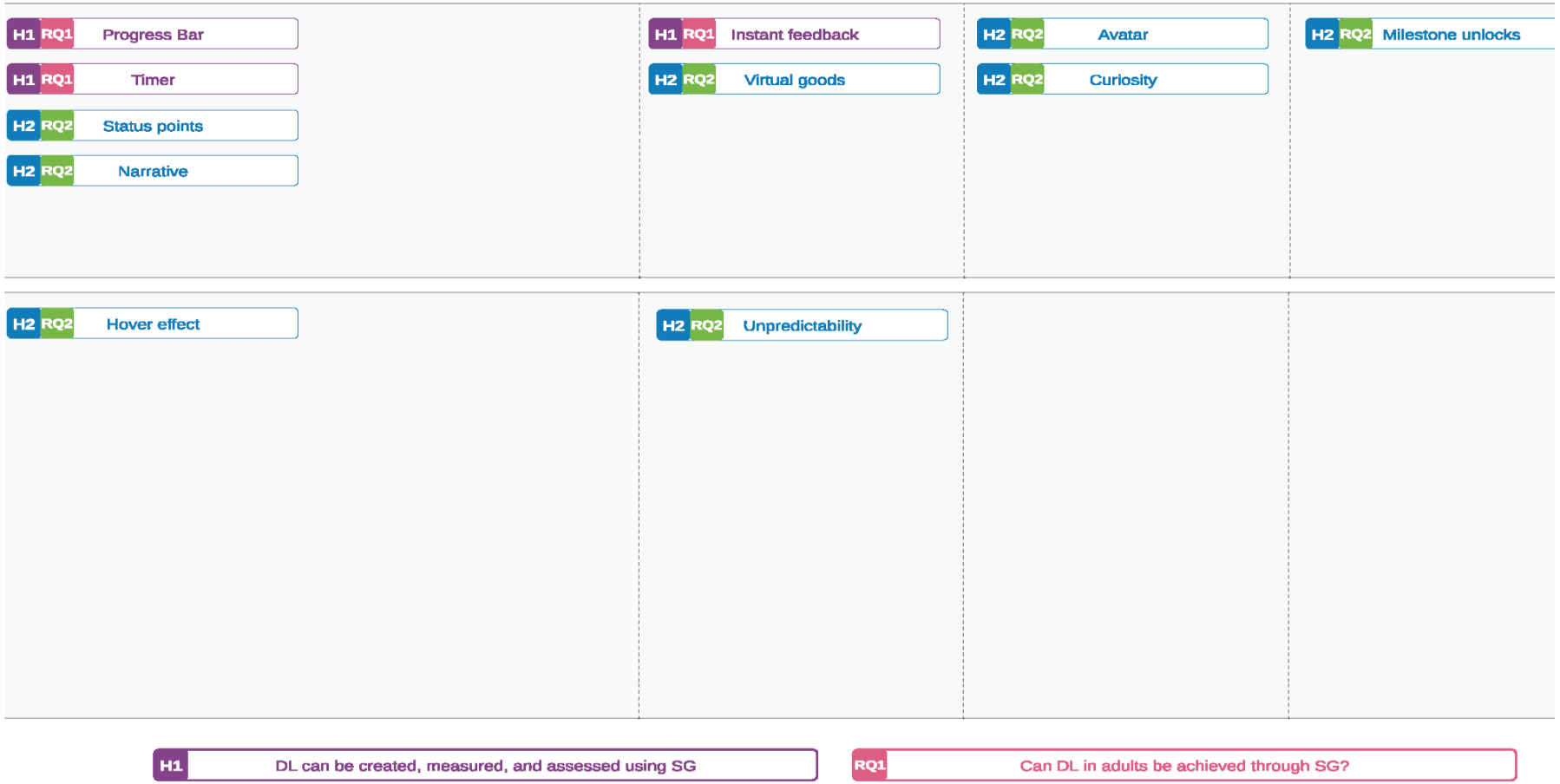

Figure 0.33. *Game element categorisation for scenario 7*

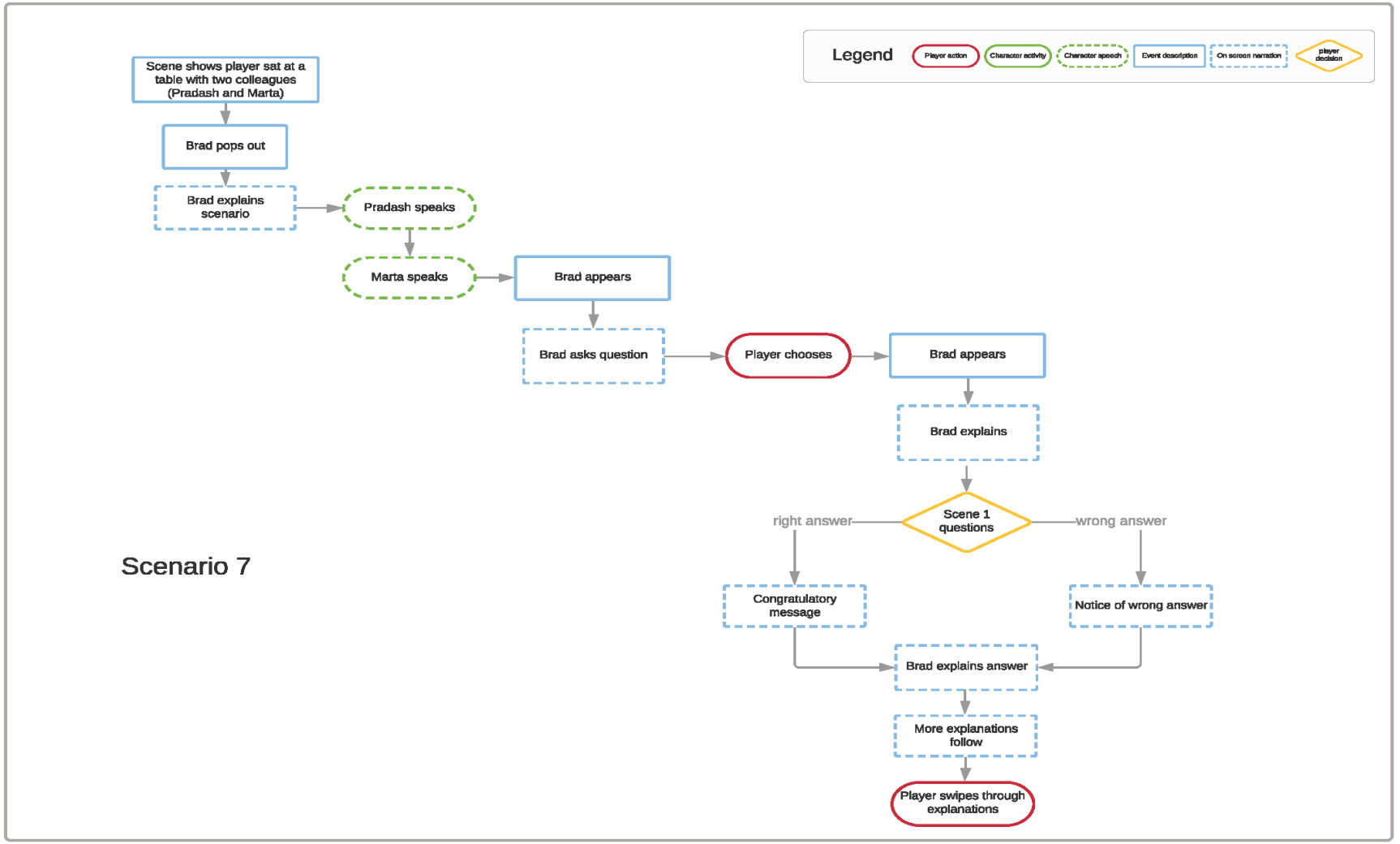

Figure 0.34. *Game flow and legend for scenario 7*

Scenario 8 – Sexual Harassment

This scenario teaches sexual harassment in the workplace. Players are asked to decide on the subject based on their colleagues' behaviours. A detailed script of scenario 8 can be seen in the Appendix D. The game elements included in this scenario are as follows:

- mechanics (*progress bar*, *timer, status points, and narrative*)
- interaction elements (*instant feedback and virtual goods)*
- system design elements (*avatar and curiosity)* and
- additional elements (*milestone unlocked*).

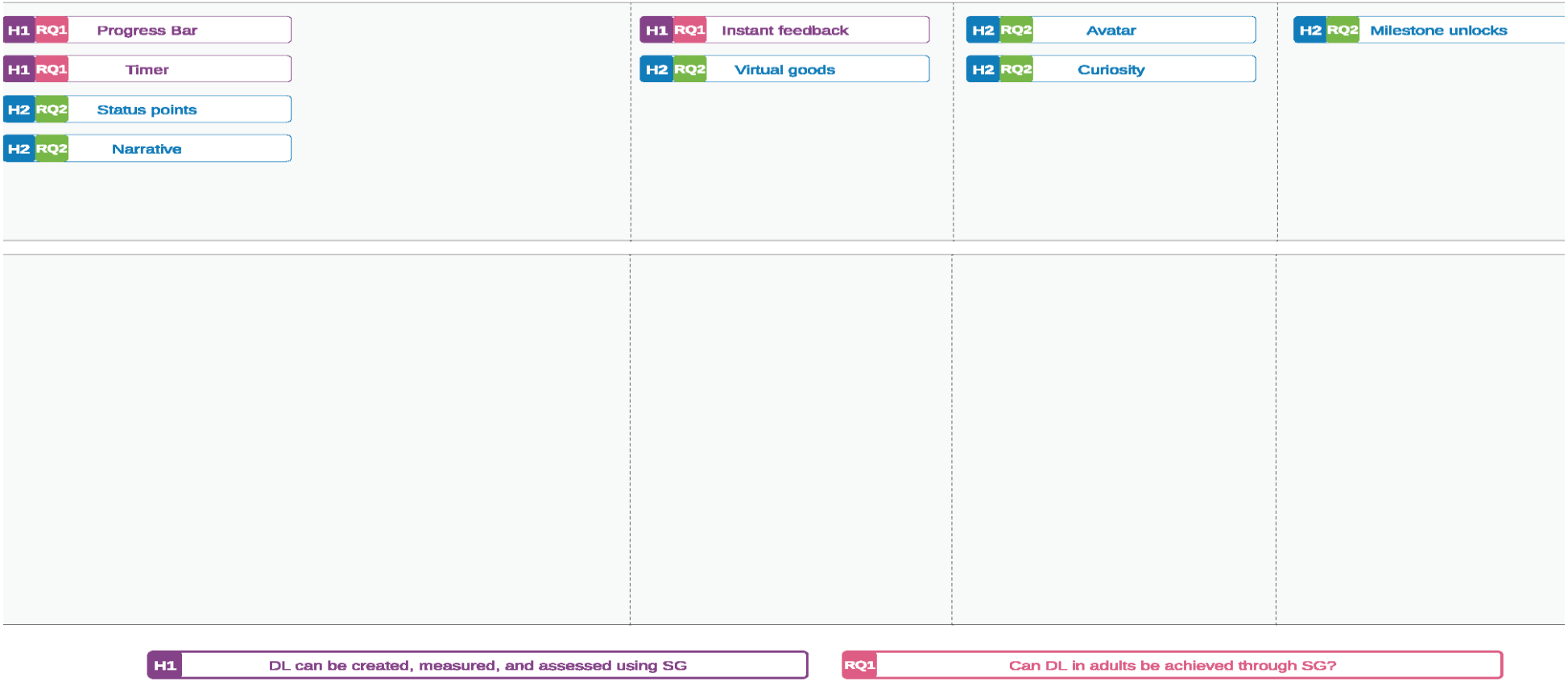

Figure 0.35. *Game element categorisation for scenario 8*

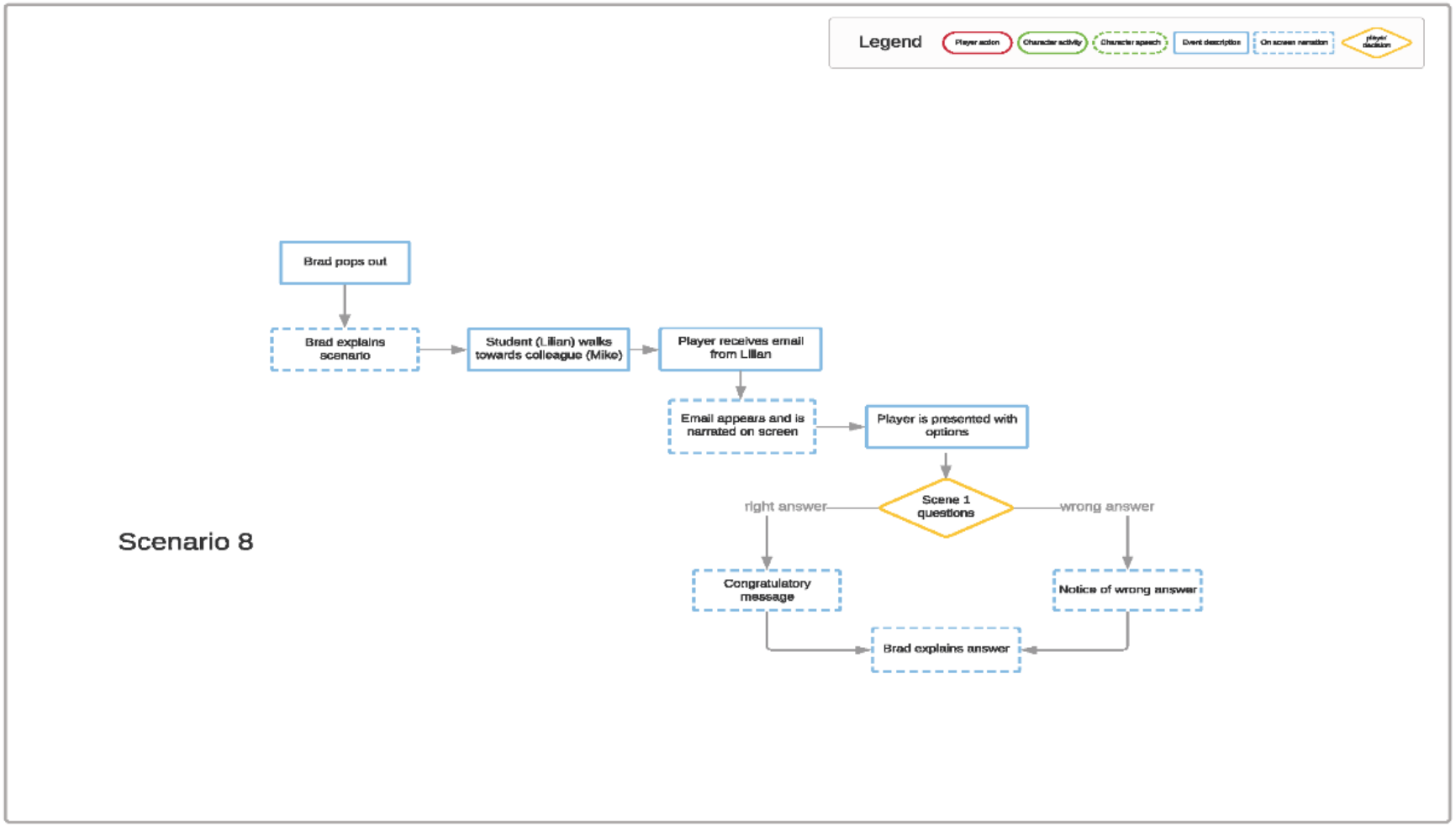

Figure 0.36. *Game flow and legend for scenario 8*

Scenarios 9 and 10 – Inclusion

These scenarios teach inclusion in the workplace. Players are set in a scene where colleagues with different views about the end of year holiday discuss their opinions. A detailed script of both scenarios can be seen in the Appendix D of this research. In addition to the core elements of the game, both scenarios also use *strategy*, *loss aversion* and *time pressure* game elements in the scene. The game flow for scenario 9 can be seen in Figure 5.38 below. These elements are embedded in four categories, namely:

- mechanics (progress bar, timer, status points, and narrative)
- interaction elements (instant feedback, virtual goods, and strategy)
- system design elements (avatar, curiosity, loss aversion, and time pressure and scarcity) and
- additional elements (milestone unlocked).

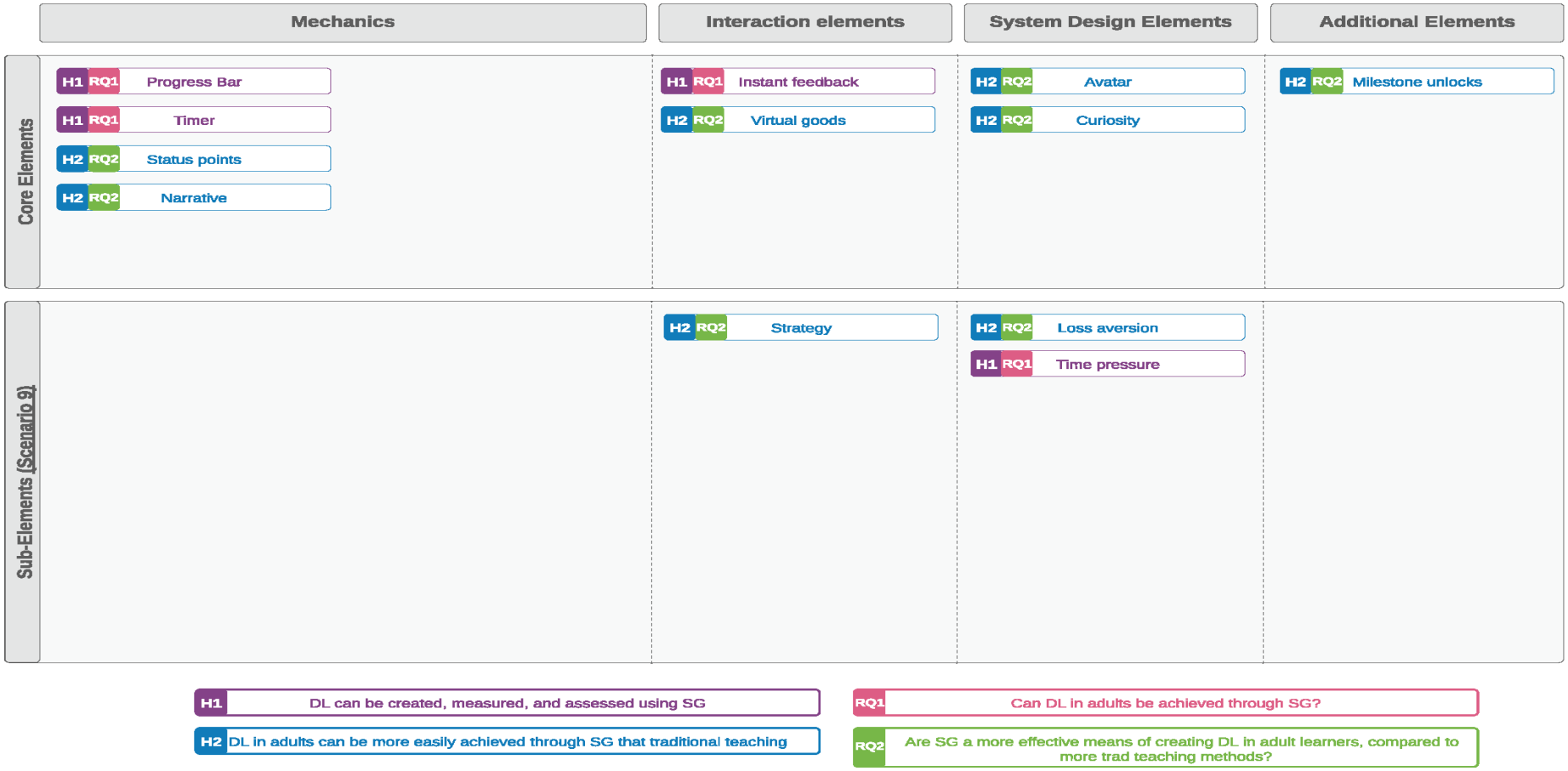

Figure 0.37. *Game element categorisation for scenarios 9 and 10*

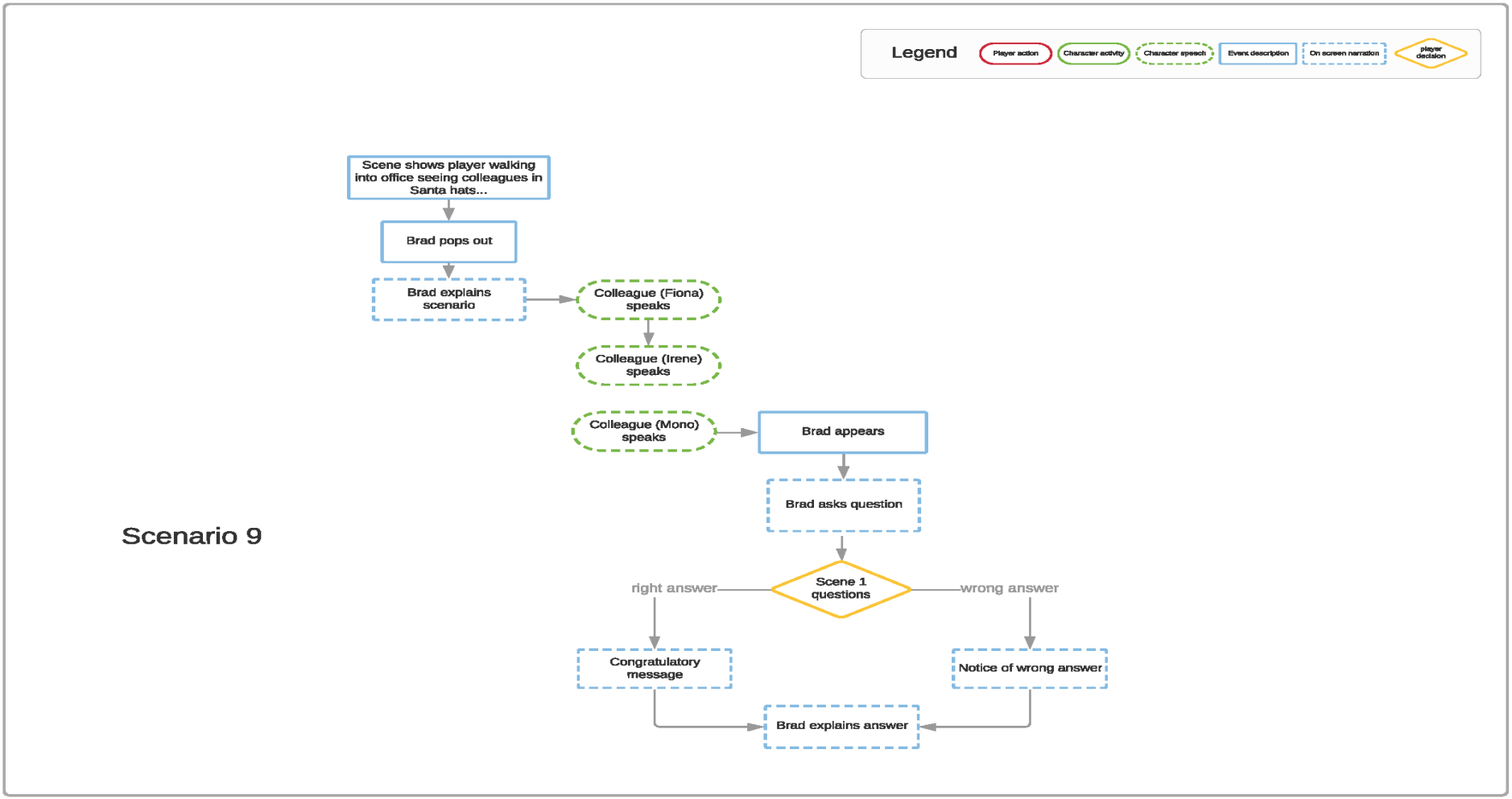

Figure 0.38. *Game flow and legend for scenario 9 of digital Serious Game*

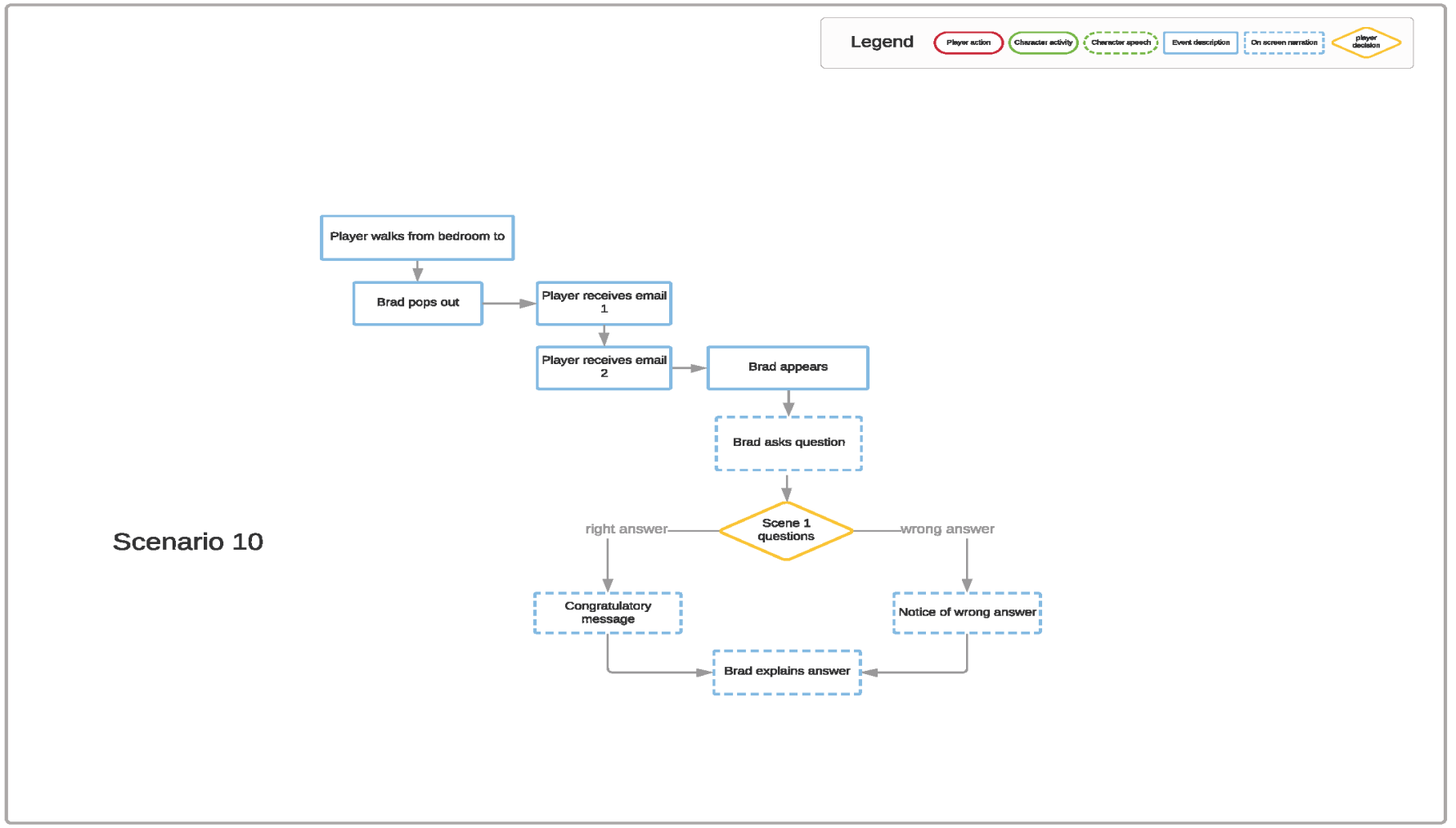

Figure 0.39. *Game flow and legend for scenario 10*

5.8. GAME DEVELOPMENT CHALLENGES

As mentioned previously in Section 1.7., the development of the andragogical gaming tool required research into available authoring tools or game development platforms. This entailed a comparative assessment of the various tools available to build the game, in line with the broader objectives of the research. Following a careful consideration of available options, a development platform that can allow to build a game within the timeframe of the research, but still intricate the required design and game elements and capabilities to study the research questions. However, these practical considerations, as well as other requirements for game development grew into development challenges, which are discussed in the following sections.

5.8.1 UNITY WEBGL AS DESIGN TOOL AND ITS ACCOMPANYING CHALLENGES

When considering the platform to develop the game, it was necessary to comply with the following requirements:

- allow the integration of the required game elements for each scenario, representing the Octalysis framework component of Game ELC+.
- include the unique scoring model created to monitor and evaluate levels of learning as players progress, representing the Bloom's taxonomy component of the Game ELC+ framework.
- accommodate teaching through multiple channels – audio, visual, and more if necessary, representing the CTML component of the Game ELC+ framework.
- create scenarios that can test for DL based on Ruskov's theory as the final component of our framework.
- Some of the tools that have been reviewed included Unity, Unreal Tournament, V-Ray, Blender, Keyshot, Cinema 4D, and Twinmotion.

As such, Unity WebGL was selected as the preferred tool to build the SG. Unity WebGL is a JavaScript application programming interface (API) for rendering high-performance interactive 3D and 2D graphics within any compatible web browser without the need to use plug-ins (Unity Developers, 2020). The API pushes content, which is supported in most versions of browsers. Users can play games without having to download apps, or access independent gaming consoles. Unity WebGL was therefore chosen as the most appropriate development platform because it can fully integrate the Game ELC+ framework, can run optimally on web browsers, and it is cost effective. Accessibility was also considered as it was imperative to build a game that could be accessed easily by the players, given the research timelines for testing, feedback, and analysis. Finally, hosting the game as a web-based environment would reduce strain in the player onboarding process and save time. While these reasons informed the choice of building on a web-based platform, some challenges were still encountered.

5.8.1.1. Unity WebGL and Game ELC+ Framework Compatibility: The compatibility of Unity WebGL with the Game ELC+ framework, was not without challenges. Testing indicated that although the API content is supported by major browsers, there are variations in the level of support offered by these browsers. As a result, the players may encounter errors from which they might not be able to recover.

5.8.1.2. Unity and WebGL API Compatibility: Although the Unity WebGL API could assimilate a good number of features from Unity as a game design tool, there were certain features that were unavailable, for instance:

- threads are not supported due to the lack of threading supporting in JavaScript. This applies to both Unity's internal use of threads to speed up performance, and to the use of threads in script code and managed *dlls*.

- WebGL builds cannot be debugged in Visual Studio.
- browsers do not allow direct access to IP sockets for networking due to security concerns (see WebGL Networking).
- the WebGL graphics API is equivalent to OpenGL ES 2.0 and 3.0, which has some limitations (see WebGL Graphics).
- WebGL builds use a custom back end for audio, based on the Web Audio API. This supports only basic audio functionality (see using audio in WebGL).
- WebGL is an AOT platform, so it does not allow dynamic generation of code using System. Reflection Emit. This is the same on all other IL2CPP platforms, iOS, and most consoles.

5.8.1.3. Unity WebGL Memory Restrictions: An additional challenge with development was the restrictions on how much memory could be used. This meant that the game being developed had to be highly optimised. Code and assets needed to be prepared efficiently, mechanics needed to be programmed elegantly, and models needed to have a small number of vertices while remaining detailed. Finding the right balance between all these elements provides a challenge when trying to build a game that meets the brief of a Minimum Viable Product but is also attractive and engaging to the player. This is even more important when the game is a simulation that needs to maintain levels of realism.

5.9. GAME DESIGN CHALLENGES

The development of the andragogical gaming tools required research into the game building tools that are available. This entailed a comparative assessment of the various tools available to build the game in line with the broader objectives of the research. Following a careful consideration of the available options, the study prioritised a simple game building tool that can be built within the timeframe of the research, but it is still intricate enough to accommodate

all elements and capabilities needed to teach in an engaging way. However, these practical considerations, as well as other requirements for game development grew into development challenges, which are discussed in the following sections.

5.9.1. *Creating Realistic and Relatable Scenarios*

The fact that player engagement is the key objective of SG makes it imperative to develop scenarios that are both relatable and realistic, as one without the other would be disadvantageous to the learning objectives of the game. A realistic but unrelatable game would only be interesting to look at but not deliver the desired results in terms of learning. Likewise, a relatable but unrealistic game will not be engaging enough to hold the player's attention and deliver desired results. In order to satisfy both requirements, the researcher consulted an experienced HR professional – Dr. Chima Mordi from the Business School offices at Brunel University – for the design of relatable game scenarios. This brought to the fore the challenge of effectively applying the tools available for game development to build scenarios created by the HR expert in a realistic way that stimulates an immersive player experience and also drive engagement.

5.9.2. Assessing Learning and Teaching

Determining the number of game scenario iterations to justify sufficient testing and teaching was informed by the game mechanics, drawing from scientific evidence, demonstrating that a player is to be tested or taught to a certain extent (in this case, using a certain number of scenarios) before making conclusions about the player's knowledge/skill level. Likewise, for the teaching phase. In order to evaluate the strength of the digital game-based andragogy, a player must have been sufficiently taught a topic to progress to testing his/her knowledge and understanding.

5.9.3. Accessing HR and Academic Expertise

An equally important, but more scientific stage of the game design process was to develop the right options for player feedback. Two critical factors were involved in this stage. The first being the formation of accurate questions which are relevant to the subject matter, simple enough to assimilate, but complex enough to require the player to be thoughtful. The second aspect is that these questions correspond accordingly with the levels of learning from Bloom's Taxonomy and Ruskov's theory, being the premise of the scoring algorithm developed for this framework. In order to mitigate against this challenge, the researcher relied on the expertise of a HR professional to develop the accurate player options. The researcher also relied on the expertise of an educationist that can assess and verify that the player options in each scenario reflects the corresponding learning levels and evidence of DL from Bloom's Taxonomy and Ruskov's theory respectively.

5.10. CHAPTER SUMMARY

This chapter details the research instruments of this study and justifies their application in answering the research question. It discusses the different instruments of the research including the prequalifying questionnaire, the eLearning platform and content for traditional andragogy, and the online SG created for comparative analysis of adult DL. It goes further to elaborate on the design of the games, the game flow, and scenarios used in the gaming experience. Furthermore, it evaluates the game element categorisation according to the MDA frameworks and explains with diagrams the grouping of specific elements and how the adult player will interact with them in each scenario.

The chapter also outlined and discussed the game development process and tool, citing the reason for choosing Unity WebGL as the development platform. This is in addition to

discussing the development (technical) and design challenges in creating the serious game. The next chapter builds on these discussions by analysing the data derived from the gameplay and testing of the game.

CHAPTER 6 RESULTS AND ANALYSIS

6.1. INTRODUCTION

In Chapter 5, the study explained the research instruments and justified their application in answering the research questions. It discussed the different instruments of the research including the prequalifying questionnaire, the eLearning platform and content for traditional andragogy, as well as the online SG created to comparatively analyse adult DL. It went further to elaborate the scenarios used such as the game flow, how the design decisions in each created scenario mapped the MDA and Game ELC+ framework. Additionally, the chapter provides detailed diagrams that depict the grouping of game elements in the different scenarios and the flow of interaction of adult players in each scenario.

Additionally, the chapter described the research instruments used in conducting the study and the processing of data collection culminating in testing the research hypotheses. The chapter presents the study plan and highlights how the study has been operationalised. It provides an overview of the participant selection and the recruitment process. It then presents the research study process, including the specification of the study variables and working assumptions. Following this, the statistical analytical approach to compare the data through the comparison of the means of post-learning score of serious games and traditional eLearning method are explained.

The study finds that participants using the SG achieved a higher learning outcome than participants using traditional eLearning material and this may not be unrelated to the gaming elements integrated in the SG. Participant observation during the testing phase suggests that the participants interacting with the SG demonstrated high level of engagement and curiosity, when compared to participants who used the traditional eLearning platform.

6.2. Study Sample And Participant Recruitment

Three hundred (300) participants were informed of the purpose of the study and invited through emails and face-to-face conversations to take part. Following this initial contact, an email was sent to all participants explaining the different phases and processes of the experiment. With a response rate of 38%, 114 participants consented to participate in the study. Participants were recruited based on the following parameters:

- **Source**: Participants are chosen through a LinkedIn search using keywords such as "HR", "Head of People", "HR manager". As mentioned in Chapter 2, there are several diverse reasons for the choice of HR managers, these include but not limited to the challenges they experience in balancing the diversity required at the organisations they are recruiting for. Furthermore, the nature of their job and the impact they make on deciding the quality of talents they bring into organisations mean that their contribution can lead to a quality analysis of the game testing process.
- **Focus Area**: As a starting point and to narrow the sample choice, tech companies are selected to provide a dynamic area to establish this research. The research chose this focus area due to the fast-paced nature and often challenging needs of tech organisations in the recruitment of new employees.
- **Participants' Age Range**: Participants are shortlisted based on people between the ages of 25- 55. While the LinkedIn search provided a wide array of options, these age groups are necessary to allow an inclusion of early, mid, and advanced career HR people to contribute to the testing of the game.
- **Race Demographic**: A filter process that responsibly selected from Black/African, Asian and Caucasian HR participants. This is important to capture the reality of our world and to ensure that the game testing was conscious of how a diversified participant group can lead to a richer outcome.

Participants emails and all other personal data will be deleted after participant feedback is gathered and tagged to encrypted IDs for the purpose of reporting.

6.3. ETHICAL CONSIDERATIONS

The research study complied with the provisions of University Ethics Guide (see the University of Westminster Code of Practice Governing the Ethical Conduct of Research 2020/21. Also, the British Educational Research Association Document Ethical Guidelines for Educational Research 2011) to proceed with study testing involving real users.

University ethics approval acquired for this study and a consent form was prepared and signed by all the participants along with a participant's information sheet provided to them on information about the purpose of the study (See Appendix A). Therefore, to conduct the research study, the following ethical issues were addressed:

- informed consent was granted from participants and participants were treated with dignity and without prejudice.
- there was no coercion in recruitment of participants.
- confidentiality and anonymity of participants personal data following the Data Protection Act (1998) was adhered to.
- the researcher took the responsibility to design an inclusive study, fit the purpose, produce meaningful data and cover themes that positively contributed to and extend knowledge of pedagogy.

For the current research thesis all related documents were submitted for approval to the Westminster Research Ethics Committee:

- the Part A form which describes the pedagogic nature of the research thesis.

- the Information Sheet which informs the participants about the aims and the scopes of the research study.
- the design of participants' consent form that gives the researcher the consent to collect, analyse and publish data about participants anonymously, meaning without revealing their identity.

6.4. THE RESEARCH STUDY PROCESS

Game testing is an essential method employed to evaluate and improve product design and user experience. The collection of data sample and analysing them can be a complex exercise in game testing, however, researchers contend that it is an efficient way to collect rich data from users. To ensure that the design or development of the game do not influence user outcomes or how they encounter the game, the testing stage is an essential step. According to Ternauiuc and Vasiu (2015), game testing ensures that research elements used in the study are satisfactorily evaluated.

The study was conducted remotely, at the convenience of the participants. As such, the data was gathered at various times over a 9 months period, starting in March 2021 and terminated in December 2022. The long duration of data collection was due to the reduced pace of working and feedback caused by the impact of the COVID-19 pandemic. Within the first 3 months, the invitations were sent out 3 times in batches of 100 invitees. The invitations were sent via email using SurveyMonkey tool. The first batch of 100 invitations yielded 32 participants, the second campaign had the highest number of respondents which recorded 51 participants, and the third campaign had 31 participants who responded. This brought the total number of respondents to 114.

Within the fourth month, a link to the pre-qualifying survey (see Figure 5.1) was sent out to the entire sample size of 114 people who consented to participate in the study in line with the ethics guidelines. Prior to the commencement of the study process, the researcher welcomed the participants and clarified any concerns that they may have had. Each participant was also sent a link to the online participation sheet (see Appendix B), which further explained the aim of the study and sought their consent to apply their data anonymously for academic purposes only. All the 114 participants who participated in the pre-testing phase signed the consent sheet and completed the study despite being informed that they are free to withdraw their consent and exit the study should they want to do so. It is important to note that the survey was done using Google Forms and participant personal details were not collected in accordance with GDPR guidelines.[4] Overall, from a practical point of view, the data-gathering phase of the study proceeded smoothly.

Feedback was collected, enabling the research to categorise the participants into the Experimental (E) and Control (C) groups, as shown in Figure 6.1. From the pre-qualifying survey, 47 participants scored 50% and above; showing good knowledge of the subject matter and, as such, were classified in the Control Group (C) based on the categorisation in Figure 3.2. Out of the 70 participants who scored 49.9 % and below, 60 were randomly selected and placed in the Experimental Group (E). Group E was then randomly split at random into two equal sub-groups of 30 participants each, with the first group (E_1) consisting of participants who would learn using the digital E1 created based on the Game ELC+ Framework while the second group (E_2) consists of participants who would learn through the traditional eLearning method.

[4] https://www.gov.uk/government/publications/guide-to-the-general-data-protection-regulation

Within the fifth, sixth, and seventh months, the 60 participants within the E category completed the learning exercise through the different learning channels – traditional eLearning and digital SG. The traditional eLearning process was created using Articulate Storyline which enabled the research to collect the type of data that can be compared with that from the alternate learning method. The alternate learning method – digital E_1 – was created using Unity WebGL which enabled the research to accommodate all elements of the Game ELC+ Framework. In this timeframe, they also completed the test exercise which flows automatically after the learning exercise. That is, after being taught through these different methods in the learning stage, both groups (E_1) and (E_2) are then tested through the traditional eLearning method and SG method. The purpose of this is to compare the effectiveness of the different learning methods used in the learning stage of the research. The diagram below depicts the participant numbers and flow. Following a period of 2 weeks, group E_1 was subjected to a retention test in order to ascertain if DL has occurred.

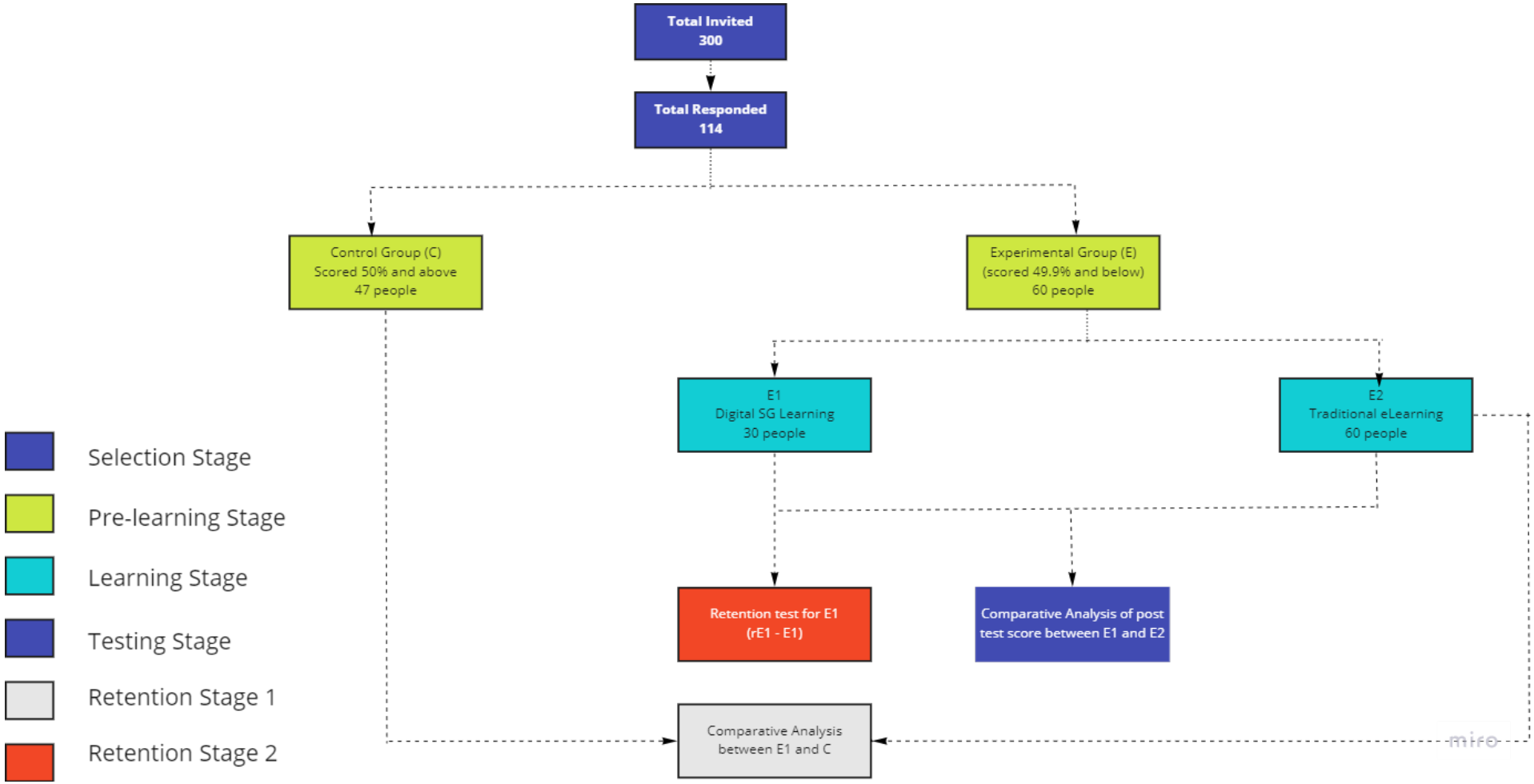

Figure 0.1. *Participant and Process Flow for Testing of Thesis Framework*

Both qualitative observations and quantitative data were duly gathered, recorded and subjected to analytical scrutiny, with the ultimate objective of validating or invalidating the research hypothesis. This is discussed in detail in the subsequent section.

6.5. Analysis And Results

The quantitative component of the data was analysed using ANOVA test. Kenton and Waters (2021) explain that the ANOVA test allows a researcher to determine the significance of a survey or experiment. Put differently, it is an approach to data analysis that facilitates the decision to either accept an alternative hypothesis or reject the null hypothesis. In simpler terms, it allows for the comparison of two groups in order to determine if differences exist between them or if one group is better than the other.

Following this analytical approach, Microsoft Excel was used for the data analysis and it proceeded in two stages of between-group comparison. While the first stage compared the mean score of the traditional learning game and SG, the second stage compared the mean score of the difference between the experimental and control groups. The following section expatiates this process.

6.5.1. Approach to Data Analysis

In order to address the first research question of the thesis, the analysis proceeds in three stages.

Stage 1: Hypothesis Formation

Two hypotheses form the basis of the analysis in this chapter—the null (H_0) and the alternative (H_1). The null hypothesis proposes that no significant difference exists between the means of the variables, while the alternative hypothesis proposes that a significant difference does exist. To the extent that the null hypothesis in this study is true, there is no difference in the mean

values of SG and traditional learning games. This suggests that there is no difference between learning using SG and traditional learning games, implying that SG have not improved learning outcomes. Where the alternative hypothesis is true, indicating that a significant difference does exist in the mean values of SG and traditional learning games, the difference did not occur by chance.

Stage 2: Normality Test

A normality test is used to determine if the sample data derives from a normally distributed population. Here, it helps in selecting the choice of test to use in testing the mean. A set of data is said to be normally distributed when the significant value is greater than 0.05, prompting us to accept the null hypothesis. When the data is found to be normally distributed, a parametric test is used to compare the means of the variables. If the reverse is the case, a non-parametric test is used. Given that the comparative analysis in this thesis is conducted between separated scores, the normality tests applied are as follows:

- Normally distributed data — Independent Sample t-test
- Not normally distributed data — Man-Whiney U Test.

Stage 3: Testing

Using the appropriate test options listed in Stage 2, the outcome of the test will suggest whether to retain or reject the null hypothesis in Stage 1. The test reveals a significant value (sig) that indicates whether to reject the null hypothesis and accept the alternative and vice versa. The former applies when the significant value is lesser than the p-value (0.05). As is the case with this study, it implies that the alternative hypothesis is accepted, thus, affirming that a significant difference does exist between the mean values of E_2 and E_1.

6.5.2. Specification of variables

There are three main dependent variables considered for analysis:

- **pre-learning score (C)**

  The pre-knowledge score accounts for the knowledge of the participants who scored 50% and above in the pre-selection phase test before interacting with the research instruments, namely the eLearning material and the SG. This implies that it accounts for the knowledge of the participants before taking the test and playing the game.

- **post-learning score (E_2) and post-learning score (E_1)**

  The post-knowledge scores account for the knowledge of participants acquired after interacting with the research instruments, the eLearning material or the SG.

- **Retention Score (rE1)**

  The retention score only applies to E1, and accounts for amount of knowledge learners retained or recalled two weeks after the post learning test.

6.6. COMPARATIVE ANALYSIS

In this section, the study focuses on answering two important questions; the first being have learners using SG achieved a higher learning score than traditional online games and the second being has the experimental group improved their learning by using SG compared to their knowledge before paying the game.

6.6.1 *COMPARATIVE ANALYSIS BETWEEN E_1 AND E_2*

Question 1: *Have users of SG achieved a higher learning score than users of online traditional games?*

To answer this question, we compare the means of the post-learning score of the traditional eLearning material and the SG.

6.6.1.1: Overall post-learning score analysis

Stage 1: Hypothesis formation

Q1aH0: There is no significant difference between the means of E_1 and E_2

$$\mu_{\text{post-learning score E1}} = \mu_{\text{post-learning score E2}}$$

Q1aH1: There is a significant difference between the means of E_1 and E_2

$$\mu_{\text{post-learning score E1}} \neq \mu_{\text{post-learning score E2}}$$

Stage 2: Normality test

The Shapiro-Wilk test below in Tables 6.1 and 6.2 reveals that the data for both E_1 post-learning scores ($0.022<0.05$) and E_2 post-learning scores ($0.033<0.05$) are not normally distributed. As such, we select a non-parametric test (Mann-Whitney U test).

Normality Test

Shapiro-Wilk test (Serious game post-learning score):	
W	0.917
p-value (Two-tailed)	0.022
Alpha	0.05

Table 0.1: *Shapiro-Wilk test of Normality for SG learners*

Shapiro-Wilk test (Traditional game post-learning score):	
W	0.923
p-value (Two-tailed)	0.033
alpha	0.05

Table 0.2. *Shapiro-Wilk test of Normality for Traditional Online games learners*

Stage 3: Mann-Whitney U Test

As Table 6.3 below reveals, the Mann-Whitney U test rejects the null hypothesis, given that the p-value < 0.05. As such, it accepts the alternative hypothesis, suggesting that there is a significant difference between the means of the serious-game post-learning scores and traditional game post-learning scores.

Mann-Whitney test / Two-tailed test:

U	900
U (standardized)	6.669
Expected value	450.000
Variance (U)	4542.839
p-value (Two-tailed)	<0.0001
Alpha	0.05

The exact p-value could not be computed. An approximation has been used to compute the p-value.

Table 0.3: *Mann-Whitney test/ Two-tailed test for E_1 and E_2*

Table 6.4 below shows that post-learning scores for E_1 (M = 83.04, SD =13.44) and E_2 (M = 33.67, SD = 10.25), suggesting that participants who learnt through serious games achieved a higher learning performance than participants who learnt through online traditional games. This implies that serious games, designed through Game ELC+ framework serve as a better learning tool than online traditional games.

Summary statistics:

Variable	Observations	Minimum	Maximum	Mean	Std. deviation
E_1	30	58.325	99.980	83.039	13.441
E_2	30	15.000	50.000	33.667	10.250

Table 0.4: *Descriptive Statistics of E1 and E2*

Figure 6.1 below illustrates the mean scores of participants of SG and traditional games, showing that the former provides a better learning experience than the latter. In other words, the analysis suggests that SGs provide a more effective tool to create DL in adult learners, compared to more traditional teaching methods.

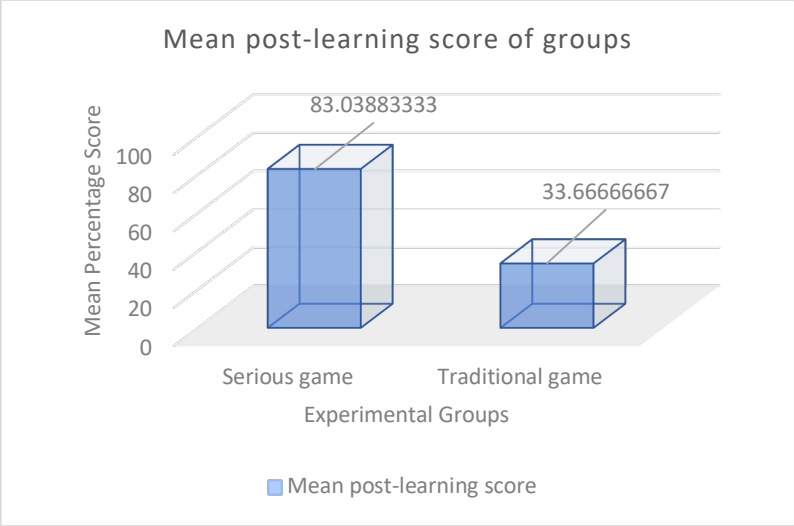

Figure 0.2: *The means of the post-learning score for E1 and E2*

6.6.1.2: Game Scenario Analysis

In this section the study presents a comparative analysis of the mean scores of SG and traditional game participants obtained in nine scenarios of knowledge: GDPR compliance, bribery, fraud suspicion, fraud reporting, security practices, equality, diversity, sexual harassment, and inclusion — discussed in Chapter 5. The goal here is to derive further insight into variations in learning outcomes for participants of both groups. It follows a similar statistical approach used in the previous section by comparing the mean scores of both experimental groups. However, it differs in the sense that the focus here is to assess learning outcomes across the scenarios of knowledge. The analysis adopts a single hypothesis for the nine scenarios, which is:

Q1bH0: There is no significant difference between the means of E1 and E2 within the learning scenarios

$$\mu_{\text{post-learning scenario score E1}} = \mu_{\text{post-learning scenario score E2}}$$

Q1bH1: There is a significant difference between the means of E1 and E2 within the learning scenarios

$$\mu_{\text{post-learning scenario score E1}} \neq \mu_{\text{post-learning scenario score E2}}$$

The data for all the scenarios went through a test of normality using the Shapiro-Wilk test. It reveals that data for E_1 and E_2 within the nine learning scenarios are not normally distributed. As such a Mann-Whitney U test used to evaluate the null hypothesis. Table 6.5 below reveals the p-value for the various learning scenarios.

Learning Scenario	Groups	N	Mean	Std. deviation	Mann-Whitney test P-value
GDPR compliance	E1	30	78.3	31.3	0.002
	E2	30	48.3	38.2	
Bribery	E1	30	93.3	25.4	<0.0001
	E2	30	30.0	46.6	
Fraud Suspicion	E1	30	80.0	40.7	<0.0001
	E2	30	16.7	37.9	
Fraud Reporting	E1	30	83.3	37.9	
	E2	30	46.7	50.7	<0.0001
Security Practices	E1	30	80.0	40.7	
	E2	30	3.3	18.3	<0.0001
Equality	E1	30	86.7	34.6	<0.0001
	E2	30	0.0	0.0	
Diversity	E1	30	100.0	0.0	<0.0001
	E2	30	35.0	29.8	
Sexual Harassment	E1	30	83.3	37.9	<0.0001
	E2	30	90.0	30.5	
Inclusion	E1	30	73.3	28.6	0.837
	E2	30	70.0	33.7	

Table 0.5. *Comparison of mean scores of serious game and traditional game post-test across the different scenarios.*

As Table 6.5 indicates, there is significant difference between the mean scores of E_1 and E_2 in the learning scenarios of GDPR compliance, bribery, fraud suspicion, security practices, equality, diversity, and sexual harassment (p-value < 0.05). As such, we reject the null hypothesis and accept the alternative hypothesis that there is a significant difference between the mean scores of E_1 and E_2. For the learning scenario concerning the subject of inclusion, the reverse is that case, as the p-value of 0.837 > 0.05 suggest that there is no significant difference in the mean score of E_1 and E_2.

These findings reveal that participants who learnt using SG achieved a higher post-test score than those who used online traditional games in the learning scenarios of GDPR compliance (M78.3 and 48.3), bribery (M93.3 and 30.0), fraud suspicion (M80 and 16.7), security practices (M80 and 3.33), equality (M86.7 and 0.00), diversity (M100 and 35), and sexual harassment (83.3 and 90). However, for the learning scenario concerning inclusion, the analysis suggests that the difference between the means score of E_1 and E_2 happened by chance, as such there is no difference in learning outcomes using either SGs or traditional online games to learn about inclusion.

6.6.2: COMPARATIVE ANALYSIS BETWEEN E_1 AND C

Question 2: *Has the experimental group improved their learning by using serious games compared to their knowledge before playing the game?*

To answer this question, we compare the means of the post-learning score of serious games and the control group.

Stage 1: Hypothesis formation

Q2H0: There is no significant difference between the means of E1 and C

$$\mu_{\text{post-learning score E1}} = \mu_{\text{pre-learning score C}}$$

Q2H1: There is a significant difference between the means of E1 and C

$$\mu_{\text{post-learning score E1}} \neq \mu_{\text{pre-learning score C}}$$

Stage 2: Normality test

The Shapiro-Wilk test below in table 6.x below reveals that the data for both serious game post-learning scores (0.022<0.05) and control group pre-learning scores (0.000<0.05) are not normally distributed. As such, we select a non-parametric test (Mann-Whitney U test).

Shapiro-Wilk test (E_1):

W	0.917
p-value (Two-tailed)	0.022
alpha	0.05

Table 0.6: *Shapiro-Wilk test of normality for E_1*

Shapiro-Wilk test (Control Group):

W	0.887
p-value (Two-tailed)	0.000
Alpha	0.05

Table 0.7: *Shapiro-Wilk test of normality for C*

Stage 3: Mann-Whitney U Test

As Table 6.8 below indicates, the Mann-Whitney U test rejects the null hypothesis, given that the p-value < 0.05. As such, it accepts the alternative hypothesis, suggesting that there is a significant difference between the means of the serious-game post-learning scores and control group pre-learning scores.

Mann-Whitney test / Two-tailed test:

U	1245
U (standardized)	5.668
Expected value	705.000
Variance (U)	9059.467
p-value (Two-tailed)	<0.0001
alpha	0.05

The exact p-value could not be computed. An approximation has been used to compute the p-value.

Table 0.8. *Man Whitney test/ Two-tailed test for E1 and C*

Table 6.9 below shows that post-learning scores for SG (M = 83.04, SD =13.44) and the control group (M = 63.72, SD = 8.04), suggesting that participants who learnt through SG achieved a

higher learning performance. This implies that SG, designed through the Game ELC+ framework led to improved learning outcomes.

Summary statistics:

Variable	Observations	Minimum	Maximum	Mean	Std. deviation
E1	30	58.325	99.980	83.039	13.441
C	47	55.000	85.000	63.723	8.040

Table 0.9. *Descriptive statistics of E1 and C*

Figure 6. below illustrates the mean scores of participants of SGs and the control group, showing that the former provides a better learning experience than the latter. In other words, the analysis suggests that SGs provide a more effective tool to create DL in adult learners.

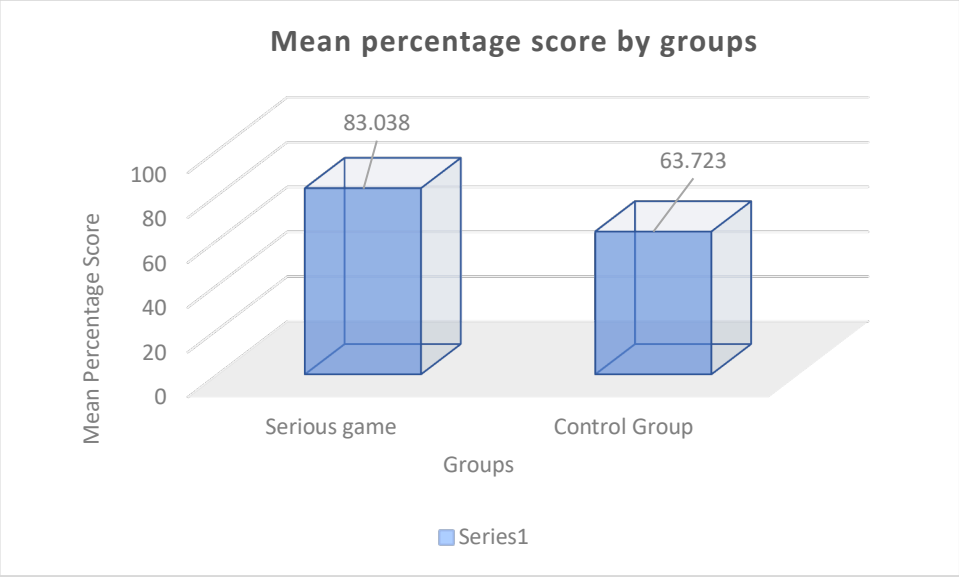

Figure 0.3. *The means of the post-learning score for E1 and C*

Overall, the comparative analysis reveals that SG, developed though the Game ELC+ Framework, provides better learning experiences and outcomes than the online traditional games. While further discussions of these findings will be carried out in Chapter 7 where these

results will be juxtaposed with the game element to explain the implications of these findings, the next section will provide explanation about the experiences of participants using SG and online traditional games.

6.6.3: RETENTION KNOWLEDGE TEST

Question 3: Has the experimental group retained the knowledge learned from SG? In order to answer this question, we compare the means of the post-learning score (E_1) and retention score (rE_1).

Step 1: Form the hypothesis

$Q2H_0$: There is no significant difference between the means of E_1 and rE_1

$$\mu \text{ post-learning score } E_1 = \mu \text{ retention score } rE_1$$

$Q2H_1$: There is a significant difference between the means of E_1 and rE_1

$$\mu \text{ post-learning score } E_1 \neq \mu \text{ pre-learning score } rE_1$$

Stage 2: Normality test

The Shapiro-Wilk test below in table 6.x below reveals that the data for both serious game post-learning scores (0.022<0.05) and retention scores (0.035<0.05) are not normally distributed. As such, we select a non-parametric test (Mann-Whitney U test).

Shapiro-Wilk test (rE1):

W	0.911
p-value (Two-tailed)	0.016
alpha	0.05

Table 0.10: *Shapiro-Wilk test of normality for rE_1*

Shapiro-Wilk test (E_1):

W	0.917
p-value (Two-tailed)	0.022
alpha	0.05

Table 0.11. *Shapiro Wilk test of normality for E_1*

Stage 3: Mann-Whitney U Test

As Table 6.12. below reveals, the Mann-Whitney U test accepts the null hypothesis, given that the p-value < 0.05. As such, it rejects the alternative hypothesis, suggesting that there is no significant difference between the means of the serious-game post-learning scores and retention scores.

Mann-Whitney test / Two-tailed test:

U	444
U (standardized)	-0.082
Expected value	450.000
Variance (U)	4537.627
p-value (Two-tailed)	0.935
Alpha	0.05

The exact p-value could not be computed. An approximation has been used to compute the p-value.

Table 0.12. *Mann-Whitney test/ Two-tailed test for rE_1 and E_1*

Table 6.13 below shows the post-learning scores for E_1 (M = 83.04, SD =13.44) and the retention scores rE_1 (M = 81.667, SD = 14.404), suggesting that participants who learnt through SG retained their knowledge after two weeks of taking the post-learning test. This implies that SG, designed through the Game ELC+ framework led to improved learning outcomes.

Summary statistics:

Variable	Observations	Minimum	Maximum	Mean	Std. deviation
E_1	30	58.325	99.980	83.039	13.441
rE_1	30	40.000	100.000	81.667	14.404

Table 0.13. *Descriptive statistics of E1 and rE1*

Figure 6.4. below illustrates the mean scores of participants of SG immediately after learning and two weeks later, showing evidence of retained knowledge, and by implication, deeper learning. In other words, the analysis affirms that SGs provide a more effective tool to create deep learning in adult learners.

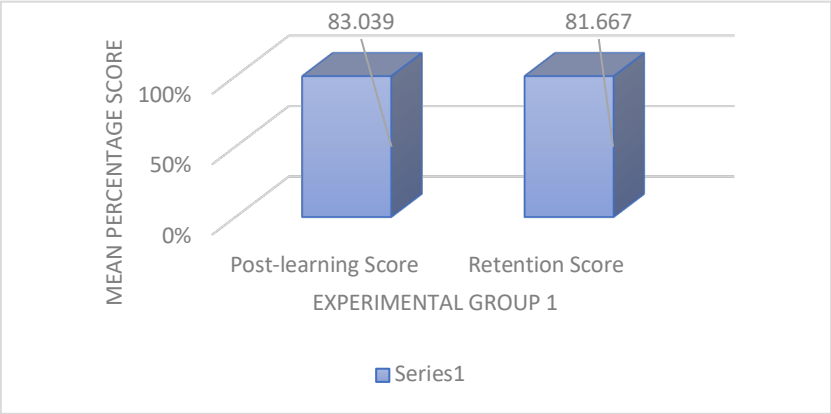

Figure 0.4. *Mean Scores of post-learning and retention for E1*

Overall, the comparative analysis reveals that SG, developed through the Game ELC+ Framework, provide better learning experiences and outcomes than online traditional games. Further discussions of these findings will be carried out in Section 6.7.; however, some

qualitative insights were also gathered during the research process that the next section discusses.

6.6.3: *QUALITATIVE ANALYSIS OF USER EXPERIENCES WITH GAME ELEMENTS*

The qualitative data discussed in this section derives from observations carried out by the researcher as participants undertook learning using the research instruments that have been used to rest the research questions of the Ph.D. research. While the objectives of the observations extended beyond capturing the experiences of users while playing the games, to include making sure that the testing phase runs smoothly, the insights derived from this process tend to reinforce the findings of the quantitative data, which shows improved learning outcomes for participants that used SGs.

Aided by the game elements which differentiates SG from the traditional eLearning platform, learners using SGs appeared more focused, captivated and engaged in the process which shows most of the participants completing the game earlier than the threshold time allocated. It was expected that the time to complete the SG test would not extend beyond 50 mins, but most learners were able to complete it within 30 to 45 mins. Given that time data was not gathered for traditional e-learning players, one cannot compare how both groups fared in this context. However, it may not be far-fetched to assume that the observed disparities in levels of interest and engagement is connected with the inclusion of system design and interaction elements, as these are strategically organised to encourage decision making and user progression through each level or scenario, thus allowing for improved user concentration. Beyond disparities in levels of engagement, learners using SGs demonstrated a high level of curiosity about the learning subjects embedded in the different scenarios.

It is not that learners using the traditional methods did not ask subject specific questions, but only few did so compared to learners using SG. For instance, one participant asked further

questions concerning GDPR compliance, including where further information can be accessed. Another claimed ignorance of her company's policies surrounding equality and diversity, and was particularly interested in bridging this gap in knowledge by paying more attention to her company's policies. What this finding suggests is learners using SGs where more engaged and reflective, which aroused their curiosity to seek more information, thereby, improving learning. This position is reinforced by the works of several scholars. For example, Stone (2008, p.11) argues that SGs "... *move beyond entertainment per se to deliver engaging interactive media to support learning in its broadest sense*". Miller et. al., 2011, p.1425). Also, Koivisto and Hamari, (2014), opined that SG incentivises gameplays while making the target tasks more exciting. Therefore, the findings of the study and scholarly literature validates the assertion that SG is both reflective, engaging and provides a focused learning environment for participants.

The fact that users received instant feedback with SG was also helpful, as more participants were bent on getting their answers right as the game proceeded. Although this researcher did not comply with these requests, learners sought to even compare their performance with other participants, in a bid to contextualize their performance. What this suggests is that beyond the competitive instincts of the learner, which this researcher observed, learners appeared interested in deepening their understanding of the subject by drawing on the feedback provided by the game to reinforce knowledge.

It is important to note that while these observations do not prove causation, as their impact are not readily visible to the researcher and cannot be directly measurable, the evidence is nonetheless compelling that the superior performances of adult learners have something to do with the inclusion of these game elements.

6.7. DISCUSSIONS

This section attempts to take a deeper dive into the outcome of the analyses by juxtaposing these findings with the research questions.

6.7.1. *SUMMARY OF RESEARCH FINDINGS*

The analysis focused on two types of investigation — between subjects and within-subjects. While the latter focused exclusively on group E_1, that is, the group that played the SG, designed through the Game ELC+ framework, the former took the form of a comparative analysis between groups E_1 and E_2 on the one hand, and groups E_1 and C on the other. As will be further elaborated in this section, the analysis revealed that participants who played SG performed better than those who used the traditional e-learning method, as well as those in group C, suggesting that the Game ELC+ framework provides an effective tool for achieving DL. In other words, in both categories of analysis, group E_1 demonstrated a better learning outcome than groups E_2 and C.

As discussed in Chapter 3, individuals who scored below 49.9% and below were placed in the experimental group, where they were split equally between E_1 and E_2, while those who scored above 50% were placed in group C. As the analysis demonstrated, group E_1 achieved a post-learning mean score of 83.04% compared to group E_2 which achieved a score of 33.67%, revealing a significant difference of 49.37%. When the test scores are assessed across the different scenarios, Figure 7.1 illustrates that players of SG performed better than those who used traditional e-learning in GDPR Compliance, Bribery, Fraud Suspicion, Fraud Reporting, Security Practices, Equality, and Diversity with a difference of 30%, 53.3%, 63.3%, 36.6%, 76.7%, 86.7%, and 65% respectively. However, in the Sexual Harassment scenario, learners using the traditional e-Learning method performed better those who used serious game with a difference of 6.7%, while there was no statistically significant difference in the Inclusion

scenario, suggesting that the Game ELC+ framework embedded in SG did not have particular impact on learning outcomes in these scenarios or that traditional e-learning tools are equally effective in teaching subjects surrounding Inclusion or sexual harassment.

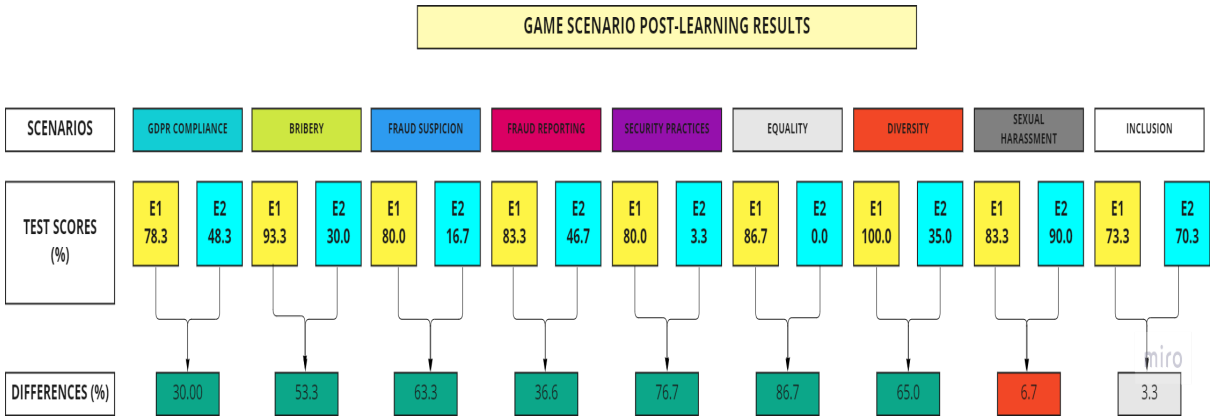

Figure 0.5. *Mean score differences for E1 and E2 across the different scenarios*

To ascertain if there is evidence of DL, the analysis compared the mean score between groups E_1 and C and this revealed that learners in the former achieved a mean score of 83.04% while those in the latter achieved a mean score of 63.72 per cent. This amounts to a difference of 19.32%, implying that SG did improve learning outcomes. Even more, the analysis compared the post-learning and retention scores of groups E_1 to ascertain if participants who used SG retained their knowledge after a period of two weeks. This analysis revealed that DL has occurred given that there was no significant difference in the mean score of E_1 (83.04%) and the mean score of rE_1 (81.67%). What this implies is that the Game ELC+ framework embedded in the SG to achieve DL can improve learning outcomes and also achieve deeper learning. From the foregoing, the study infers that compared to traditional e-learning, SG is more effective in assisting the participants of the study to achieve learning and deeper learning.

6.7.2. ASSESSING RESEARCH QUESTION 1

Are SGs more effective in creating DL in adult learners than traditional e-learning methods?

Following the Game ELC+ framework discussed in Section 3.2.2, participants who played both games went through a selection phase where they were taught and subsequently subjected to a prequalifying test which further informed their allotment into groups C, E_1 and E_2. E_1 and E_2 were taught using SG and traditional e-learning respectively HR-related topics. The analysis conducted previously informed the conclusion that Game ELC+ framework is more effective in achieving DL traditional e-learning methods. To reach this conclusion and address the research questions, the study addressed two questions:

Q1.1. Have users of SG achieved a higher learning score than users of online traditional games?

In order to determine the effectiveness of SG in achieving DL in adult learners compared to traditional e-learning methods, the study compared the mean post-learning scores between participants of SG and traditional e-learning methods. The results discussed in Section 6.6.1 show that the mean post-learning score for SG (M = 83.04, SD =13.44) is significantly higher than the mean post-learning score for traditional games (M = 33.67, SD = 10.25), suggesting SG is a more effective method of adult learning than traditional e-learning methods. The fact that the standard deviation for both groups reveal a similar level of group convergence suggests that there is some level of homogeneity in group performances, which further reinforces the effectiveness of SG over traditional games. That means the mean-post learning score of each participant of SG did not deviate too far from the mean.

To gain further insights into the data, the study compared the mean post-learning scores between participants of SG and traditional e-learning methods across 9 learning scenarios. Players using SG performed better than those who used traditional e-learning in GDPR

Compliance (M = 78.3, SD = 31.3; M = 48.3, SD = 38.2), Bribery (M = 93.3, SD = 25.4; M = 30.0, SD = 46.6), Fraud Suspicion (M = 80.0, SD = 40.7; M = 16.7, SD = 37.9), Fraud Reporting (M = 83.3, SD = 37.9; M = 46.7, SD = 50.7), Security Practices (M = 80.0, SD = 40.7; M = 3.3, SD = 18.3), Equality (M = 86.7, SD = 34.6; M = 0.0, SD = 0.0), and Diversity (M = 100.0, SD = 0.0; M = 35, SD = 29).[5] In the Sexual Harassment scenario, learners using the traditional e-Learning method performed better than those who used SG (M = 83.3, SD = 37.9; M = 90, SD = 30.5) while there was no statistically significant difference in the Inclusion scenario (M = 73.3 SD = 28.6; M = 70.0 SD = 33.7).

What the foregoing implies is that while the overall mean post-learning score of learners using SG designed through the Game ELC+ framework surpasses those of traditional e-learning, this is not uniform across the 9 learning scenarios, suggesting that the game elements or the MDA framework embedded in the design of the Sexual Harassment and Inclusion scenarios did not particularly alter the learning outcomes of learners using SG or perhaps, the nature and relatability of the subject of the game scenario did not necessarily require the gaming elements applied in the design process to be comprehensible.

6.7.3. ASSESSING RESEARCH QUESTION 2

Can DL in adults be achieved through SGs?

To investigate whether the design framework helped achieve DL, SG participants ought to have acquired a higher learning score than the control group following the post-learning test and also demonstrate a recollection of, and the ability to reflect on, what they learnt 2 weeks later

[5] While the first set of mean and standard deviation in the parenthesis captures the post-test scores for learners using SG, the second are for learner using traditional games.

in a retention test. The retention test provides an observation into the level of knowledge players of SG retained two weeks after the post-learning test. Where scores of the retention test are greater than or equal to the scores participants obtained during the post-learning test, it can be concluded that deeper learning has occurred.

Q2.1. Has E_1 achieved a higher learning score compared to the control group?

Q2.2. What is the retention-test score of E_1 in relation to the post-learning test score?

Addressing Q2.1.

The analysis conducted in Section 6.6.2 revealed a significant difference in the means of the post-learning scores of SG (M = 83.04, SD =13.44) and the control group (M = 63.72, SD = 8.04), suggesting that participants who learnt through SG achieved a higher learning performance. This implies that SGs, designed through the Game ELC+ framework led to improved learning outcomes. Also, the SD of 13.4 for SG and 8.04 for the control group suggest that performances were largely homogenous across both learning groups. What this finding implies is that SG provides a more effective tool to create DL in adult learners.

Addressing Q2.2

The data analysis in Section 6.6.3 reveals the difference between the post-learning scores for SG (M = 83.04, SD =13.44) and the retention scores (M = 81.667, SD = 14.404) is not statistically significant, suggesting that participants who learnt through SG retained their knowledge after two weeks of taking the post-learning test. This implies that SG, designed through the Game ELC+ framework led to improved learning outcomes. Also, the evidence of

retained knowledge suggests that learners using SG achieved DL. In other words, the analysis affirms that SG provides a more effective tool to create DL in adult learners.

6.8. Chapter Summary

This chapter began by recalling the research question before elaborating the analytical procedure chosen for the data. The chapter applied ANOVA as analytical approach to compare the mean score of learners using SG and tradition eLearning platforms. It presents the results of the analysis achieved from the testing process by comparing the mean post-learning score obtained from learners using SG and traditional eLearning platforms. It also provided a qualitative analysis of the data gathered from observing participants engaged in both SGs and traditional eLearning platforms. In so doing it demonstrates superior levels of engagement by learners using SGs as they appeared to be better motivated to scale through the different scenarios and achieve better learning outcomes. This tends to correspond with the findings of the comparative analysis, which reveals that learners using SG achieved better learning outcomes than those who used traditional eLearning platforms. This chapter concluded with a detailed discussion on these findings of this research which validates the assumption that the Game ELC+ framework provides better learning outcomes for users in HR settings. This provides a basis for further discussions in the next chapter.

CHAPTER 7. CONCLUSIONS, CONTRIBUTIONS TO KNOWLEDGE AND DIRECTIONS FOR FURTHER RESEARCH

7.1. INTRODUCTION

This chapter provides an overview of the entire thesis. It also outlines and discusses the key contributions this research undertaking has made in the knowledge area, based on the data analysis conducted in Chapter 6. The research was carried out in clear stages by first understanding the problem that guides it. It then explores how scholars have affirmed, attempted to, or critiqued the application of SG to DL. The study clearly highlights the voices of scholars that have evidenced the advantage of identifying and utilising frameworks that advance the application of SG to DL. It proceeds from that premise to identifying a design that would contribute to the knowledge gap.

From the comparative analysis of two learning tools, that is, SG and traditional game or mode of teaching, the study finds that participants using SG achieve higher learning outcome than participants using traditional eLearning platforms. In other words, SG contributes more to motivating users to achieve DL as a result of the game elements embedded in the design of the different learning scenarios. As participant observation conducted during the testing phase suggests, the SG users exhibited high level of engagement and curiosity compared to participants who used the traditional eLearning platforms. The study attributes this to the gaming elements that are included in SG. Based on the data analysis, the chapter concludes by summarising the key findings for each research objective and went on to suggest areas for further research, so as to extend the findings of this study.

7.2. SUMMARY OF THE RESEARCH

This research compares SG, designed using Game ELC+ framework, and traditional eLearning games to determine their impact in achieving DL in HRD. The study compared the traditional andragogy, which uses online digital media without physical instructors in a classroom setting and the DGB andragogy which uses SG. It concludes that SG is more effective in creating DL in adult learners than the traditional mode of learning. This conclusion was reached after conducting a comparative analysis of the mean post–test learning scores of SG and traditional game learners; the mean pre-learning test score of C and the mean post-learning tests scores of E_1; and the mean post-learning score and the retention score for E_1.

The study finds that, participants who learnt using SG achieved a higher post-test score than those who used online traditional games in the learning scenarios of GDPR compliance, bribery, fraud suspicion, security practices, equality, and diversity. Overall, the comparative analysis suggests that SG is a more effective tool in achieving DL in adult learners than online traditional tools. This is not without noting that learners using traditional games had a higher mean score than those using SG in the sexual harassment scenario and there was no significant difference between the mean score of both groups in the inclusion scenario. This suggests that traditional learning games can also be effective learning tools. What is obvious throughout the PhD thesis is that the analysis cannot isolate the deterministic effects of the game elements on learning outcomes. Game elements are what differentiates SG from the traditional eLearning tools and this was evidenced in the finding that learners using SG were more engaged, attentive, and engrossed in the learning as a result of its intuitive and interactive components.

What this evidence demonstrates is that the Game ELC+ framework provides better learning experiences and outcomes than the online traditional games. As discussed in Chapter 1 and subsequently Chapter 4, the Game ELC+ framework is a combination of four learning theories

brought to support learners in achieving DL. These four learning theories include: the Yu Kai Chow's Octalysis Framework, the Bloom's Taxonomy, CTML, and the Ruskov's four evidence of DL. Embedded in the design component of the Game ELC+ framework are game elements such as narrative, avatar, status points, timer virtual goods, progress bars, milestone unlock, feedback and unpredictability and curiosity, which interact together to stimulate leaners to achieve DL.

To ascertain if there is evidence of DL, the analysis compared the mean score between groups E_1 and C and this revealed that learners in the former achieved a mean score of 83.04% while those in the latter achieved a mean score of 63.72 per cent. This amounts to a difference of 19.32%, implying that SG did improve learning outcomes. Even more, the analysis compared the post-learning and retention score of group E_1 to ascertain if participants who used SG retained their knowledge after a period of two weeks. This analysis revealed that DL has occurred given that there was no significant difference in the mean score of E_1 (83.04%) and the mean score of rE_1 (81.67%). What this implies is that the Game ELC+ framework embedded in the SG to achieve DL can improve learning outcomes and also achieve deeper learning. From the foregoing, the study infers that compared to traditional e-learning, SG is more effective in assisting the participants of the study to achieve learning and deeper learning.

This finding validates the effectiveness of SG as a learning tool, and demonstrate the limitations of traditional online learning tools. This is an original contribution to academic scholarships, specifically the disciplines of human resource development, human-computer interactions, education. This is because this is the first study to make a robust attempt to theorize and demonstrate the effectiveness of the Game ELC+ framework to achieve DL in adults operating in HR settings. The findings of the study affirm that the game elements embedded in the design of SG does stimulate learners' curiosity, improve cognitive absorption, and inspire motivation.

This is of critical relevance in real world settings as organisations are exploring different ways to maximize the productivity of their work force.

7.3. NOVELTY OF FRAMEWORK

This research brings to bear an innovation on the Game ELC+ framework by identifying key elements that understand and contribute to the design of a game that stimulates learners' curiosity as well as improve their cognitive absorption. Unlike the DeLEC Framework, this framework is less restrictive because it factors in a greater number of game elements which are robust enough to deepen learners' engagement and participation. The study underscores the relevance of knowledge production by learners themselves and how that leads to deep learning and by extension, greater knowledge concentration and retention in adult learners.

7.4. **KNOWLEDGE CONTRIBUTIONS TO SERIOUS GAME**

This thesis contributes to academic scholarship and the real world by measuring the effectiveness of SG to achieve DL in adults. To this end, it explored and designed and tested the Game ELC + framework that has proven to support learning DL. In this regard, the research found that SGs can be impactful not just in real world setting to improve HRD. In academia, score can begin to interrogate the deterministic effects of the different game elements on user behaviour, or how this element interacts and human cognitive factors to improve learning. SG provides a forward-thinking approach that is inclusive and triggers curiosity among users. In this research, the connectivity of SG and DL has been established. For instance, the innovative application of SG improves learning motivation, adaptability, and the cognitive exposure that players derive from its use. SG supports creative use of content that improves curiosity and

helps adult learners comprehend diverse subject matters. As Smith (2018) argues, the contribution of SG's can range from signifying goals that drive a user to how they intend to achieve them.

7.4.1. KNOWLEDGE CONTRIBUTION TO THE GAME ELC+ FRAMEWORK

The ELC+ Framework is a theoretically integrative approach. While the Octalysis advocate a human-centred gamification, where users efficiently undertake tasks in an interactive environment, Bloom's taxonomy emphasises the importance of critical thinking and questioning techniques in learners. CTML creates a convergence between Octalysis and Bloom's taxonomy in a multimedia learning process where auditory and visual process invoke the sensory memory to enhance retention of information acquired. These are incorporated in the SG. The integration of these theories validates the efficacy and effectiveness of the SG application in HR trainings as well as in any learning environment resulting in Ruskov's deep learning. This justifies the choice of the Game ELC+ as a framework of analysis for this study. The merger of the Octalysis, Bloom's taxonomy, and CTML provides a robust frame for explaining and predicting the outcome of the study and provides a suitable basis for the explanation of the outcome of learner's experience.

The effectiveness of the Game ELC+ framework can be also explained by the incorporation of flow theory, which explains how user satisfaction and game standards stimulate heightened concentration focus on the part of users. Although the study did not determine how the feelings of enjoyment or satisfaction with the flow of the game elements influence learning, the flow theory suggests that enjoyment create focus and stimulates active participation in learning. As a result of its innovative components, learning through SG can trigger the learner's interest to continue playing to the point of DL. Equally the standard of the game also impacts performances because when the game is easy the learners learn less due to boredom, but when the standard of

the learning is set higher, the player is challenged to be hyper-focused, thereby, acquiring higher skills. Where the standard is higher than the player, they tend to be discouraged and withdraw from playing. The study recorded that learners who used traditional online games were sometimes disengaged and discouraged, but this was not the case with learners using SG, indicating that the standard of the game was within the acceptable threshold in design and evaluation. Also, while the enjoyability of the game by the learners have not been measured in this research, it can be said that the process was enjoyed by the learners given the post learning and retention scores.

The study does not rule out the importance of learning process that is driven by the teacher, however, significant impact has been noticed from the findings that interactive learning in a SG environment provides deeper learning more than the traditional learning process. Thus, digitalised SG learning is more effective and shows more knowledge retention as well as problem- solving capacity of learners. Evaluation and measurement are at the centre of all learning. In traditional learning, measurement and evaluation tend to be subjective and interfered with by the teacher-driven process. The accuracy of evaluation and measurement in digitalized game learning suggest that learning in SG is measurable and represent a deeper learning experience. Another significant finding is that serious game is not only interactive but consist of the integration of several processes to achieve deeper learning that cannot be found in the traditional learning process or environment.

7.5. AREAS OF CONCENTRATION FOR FURTHER RESEARCH

- The development of a means for defining DL empirically. This can result in a benchmarking model for HR processes. For example, if promotion to a certain position or recruitment into a job role requires the applicant to possess deep learning of a key relevant skill or knowledge.
- This research developed a unique scoring method during gameplay that measures the different levels of learning as well as evidences of deep learning. The levels of learning, based on Bloom's Taxonomy are given numerical value, and are used to calculate the probability of deep learning. The four parameters of deep learning identified by Ruskov are also given numerical value to calculate the presence of the evidences of deep learning. Based on a hybrid of both scoring models, a novel scoring algorithm to prove Deep Learning in adults was developed, with the formula being:

  Probability of Deep Learning: $p(DL) = \Sigma$ (s score %) / $n(s) \geq 83.31\%$

  Evidence of Deep Learning: $e(DL) = \Sigma$ (s scores%) / $4 = 100\%$

  Proof of Deep Learning: $Pr(DL) = p(DL) + e(DL) \geq 183.31\%$.

- Deep Learning will only be said to have occurred if:
  i) The probability of deep learning falls within the level of Creation, i.e., 83.83% - 99.96%; and
  ii) The evidence of deep learning comes to 100% score.
- This research developed a unique framework model to develop an educational resource for adult andragogy that can achieve DL. Even in isolation, the second and third section of the framework (learning and testing) can be applied to teach adult learners in a more engaging method. The framework also allows to test the strength of the andragogical process through evaluation of player feedback during teaching to see progression of player thinking.

- The creation of a holistic method of teaching, testing, and assessing player feedback in one fell swoop through a scientifically replicable model.

7.6. LEARNING OUTCOMES

At the point of completion of gameplay, the adult learners are expected to demonstrate clear indications of successful deep learning, or the lack thereof. However, the expected learning outcomes should prove the former – the participants in the 30 experimental group (E_1) who are taught using the SG, after initially showing little/insufficient knowledge of the subject matter, would show a measured heightening in their holistic comprehension and demonstration of decision-making skills in recruitment and selection. Specific learning outcomes will be:

- The players will be able to show clear development in depth of knowledge on subject matter from being able to comprehend and apply fundamental principles in recruitment process to being able to critically analyse complex scenarios, identify the options available, then make sound decisive actions based on informed evaluation.
- The players will demonstrate the ability to identify patterns, synthesise past experiences with new dynamic situations, and ultimately develop intelligent postulations of what the outcomes of different decisions could be, which will enable them make decisions from a point of complete knowledge.

7.7. RESEARCH IMPACT POINTS OF THE THESIS

The areas of impact of this research span across from academic to Human Resource Management. As a result of the research being human facing (adult DL), there is a clear psychological impact of the research, creating a more engaging method of assimilating

knowledge in a deep way and reducing cognitive load (Sweller, 1994). The ripple effects of unsuccessful traditional andragogy have been found to flow beyond work confines (Lee, 2006).

Also, andragogy through SGs can provide a more inclusive way to teach and train adults with poor comprehension, still ensuring DL. With the growing diversity and need to run businesses devoid of discrimination and prejudice, this framework can become a step towards a practical solution by providing a platform that can affect DL in adults' incapable of easily absorbing new or improving old information through typical traditional (often less effective) methods.

From an organisational perspective, the end goal of the business being increased productivity of the employees makes this research of value to businesses as well (Harter, 2002). This framework can more readily deliver quality knowledge/skill transfer to the game players through a measurable medium with feedback insights that can help scientifically benchmark DL performance, based on which organisations can make confident management decisions.

Furthermore, this research can give some relief to the fiscal impact of employee training, which often is not commensurate to the output of the trainee. The iterative (scenario) approach this framework adopted better guarantees the desired result of the process - effecting deep learning. Routes to impact will include iLRN and iEEE publications among others, as well as seminar and conference presentations.

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APPENDICES

APPENDIX A	**ETHICS FORMS**
APPENDIX B	**INVITATION TO PARTICIPANTS**
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APPENDIX A – ETHICS FORM

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

PARTICIPATION INFORMATION SHEET

A methodology to evaluate the use of Serious Games in achieving Deep Learning: An Application for Andragogy in Human Resource Development

Researcher(s): Mamfe-ter J. Gemade

Supervisors: Mr Markos Mentzelopoulos, Dr Daphne Economou, Dr Vassiliki Bouki

You are being invited to take part of a research evaluating the effect of Serious Games (SGs) (games with focus to train rather than entertain) in helping people develop Deep Learning (DL). The study involves comparing a group of who will try to achieve DL by playing a game and another group doing the same using traditional learning. There is evidence that learning through certain modes, may lead to deeper learning compared to others, therefore this research aims to investigate whether SGs are more effective means of creating DL in adult learners, compared to more traditional teaching methods. To extract evidence-based results that evaluate this claim we created a SG involving several characters that face some problem-solving scenarios in Human Resources context. You are asking to take the role of one of those characters in the game we created. The game is not designed to evaluate your knowledge, but the design of the game. The process of completing the task will take 45 mins. Explain the process they are expected to follow. The task starts off with a questionnaire (5-10 mins). If you score outside a pre-set range, your performance will be used as part of a control group for comparison, and the exercise ends there. However, if you score within the desired range, you will proceed to a short learning exercise (15 mins), then finally a short testing exercise (15 mins). If a participant wishes, they will be contacted for a follow up interview with the researcher via Zoom or phone call. This research is being undertaken as part of the researcher's studies for the doctoral program in computer science at the university.

The study will involve you:

1) In playing a SG developed around various HR office scenarios solving various arising problems.
2) Completing a questionnaire about your experience in the work place and how relatable the game is.
3) Participating in an interview with Mamfe-ter J. Gemade, about your overall experience using the game and recommendations about how the game could be improved. This will take about 5 minutes and will be tape-recorded. The recording will be transcribed and the audio recording will retained as part of the research archive for a period of 2 years.

Please note:

- Your participation in this research is entirely voluntary.
- You have the right to withdraw at any time without giving a reason.
- Wherever practicable, withdrawal from the research will not affect any treatment and/or services that you receive.
- You have the right to ask for your data to be withdrawn as long as this is practical, and for personal information to be destroyed.

- You do not have to answer particular questions either on questionnaires or in interviews if you do not wish to do so.
- Your responses will normally be made anonymous and will be kept confidential unless you provide explicit consent to do otherwise, for example, the use of your image from photographs and/or video recordings.
- No individuals should be identifiable from any collated data, written report of the research, or any publications arising from it.
- All computer data files will be encrypted and password protected. The researcher will keep files in a secure place and will comply with the requirements of the Data Protection Act.
- All hard copy documents, e.g. consent forms, completed questionnaires, etc. will be kept securely and in a locked cupboard, wherever possible on University premises. Documents may be scanned and stored electronically. This may be done to enable secure transmission of data to the university's secure computer systems.
- If you wish to, you can receive information on the results of the research. Please indicate on the consent form if you would like to receive this information.
- The researcher can be contacted after participation by email (w1530184@my.westminster.ac.uk).
- If you have a complaint about this research project you can contact the project supervisor, Markos Mentzelopoulos by e-mail (M.Mentzelopoulos01@westminster.ac.uk) or by telephone (0207 911 5000 ext 64506).

CONSENT FORM

Title of Study:
A methodology to evaluate the use of Serious Games in achieving Deep Learning: An Application for Andragogy in Human Resource Development

Lead researcher: Mamfe-ter J. Gemade

I have been given the Participation Information Sheet and/or had its contents explained to me.	Yes ❒	No ❒
I have had an opportunity to ask any questions and I am satisfied with the answers given.	Yes ❒	No ❒
I understand I have a right to withdraw from the research at any time and I do not have to provide a reason.	Yes ❒	No ❒
I understand that if I withdraw from the research any data included in the results will be removed if that is practicable (I understand that once anonymised data has been collated into other datasets it may not be possible to remove that data).	Yes ❒	No ❒
I would like to receive information relating to the results from this study.	Yes ❒	No ❒
I wish to receive a copy of this Consent form.	Yes ❒	No ❒
I confirm I am willing to be a participant in the above research study.	Yes ❒	No ❒
I note the data collected may be retained in an archive and I am happy for my data to be reused as part of future research activities. I note my data will be fully anonymised (if applicable).	Yes ❒	No ❒

Participant's Name: _____

Signature: _____ **Date:** _____

This consent form will be stored separately from any data you provide so that your responses remain anonymous.

_____

I confirm I have provided a copy of the Participant Information Sheet approved by the Research Ethics Committee to the participant and fully explained its contents. I have given the participant an opportunity to ask questions, which have been answered.

Researcher's Name: _____

Signature: _____ **Date:** _____

v1.1 - BO ARD - 14 April 2021

RESEARCH ETHICS CONSIDERATION APPLICATION COVER SHEET

UNIVERSITY OF WESTMINSTER

University Research Ethics Committee

Front cover sheet for applications

Applicant's name: Mamfe-ter J. Gemade

Project Title:

A methodology to evaluate the use of Serious Games in achieving Deep Learning: An Application for Andragogy in Human Resource Development

Application Reference ___ - ___ - ___ **(for office use only)**

Please complete the checklist below before submitting your ethics application

Enclosed:	**YES**	**NO**	**N/A**
Application Form Part A attached.	☒	☐	☐
Application Form Part B attached (if applicable).	☐	☐	☒
Any external ethical approval (copy of application and approval letter) attached.	☐	☐	☐
Draft Participant Information Sheet attached (see exemplars).	☒	☐	☐
Draft Informed Consent Form attached (see exemplars).	☒	☐	☐
Draft Indicative Questions, e.g. questionnaire(s), proposed interview questions or questioning areas, etc. attached.	☒	☐	☐
Appropriate risk assessments have been completed, e.g. Control of Substances Hazardous to Health (COSHH), Radiation, etc. (if applicable) – *Contact the University's Safety, Health and Wellbeing Team for advice on this and other aspects of health and safety.*	☐	☐	☒
Fieldwork Risk Assessment attached (if applicable). *(UCEA Guidance on Health and Safety in Fieldwork Including offsite visits and travel in the UK and overseas) – Contact the University's Safety, Health and Wellbeing Team for advice on this and other aspects of health and safety.*	☐	☐	☒
Travel Insurance Request clearance notification attached (if applicable). *Contact - Andrew Clarke (a.clarke03@westminster.ac.uk) or Alison Sylvestre (a.sylvestre@westminster.ac.uk) in Procurement if advice is required – This is essential if there is any Foreign and Commonwealth Office or RED24 advice against travel.*	☐	☐	☒
Confirmation of Insurance coverage for research undertaken off campus.	☐	☐	☒
Security-sensitive research assessment completed (if applicable) and uploaded (see UniversitiesUK Guidance and, if applicable, complete the Annex to Part B and upload).	☐	☐	☒
Other (please specify, e.g. letters from collaborators, etc.): _____	☐	☐	☒

Applicant's signature:  Mamfe-ter J. Gemade **Date:** __14/04/2021_____

Supervisor's or Faculty Research Director's signature:

UNIVERSITY OF WESTMINSTER

Markos Mentzelopoulos_____ **Date:** _____

PLEASE RETURN THIS COVER SHEET ALONG WITH THE REQUIRED DOCUMENTS BY EMAIL ATTACHMENT TO: SECRETARY, UNIVERSITY RESEARCH ETHICS COMMITTEE C/O RESEARCH-ETHICS@WMIN.AC.UK

RESEARCH ETHICS CONSIDERATION APPLICATION PART A (1)

UNIVERSITY OF WESTMINSTER

OFFICE USE: ____ - ___-_____

University of Westminster
University Research Ethics Committee

Application for Research Ethics Consideration*

PART A

Section 1 – PROJECT AND APPLICANT DETAILS

1.1 **Project Title:** A methodology to evaluate the use of Serious Games in achieving Deep Learning: An Application for Andragogy in Human Resource Development

1.2 **Applicant Details**

Name: Mamfe-ter J. Gemade	**University Email Address:** w1530184@my.westminster.ac.uk
Contact Address: 5 Cavendish House, UB7 9FR, West Drayton	**Telephone Number:** 07968633120
Faculty: Science and Technology	

Please check the relevant box:

Undergraduate ☐ **Postgraduate** ☐ **MPhil/PhD Student** ☒ **Staff** ☐

I confirm I have read the *University's Code of Practice Governing the Ethical Conduct of Research*	**YES** ☒ **NO** ☐

1.3 Supervisor/Dean of Faculty/Faculty Research Director details

Please note that all applicants with a supervisor(s) must ensure that the supervisor signs the declaration at the bottom of this page if completing Part A only or in **Section 10.3** if completing Part B

All **staff** must ensure that their Dean of Faculty, or Faculty Research Director (or nominee), as appropriate, signs the declaration at the bottom of this page if completing Part A only or in **Section 10.3** if completing Part B

Name: Markos Mentzelopoulos	**University Email Address:** M.Mentzelopoulos01@westminster.ac.uk
Faculty: Science and Technology	**Telephone Number:** 02079115000 ext. 64506 07943097268

NOW PLEASE COMPLETE THE REMAINDER OF PART A **(* Part A is a self-assessment form used to ascertain whether you have ethical implications in your work. Part A is not an Application for Consideration by University Research Ethics Committee (UREC) unless specified when submitting. Part B is the Application for Ethical Approval and when submitting, it should have a Cover Sheet and Part A attached in all cases).**

PART A (Continued)

Section 2 – Project Details

2.1 Please provide a description of the background with references to relevant literature (250 words maximum):

The prospect of a technology-rich society demonstrates how the true potential for pedagogies in learning can be materialized, since learning has become a lifelong process - "the processing of information derived from experience to update system properties" (Barron, et. al. 2015). Our knowledge shelf life is only ever increasing and many things that were once considered facts are being rapidly questioned by progress and new knowledge. There is a need for a successful learning approach because of the fast-paced nature of information that continues to churn out and needs to be absorbed.
New learning objectives include a shift in the way student-teacher relationships are structured, how teaching and learning are conducted, and how learning is assessed. Learning systems need to do more in encouraging different levels of learners to develop their own visions about what it means to connect and flourish in their constantly emerging world. It also needs to equip them with the skills to pursue those visions. Prodigious technology contributes to the modern world of both children and adults alike (Fullan & Langworthy, 2013). This has provided the need to learn new skills on an on-going basis birthing continuous self-motivated learning, gaining knowledge and expertise, improving employability skills set and creating new opportunities for the future. It involves adults talking on challenges and self-initiative for personal and professional growth. People using continuous learning as a medium offer the chance to engage in learning experiences in their adult life (Carlson, 2016).

2.2. Please provide a brief description and the aims of your study (250 words maximum):

- To design a framework that allows effecting and quantifying DL and can be used to guide the design SG to support learners to reach DL. This is the so-called ELC+ framework which is discussed in more details in Chapter 4.

- The application of the ELC+ framework for the design and development of a SG which forms a focal research instrument for this PhD research and serves the study in a two-fold manner: (a) it evaluates the application of the ELC+ framework for the design of SGs; and (b) it is then used to be tested with users to evaluate if it really helps learners to develop DL. This is achieved by collecting user behavioural data while playing the game by variables integrated in the design of the SG. This data is analysed to evaluate the effectiveness of the ELC+ framework and address the research questions of this project.

- The design of the comparative study using as the principal research instruments the SG that has been designed based on ELC+ framework, the e-learning lesson and a set of questionnaires all used for the evaluation of the ELC+ framework.

- Data analysis and evaluation of the research output to answer the research questions and draw conclusions on the validity and the value of the proposed ELC+ framework.

- The generation of design guidelines for the creation of educational resources using the ELC+ framework targeting educators and game designers.

2.3. Please outline the design and methodology of your study (include details of the selection and recruitment of participants (if any) and details of any invasive (e.g. blood samples, inhalation/ingestion of food and/or non-food products (in abnormally higher or lower levels than normal or a different form), or intrusive (e.g. questionnaires, focus groups, interviews, etc.) procedures [attach extra information as necessary] (400 words maximum in total):

The presentation of the ELC+ framework is presented through four areas explained below:

Phase 1 – Selection: The stage is used to divide learners into two stages. In the first group, users are decided based on having substantial knowledge on a selected topic, while the other

group would differ due to their limited knowledge on the topic. Based on a score goal, participants that score above 50% will make the control group, and those below 50% will make the experimental group. Creating these groups will enable an analytical understanding of the outcome of SG on learners, once their full participation in the process has been reviewed.

Phase 2 – Andragogy: The experimental group will be further divided into groups E1 and E2, to enable they gain further knowledge on the topic using a SG created based on ELC+ and conventional digital material respectively. The educational content around which the learning material is created in this stage is related to teaching soft skills and decision making in HR based on correctly identifying issues related to diversity and equality. The SG will be divided in levels of difficulty, as proposed by Bloom's Taxonomy discussed above. Divisions in levels will demonstrate knowledge based on difficulty level, starting from the bottom and progressing to the top.

Phase 3 – Evaluation: The evaluation will channel both design and the use of it. In the first instance, the evaluation of the ELC+ framework will trail how it is designed and how this may impact its use, once it reaches the learner. Each step will be monitored to understand the challenges and outcome derived from it. In the second instance, the leaners knowledge will be tested. At this stage, results will be measured based on the engagement with SG.

ELC+ Framework Scoring Algorithm: As signified earlier, users will be divided into sections and this will provide the opportunity to base their ability to adapt and use SG on their knowledge level of the topic. To reach a reliable conclusion at evaluation stage, a user's ability to score above 50 or below 50 will lead to an understanding on if the knowledge of the topic has proved an advantage or as a disadvantage for learners.

2.4. Timescales

Start Date (DD/MM/YY): 23/07/2018

Estimated duration of work: 5 days

Section 3 - RISK OF HARM

NOTE 1: Where indicated below applicants should check if the research will require ethical approval from a National Research Ethics Committee via the Integrated Research Application System (IRAS) - nres.queries@nhs.net.- http://www.hra-decisiontools.org.uk/ethics/
NOTE 2: The University of Westminster holds a Human Tissue Authority Licence – This licence is specifically for tissue stored at 115 New Cavendish Street in accordance with the terms of the licence – Advice must be obtained from the University Human Tissue Authority Officer

	RISK OF HARM (to self, colleagues, participants, environment or animals)	Yes	No	N/A
1	Will any pain or more than mild discomfort result from the study?	☐	☒	☐
2	Could the study induce any psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	☐	☒	☐
3	Will the study involve prolonged or repetitive physical or psychological testing of human participants that may put someone at risk, e.g. use of treadmill?	☐	☒	☐
4	Will the study involve raising sensitive topics (e.g. sexual activity, drug use, revelation of medical history, bereavement, illegal activities, etc.)?	☐	☒	☐
5	Does your work involve any "relevant material" containing human cells (e.g. blood, urine, saliva, body tissues but NOT established cell-lines) from living or deceased persons (Such work must take account of the Human Tissue Act)? – See Note 1 and 2 above.	☐	☒	☐
6	Will DNA samples be taken from human participants (Such work must take account of the Human Tissue Act)? – See Note 1 and 2 above.	☐	☒	☐
7	Does your study raise any issues of personal safety for you or other researchers or participants involved in the project (Especially relevant if taking place outside working hours or off University premises)?	☐	☒	☐
8	Does your study involve deliberately misleading the participants (e.g. deception, covert observation)?	☐	☒	☐
9	Does your work involve administration of a food or non-food substance of a different type from or in abnormally higher or lower amounts than normal or one that is known to cause allergic reaction(s) or potential psychological stress?	☐	☒	☐
10	Does your study involve issues relating to personal and/or sensitive data?	☐	☒	☐
	PARTICIPANTS (and/or their records/associated data) Does your work involve any of the following:	**Yes**	**No**	**N/A**
11	Human participants in a health and/or social care setting (e.g. patients, those attending day centres, community care, rehabilitation centres, etc., including in the NHS, other public, private and/or voluntary sectors)? – See Note 1 above.	☐	☒	☐
12	Human participants who may be deemed vulnerable (e.g. children, people in poverty and/or with physiological or psychological impairments, persons attending rehabilitation centres, persons in easily identifiable positions that could be subject to victimisation, etc.)?	☐	☒	☐
13	Expectant or new mothers?	☐	☒	☐
14	Refugees/Asylum seekers?	☐	☒	☐
15	Minors (under the age of 18 years old)?	☐	☒	☐
16	Participants in custody (e.g. prisoners or arrestees)? – See Note 1 above.	☐	☒	☐
17	Participants with impaired mental capacity (e.g. severe mental illness, brain damage, sectioned under Mental Health Act, lowered or reduced sense of consciousness)? – See Note 1 above.	☐	☒	☐
18	Animals (or animal tissue).	☐	☒	☐
	INFORMATION TO PARTICIPANTS	**Yes**	**No**	**N/A**
19	Will you provide participants with a Participant Information Sheet prior to obtaining informed consent which can be taken away by the participant?	☒	☐	☐
20	Will you describe the procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
21	Will you obtain informed consent for participation (normally written)? OR in the case of using personal data previously acquired was consent given for the reuse of the data for other research purposes?	☒	☐	☐
22	Will you tell participants that they may withdraw from the research at any time and for any reason without any impact on their care, service provision etc.?	☒	☐	☐
23	Will you give participants the option of omitting questions they do not want to answer?	☒	☐	☐
24	Will you tell participants that their data will be treated as confidential and that, if published, it will not be identifiable as theirs?	☒	☐	☐
25	Will you offer feedback to participants at the end of their participation, upon request (e.g. give them a brief explanation of the study and its outcomes)?	☒	☐	☐
26	Has external funding or collaboration been applied for/received, which requires institutional ethical consideration or approval?	☐	☐	☒

Useful links:

- http://www.screc.org.uk/ - Social Care Research Ethics Committee
- http://www.hra-decisiontools.org.uk/ethics/ - Human Research Authority decision tool to identify if research needs National Research Ethics Committee approval
- http://www.nres.nhs.uk/applications/guidance/governance-and-directives/?entryid62=131341 – Governance Arrangements for Research Ethics Committees
- http://www.nres.nhs.uk/EasySiteWeb/GatewayLink.aspx?alId=134016 - NRES algorithm "Does my project require review by a Research Ethics Committee"?
- http://www.hta.gov.uk/policiesandcodesofpractice/codesofpractice.cfm - Human Tissue Authority Code of Practice
- http://www.hta.gov.uk – Human Tissue Authority website
- http://www.rsclearn.mrc.ac.uk/MRC_HumanTissueAct/player.html - Medical Research Council online training course for Human Tissue Act.

What to do next:

- **If you have answered NO to questions 1-18 (inclusive) and YES to questions 19-25 (inclusive)**, you do not need to complete the Full Research Ethics Approval Form (Part B). Please keep this form for your records, and do not submit to UREC unless you require ethical consideration of your study, regardless of ethical implications, by an external body (question 26 has been answered YES). *Some Faculties require you lodge a copy of Part A (or a local version of this) with the Faculty Registry/Office, please check with your Faculty Research Ethics Advisor/Co-ordinator. A list of Faculty Ethics Advisors is available from the Secretary, UREC: research-ethics@westminster.ac.uk.*
- **If you have answered YES to any of the questions 1-18 (inclusive) or NO to any of the questions 19-25** the Full Research Ethics Approval Form (Part B) MUST be submitted including Cover Sheet, Part A and Part B of the application form plus any required supplementary documents to the Secretary of the University Research Ethics Committee.
- If you are applying for external Ethical Approval, please send a *copy* of the Conditions/Approvals letters to the Secretary (this may include the original ethical application(s)). Where the external ethics committee/body has equal standing or primary jurisdiction, e.g. another University Research Ethics Committee or a National Research Ethics Committee, any approval will normally be received and noted by the University of Westminster Research Ethics Committee and further clearance may not be required. Where the external committee does not have equal or higher standing than the University Committee then the full ethical approval process at the university may still be required.
- All Applications (dated, signed and authorised) and supplementary information or External Approvals should be sent to the Secretary in *electronic format with a version number, document name and date and the Principal Investigator (or Undergraduate/Postgraduate Taught Student) name. On receipt your application will be issued a unique reference number*
- All new Applications should be submitted to the Secretary a minimum of 10 working days in advance of the Committee meeting date (earlier submission is recommended so that applications can be pre-vetted and obvious issues addressed before the application is considered by the Committee).

Contact details:

Secretary; University Research Ethics Committee
Academic Registrar's Department

E: research-ethics@westminster.ac.uk
W: www.wmin.ac.uk/research-ethics

For Use in Academic Year: 2013/14

Author: Dr Bob Odle - Version: 2013/14v1.2

APPENDIX B – INVITATION TO PARTICIPANTS

Dear Participant,

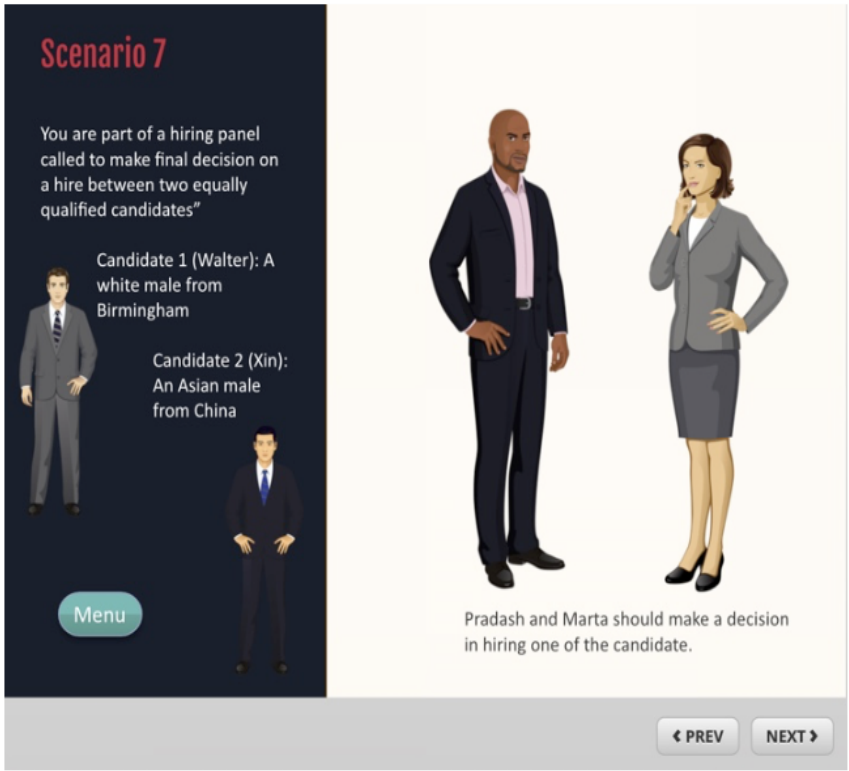
Thanks for your interest in learning a soft skill on judgement and decision making. Your participation is important to collect data on adult deep learning using educational role- playing games compared to conventional methods of learning.

You will be guided through the online learning process and asked questions related to HR issues in the workplace. You will not be scored so don't be afraid to get a question wrong. Excited? Let's begin. The duration of the game is around 20-30 minutes and then you will complete a questionnaire which takes around 15 minutes.

If you wish to participate, please follow the link and click the checkbox next to your name.

Thank you,

Mamfe Gemade



APPENDIX C — ON THE JOB QUESTIONNAIRE

On The Job

Thanks for partaking in this survey. Please answer the following workplace related questions.

Is this a risky behaviour?

1. Johnson places a folder with printouts of transaction logs on his boss's desk 1 point

   Mark only one oval.

   - ◯ Safe
   - ◯ Risky

2. Lala gives Adam a CD with encrypted reports containing card holder data. After copying the files to his computer, Franks shreds the CD. 1 point

   Mark only one oval.

   - ◯ Safe
   - ◯ Risky

3. A service provider signed an agreement regarding PCI DSS compliance. Your company continues to monitor the service provider's interactions with card holder data, even after the agreement is signed. 1 point

   Mark only one oval.

   - ◯ Safe
   - ◯ Risky

4. A call centre rep writes down a customer's credit card account number in his personal notebook 1 point

Mark only one oval.

- ◯ Safe
- ◯ Risky

5. GDPR provides rules about how companies collect data. According to GDPR, companies should also do what? 1 point

Mark only one oval.

- ◯ Offer incentives to covered individuals to use their data
- ◯ Restrict access to personal data to only those who need it
- ◯ Assume a person is not covered unless they claim protection under GDPR
- ◯ All of the above
- ◯ None of the above

True or False?

6. GDPR protects the public data of EU citizens, but not their personal data 1 point

Mark only one oval.

- ◯ True
- ◯ False

7. Penalties for data breaches are high. But there are no penalties for other violations such as non-compliant process for obtaining customer consent. 1 point

Mark only one oval.

- ◯ True
- ◯ False

8. A data subject protected by GDPR is never protected when posting to a foreign social media site. 1 point

Mark only one oval.

- ◯ True
- ◯ False
- ◯ Other: _____

9. If a company does not have a business location in an EU member nation, it does not have to comply with GDPR 1 point

Mark only one oval.

- ◯ True
- ◯ False

10. GDPR is a single regulation for data protection across all EU member countries. 1 point

Mark only one oval.

- ◯ True
- ◯ False

11. A company can refuse to give an individual a copy of their personal data if the company suspects the data will be given to a. competitor. 1 point

Mark only one oval.

- ◯ True
- ◯ False

12. In certain situations, an organisation may not need consent to store or collect data from covered individuals 1 point

Mark only one oval.

- ◯ True
- ◯ False

13. A company's website tells Aisha that it collecting data about her. Aisha continues to use the website. The company can assume that Aisha has given consent to collect that information from her. 1 point

Mark only one oval.

- ◯ True
- ◯ False

14. When a covered individual asks for their data to be erased, what must a company do? 1 point

Mark only one oval.

- ◯ Process the request for data in their systems
- ◯ Process the request in their systems and third-party systems
- ◯ Process the request in their systems and notify third parties who may also have that data
- ◯ Give the individual a detailed reason for why they collected that data

15. Under GDPR, consent to use personal data should be which of the following? 1 point

Mark only one oval.

- ◯ Freely given
- ◯ Explicit
- ◯ Informed
- ◯ All of the above
- ◯ None of the above

16. How does a piece of data indirectly identify someone? 1 point

Mark only one oval.

- ◯ It points to a specific person without the addition of other data
- ◯ It points to a specific person only when combined with other data.

17. Which of the following is a way to minimise risk when working with personal data? 1 point

Mark only one oval.

- ◯ Collect, use, and keep only the personal data that you really need
- ◯ Make sure all personal data is mapped to specific individuals in a data base
- ◯ Both of the above
- ◯ None of the above

Could the following piece of data directly or indirectly identify and individual?

18. City where a person lives 1 point

Mark only one oval.

- ◯ Direct
- ◯ Indirect

19. Last name 1 point

Mark only one oval.

- Direct
- Indirect

20. Tom is travelling for a convention. Which of the following steps will Tom need to take before leaving for his trip? 1 point

Mark only one oval.

- Decide which device he needs to bring
- Back up the data on his device
- Update any software on his devices
- None of the above
- All of the above

APPENDIX D – SCENARIO SCRIPTS

Scenario Topics

1. Compliance – GDPR
2. Bribery
3. Fraud suspicion
4. Fraud – reporting
5. Security practices
6. Equality
7. Diversity in hiring
8. Sexual harassment
9. Inclusion
10. Inclusion

Legend

Blue box: Scenario

Green box: Question and answer

Purple box: Answer Feedback

Scenario 1

Imagine you are a newly hired HR Manager at Ctel enterprise. You and your colleague Max will be meeting with Daisy, a new employee.

Max is one of the first hires the company made when it started and he is really close to the CEO so everyone tries to be on his good side.

When Max asks Daisy to fill her biodata in a form, she responds saying:

Daisy:
"If you don't mind me asking, how does the firm protect employee personal data? I mean, is it shared, and if so with who and why? I don't mean to come off unduly curious but I'm a bit of a private person and my partner's company recently had an incident, so I have to ask, sorry".

Max:
"I doubt your data will ever leave this office"

Question 1 in Scenario 1

Daisy's facial expression changes to look uncomfortable/dissatisfied. What will you do?

Have faith that Max will explain better at a later time what happens to her records (incorrect)

Max might need some help explaining this, so you should jump in (correct)

Correct Answer Feedback for Question 1 in Scenario 1

Yes, that's right!

As an HR Manager, you have a duty of care to the company and employees. Daisy’s facial expression showed that she was still uncomfortable with Max’s explanation

Incorrect Answer Feedback for Question 1 in Scenario 1

That's incorrect.

As an HR Manager, you have a duty of care to the company and employees. Daisy’s facial expression showed that she was still uncomfortable with Max’s explanation

Question 2 in Scenario 1

Which of the following is most appropriate giving Daisy's concerns?

As the HR Manager and head of your department, reassure Daisy that Max is right, and she has nothing to worry about. (incorrect)

Tell Daisy that her personal data will be shared when necessary with third parties (such as credit reference agencies) that we know provide adequate safeguards to protect personal data (correct)

Tell Daisy that her personal data will be shared when necessary with third parties (such as credit reference agencies) that are considered reputable by trusted sources (incorrect)

Your colleague is right. Do nothing (incorrect)

Correct Answer Feedback for Question 2 in Scenario 1

That's correct.

The GDPR regulation says that you may share personal data where the organisation receiving the data is proven to provide adequate safeguards. Your firm is accountable for this and could be held liable if you shared data with a firm that did not have adequate safeguards in place and a data breach occurred.

Incorrect Answer Feedback for Question 2 in Scenario 1

That's incorrect.

The GDPR regulation says that you may share personal data where the organisation receiving the data is proven to provide adequate safeguards. Your firm is accountable for this and could be held liable if you shared data with a firm that did not have adequate safeguards in place and a data breach occurred.

Scenario 2

You are a procurement staff at Ctel enterprise. A colleague of yours has a letter for you on your arrival at work.

The letter reads:

“Thanks so much for all the work you did on the FNP project. Contained within is a small token of appreciation, you deserve a break".

You client has expressed gratitude for your help in a recent project by sending you a holiday package to an adventure park for 2 and after reading the letter aloud, your colleague says

“Wow that’s a big thank you. I have some thoughts though; I wonder if they may have ulterior motives”

Question 1 in Scenario

How will you respond to your colleague?

Maybe, it depends on what the supplier's intentions are in offering the holiday package (incorrect)

No, the contract has been awarded and so there is no way to influence your decision (incorrect)

Yes, as it could influence future decisions (correct)

Possibly, but only if you know that this was an attempt to influence your position, for example, if the holiday package had been suggested before the contract was awarded (incorrect)

Correct Answer Feedback for Scenario 2

That's correct.

As defined by the Bribery Act 2010, 'Bribery is offering, promising, giving, accepting or soliciting of an advantage as an inducement for an action which is illegal, unethical or a breach of trust'. Inducements can take the form of gifts, loans, fees, rewards or other advantages such as taxes, services, donations, etc.. You could be accused of Illegal gratitude which is defined as giving or receiving something of value after a transaction is completed, in acknowledgment of some influence over the transaction. Because this is a usual contractor, future decisions may be seen to be influenced

Incorrect Answer Feedback for Scenario 2

That's incorrect.

As defined by the Bribery Act 2010, 'Bribery is offering, promising, giving, accepting or soliciting of an advantage as an inducement for an action which is illegal, unethical or a breach of trust'. Inducements can take the form of gifts, loans, fees, rewards or other advantages such as taxes, services, donations, etc.. You could be accused of Illegal gratitude which is defined as giving or receiving something of value after a transaction is completed, in acknowledgment of some influence over the transaction. Because this is a usual contractor, future decisions may be seen to be influenced

Scenario 3

Your regional manager is called Stephen, you have got on very well in the past 4 years that you have worked together. You also usually have lunches at work together but suddenly Stephen has become distant from you and other colleagues.

A few of your colleagues at the office have also began to notice some new traits that you have never seen Stephen recently.

Colleague 1, Irene says:
"Stephen has been working really late lately and he has been very tense and short tempered. I hope he is okay"

Colleague 2, Mono says:
"Yes and he has withdrawn his holiday for the second time this year"

Question in Scenario 3

Which of the following could cause suspicion that Stephen may have committed fraud? Select all that apply.

Forgetting to lock their computer screen when he leaves his desk (incorrect)
He has been receiving a lot of phishing emails lately (incorrect)
He has become short tempered and stressed lately (correct)
He has rolled over 12 day holidays for the second time in a roll (correct)

Correct Answer Feedback for Scenario 3

Correct.

None of these factors confirms that Stephen is definitely committing fraud, but there are signs that you should watch out for and report if you have any doubts or suspicion in your work place

Incorrect Answer Feedback for Scenario 3

Incorrect.

None of these factors confirms that Stephen is definitely committing fraud, but there are signs that you should watch out for and report if you have any doubts or suspicion in your work place

Scenario 4

Your colleague Tony sat at his desk looking into the. Computer and suddenly pushes a pile of papers off his desk to the floor. He also appears to be sweating.

You ask Tony to lunch like you have done several times before but he aggressively declines your invitation.

In addition to this, you remember that you have had a strong suspicion that Tony has been colluding with a partner company called Pauve Designs by approving falsified invoices.

Question in Scenario 4

What should you do next?

Tell Tony that you're on to him and that he should stop (incorrect)
Phone the police and explain the situation (incorrect)
None of these options are adequate (correct)
Ask one of your colleagues for advice on what to do (incorrect)

Correct Answer Feedback for Scenario 4

Correct.

If you find yourself in a dilemma because you suspect a colleague or anyone is involved in fraud, follow your firm's whistleblowing process and/or contact the FCA's whistleblowing helpline. The Financial Conduct Authority (FCA) has people who are trained to help and also ensure that you can freely voice your concerns, without fear of personal reprisals

Incorrect Answer Feedback for Scenario 4

Incorrect.

If you find yourself in a dilemma because you suspect a colleague or anyone is involved in fraud, follow your firm's whistleblowing process and/or contact the FCA's whistleblowing helpline. The Financial Conduct Authority (FCA) has people who are trained to help and also ensure that you can freely voice your concerns, without fear of personal reprisals

Scenario 5 – Mini Game

Which of these can be a security risk in a workplace? Select all that apply

1. Monitor with unlocked screen (correct)
2. A printer and recently printed document in the printer (correct)
3. USB stick (correct)
4. Paper tray with documents in it (correct)
5. Mouse (incorrect)
6. Radio (incorrect)
7. Picture frame with a photo (incorrect)
8. Closed filer/small desk cabinet marked confidential (incorrect)
9. A small plant (incorrect)
10. Keyboard (incorrect)

Feedback after learner selects answers in Scenario 5

A way to reduce information security risks is to follow and apply a 'clear desk' policy. This encourages good security practices by making sure that items left on desks are kept to an absolute minimum

Feedback when learner highlights hotspots on each item on workstation Scenario 5

Monitor hotspot

Locking your computer screen every time you are away from your workstation prevents sensitive data being viewed and accessed by those who shouldn't see it.

Printer with printed document hotspot

Printers, faxes and photocopiers should also be cleared immediately of any sensitive data. (Also, remember not to leave strategic or other business information anywhere else such as on whiteboards or flipcharts when vacating meeting rooms).

USB stick

It could compromise security if devices such as memory sticks, which could contain confidential information, are not locked away when you leave your desk.

Other devices such as laptops, mobile phones, password tokens, etc. should also never be left on desks while you are not there. And overnight they should be taken home as long as they do not contain any customer information, in which case they should always be locked away securely. Take care not to lose any of these items, and don't leave them in your car or on a train unattended.

Other people (such as cleaners, etc.) could be in the building after hours, and security may be compromised if folders and papers are left on desks. Everyday best practices should include:

At the end of the day, put away folders, loose papers, lock your drawers and clear your voice mail.
Keep all sensitive data locked away when it's not required (filing cabinets can be used for storing confidential and personal information, but use caution here, i.e. make sure you lock them!).

Always shred confidential/sensitive information or make use of the secure confidential waste bins and keep your desk tidy; this will avoid inadvertently mixing sensitive information with general waste.

Scenario 6

Which of the following below best describe equal opportunity? Select all that apply.

The correct answer is the second chracter

Feedback after learner selects answers in Scenario 6

Equal of opportunity is simply about treating everyone fairly: nothing more, nothing less

However, there are three key points to note in this exercise.

Key points explained to player include:

Key point 1
"Equality does not only apply to minority groups. Everyone is included"

Key point 2
"*Equality does not mean treating people with different capabilities and needs exactly the same way. It just means that everyone has an equal right to be treated fairly, based on the relevant capabilities and needs they do have"*

Key point 3
"*Equality is about creating a level playing field on which everyone is treated fairly, purely on the basis of relevant abilities and needs. Equality treats everyone fairly regardless of if they belong to a minority group or not"*

Scenario 7

You are part of a hiring panel called to make final decision on a hire between two qualified candidates"

Candidate 1 (Walter): A white male from Birmingham
Candidate 2 (Xin): An Asian male from China

- One colleague called Pradash says:

  "Our company does not look diverse enough so we should go with Xin"

- Another colleague Marta says:

  "We cannot just hire based on how we look as a company, we need to hire by best skills for the job only"

Question 1 in Scenario 7

Which colleague should you agree with?

Marta (incorrect)
Pradesh (correct)

Answer Feedback for Question 1 in Scenario 7

The most likely right choice is Pradash because you already have information that both candidates are equally qualified for the role

Question 2 in Scenario 7

It is important to note some good reasons to go with Pradash.

What could these reasons be?

Choose all that apply

Service **(correct)**
Innovation **(correct)**
Globalisation **(correct)**
Avoid media scandal **(incorrect)**
To fit the legal diversity requirement **(incorrect)**

Feedback for Question 2 in Scenario 7

While highlighting Service

"Ctel provides services to people from all diverse backgrounds so to do a good job, it will be beneficial to understand, respect and meet their needs. Therefore a diversity hire is a fringe consideration to the company's overall performance "

While highlighting Innovation

"There is rarely one solution to even the simplest problems. Different people bring different perspectives, which make equality, diversity and inclusion key factors in creativity and innovation"

While highlighting Globalisation

"We're all operating in an increasingly global world. Equality, diversity and inclusion help us to work effectively across a broad range of cultural and international boundaries"

While highlighting Media Scandal

"No wrong doing is being committed so a media scandal would not apply"

While highlighting Legal Diversity

"Without diversity in the workplace, there can be grounds for actions and behaviour that rise to unlawful and unfair employment practices. Employers have the responsibility to promote and enforce diversity in the workplace, but it is a voluntary responsibility"

Scenario 8

As one of his traditions, the Director, Mike employs a new intern for the marketing department from the local community college.

You are his assistant.

A selected few of the students have been invited to an open day at the office and Mike has just concluded his speech to college students

After the speech Mike is approached by a soon-to-be college graduate Lilian for some questions about the company and they take a seat at a table. After a sometime Mike puts his hand around her.

Sometime later, you receive an email:

"Great to hear from you. My apologies for the delayed response. I was kept busy this week wrapping up a big project as well as several school midterms. It was a pleasure meeting you this week. Thank you again for the presentation as well as the extra time that you gave me following the event.

I am humbled by your offer to create and execute a winning marketing strategy for your organization. However, after much consideration, I have decided that this opportunity, while enticing, is not the match for me. At this time, I am going to continue pursuing my passion for business within the technology and consumer products realms.

Also, because I do have much respect for you and wish you the best of luck in the future, I feel obliged to mention this to you. As a young woman, I was uncomfortable with several of Mr. Mike's gestures (such as kissing me on the head, putting your arm around me) and things that he said. While I am sure that he meant these gestures in a grandfatherly manner, just a heads up that such actions could be interpreted differently.

Again, I wish you nothing but the best in the future. I am glad that we met and am both thankful for the opportunity to work with you as well as what you taught me during our time together last week."

Question and Answer in Scenario 8

Which colleague should you agree with?

1) Talk to Mike about the email from Lilian. (incorrect)

2) Email Lilian and tell her that she should get used to this type of inappropriate behaviour, because this is going to happen to her a lot. (incorrect)

3) Report the situation and forward the e-mail thread to the HR department. **(correct)**

4) Since Lilian has refused the role there's no need bringing up the claims as it's no more a concern (incorrect)

Answer Feedback for Scenario 8

Examples of sexual harassment:

Unwanted jokes, gestures, offensive words on clothing, and unwelcome comments

Touching and any other bodily contact such as scratching or patting a coworker's back, grabbing an employee around the waist etc.

Repeated requests for dates that are turned down or unwanted flirting

If you find yourself in a dilemma because you suspect your boss or colleague is involved in sexual harassment, follow your company's reporting *procedures*

Displaying sexually suggestive objects, pictures, or posters

Scenario 9

You come to the office and see some colleagues wearing festive Santa hats and discussing Christmas plans while some others are straight faced and staying away from the conversation.

Colleague 1, Fiona says

"Hey [Player Name], it's the second week in December and we've been asked to plan an end of the year office celebration. A light part of it involves creating a party playlist for the celebration when it's time to dance and party. Do you think you can handle that? If you're up for it let me see what you have compiled by the end of the week so we can vet and approve it."

Colleague 2, Irene says

"*Hey [Player Name] I overheard your conversation with Fiona and would like to add a popular South African Christmas song to the mix if that's okay*"

Colleague 3, Mono comes to you privately a few moments later and says

"*Hey I think Irene's request is fine but could it be a South African song that's festive but not necessarily Christian? Just a suggestion since we have employees from different religions and it is an end of the year party not Christmas party.*"

Question and Answer in Scenario 9

Which of the following courses of action is best to take in light of your task and the varied requests you have received in creating the playlist?

1) Create the playlist without Irene's song and explain to her later that it was a mistake but either way religious songs aren't allowed **(incorrect)**

2) Add Irene's song to the playlist and explain to Mono afterwards that in line with company values, it's a Christmas celebration so all Christmas songs are welcome. **(incorrect)**

3) Suggest to exec team that moving forward it could be called 'end of year celebration' instead of 'Christmas celebration' so it avoids any religious biases **(correct)**

4) Speak with Irene and Mono separately and tell them everyone is allowed to send in their choice holiday songs in order to be inclusive to all **(incorrect)**

Answer Feedback for Scenario 9

One of the most important ways to show employees that you respect their backgrounds and traditions is to invite them to share those in the workplace. Appearing to disregard either of their opinions will be counterproductive. Diversity in teams leads to better decision-making, greater innovation and ultimately higher returns, but inclusion is what connects people to the business, and it's one of the core reasons they stay."

Inclusivity Checklist for HR

Make sure company leaders understand that inclusion is about ensuring that everyone's voice is heard, opinions are considered and value to the team is evident.

Train managers—and hold them accountable—to show that inclusivity is a core competency.

Form an inclusion council with genuine influence and power.

Value differences and create an environment where people can feel comfortable bringing their "full selves" to work.

Identify underrepresented groups' needs and give them necessary support and resources.

Provide workers with a safe space to voice their concerns.

Benchmark key aspects of your organization's culture—and understand the employee experience—before making changes to promote inclusivity.

Remember that daily interactions are the most telling sign of whether or not your company has an inclusive culture.

Scenario 10

It's November in 2020 and we're practically all working from home now, so everything is virtual. Yup, even coffee breaks for little chit-chatting. Things may need to be handled a little different from before.

- Player receives email from Oktawia saying:
  "Hi I'm Oktawia from the design team and I usually don't join the monthly socials meetups because it's very vocal and I'm speech impaired so it's hardly any fun for me. With working from home and us moving to playing online games, I was hoping you could include 1 or 2 that interest me and don't involve talking but are still fun."

- Player receives another email from Todd, a fellow teammate in HR:
  "*Hey bud, I looked up some feedback from the last monthly social and someone anonymously asked to include 2 games – Scattegories and Among Us. They aren't too bad but I don't they will be liked by most people, since we usually just drink and catch up about fun non-work related stuff. I'd say let's put a pin in it for now and come back to it later?*"

Question and Answer in Scenario 10

Which of the following courses of action is best to take, considering Oktawia's request and Todd's suggestion?

Moderate the next monthly social session and try to persuade the rest of the team to try out the new games **(incorrect)**

Be the inclusive 'party-pooper' and introduce the new games at the next monthly social at the risk of everyone quietly dropping off the call shortly after **(incorrect)**

Make a case to Todd for Oktawia and have him introduce it during the next monthly social since he's usually the life of the party **(correct)**

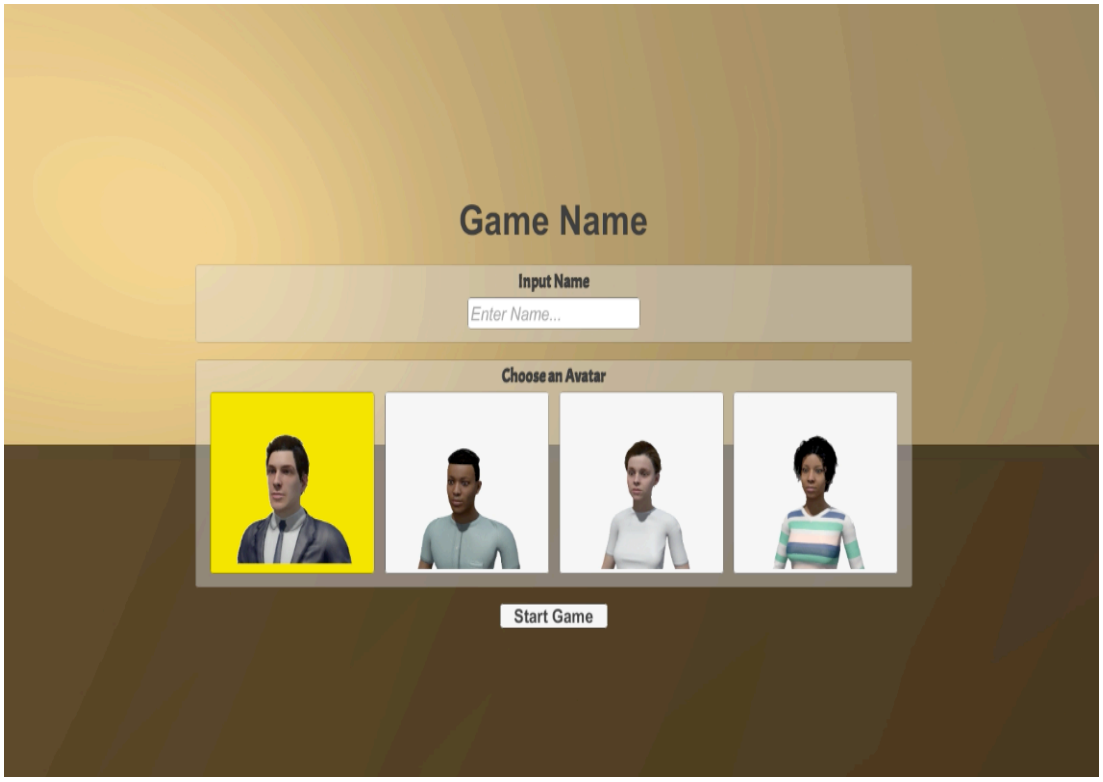
Try to explain to Oktawia that although you understand, a structure had already been created which factored in everyone's interests and since she wasn't attending previously, it was done without her, so offsetting that structure now would cause greater dissatisfaction **(incorrect)**

Answer Feedback for Scenario 10

"In May, seven in 10 U.S. employees were working from home. It's been a few months, so most of your employees and teams have created a new routine and are getting to be video conference experts. Next year, we expect to see HR professionals refocusing their concept of what the employee experience is and how to deliver a good one. Employee personas, project champions and much more are likely to be deployed to ensure that the term employee experience is clearly defined, that it powers every decision made and that there is a clear reason for making all of those decisions.

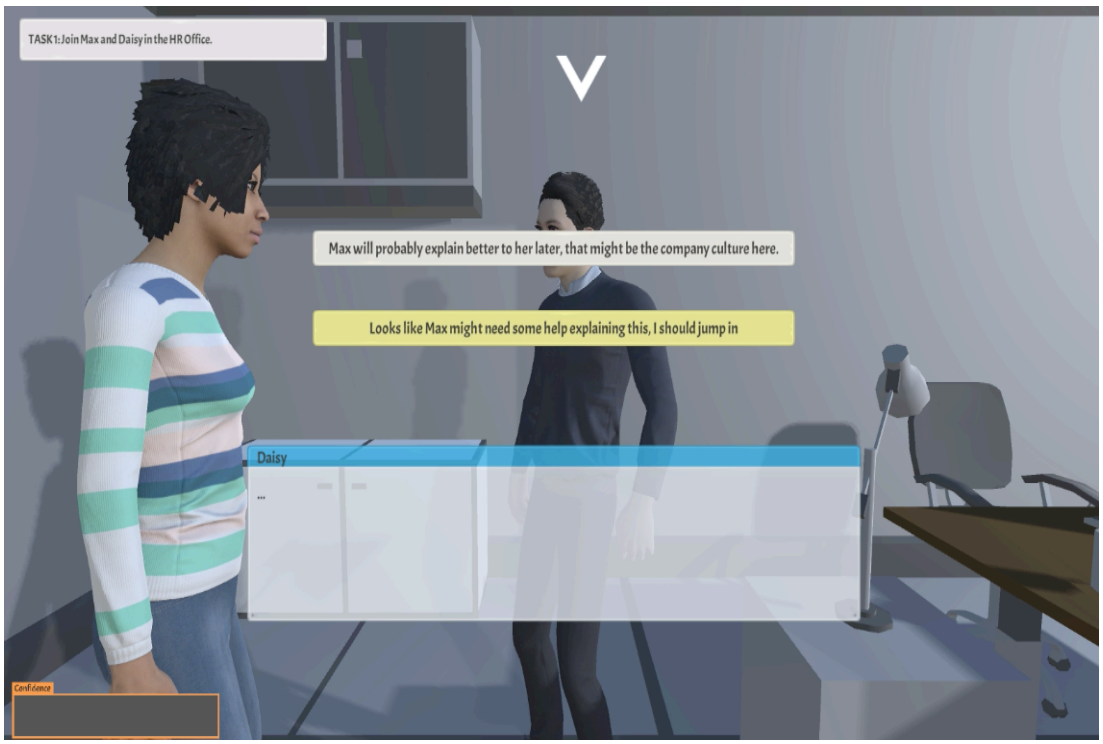
Educating the leadership and HR team is the first step in tackling the issues of inclusion and working virtually so the right answer was to first take it up with Todd, then ensure the voice of Oktawia is heard by getting others to at least try out her new game suggestion"

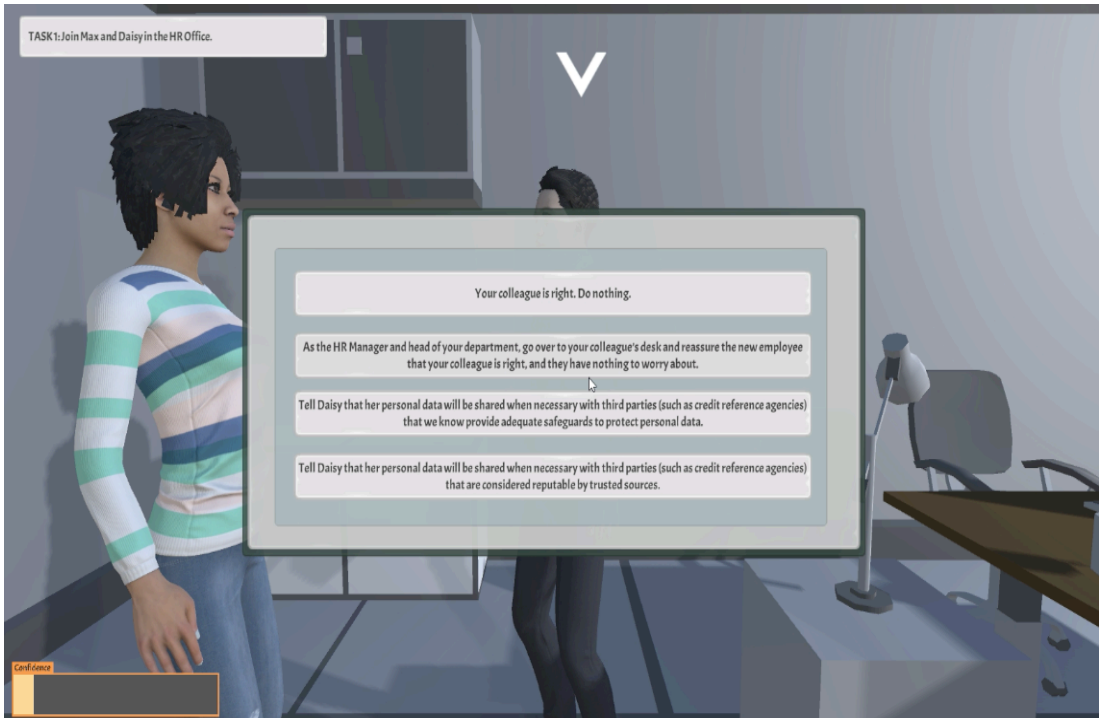
APPENDIX E – GAME SCENES




TASK1: Join Max and Daisy in the HR Office.
HR Office
Confidence


TASK1: Join Max and Daisy in the HR Office.
Max
Hello Daisy, welcome to Ctel. I'm Max, and this is Joseph, we make up the HR team here so if you need anything you can always come to us. To start things off, we will need you to fill out a biodata form with your personal details for company record purposes...
Confidence


TASK1: Join Max and Daisy in the HR Office.
Max will probably explain better to her later, that might be the company culture here.
Looks like Max might need some help explaining this, I should jump in
Daisy
...
Confidence


TASK1: Join Max and Daisy in the HR Office.
Your colleague is right. Do nothing.
As the HR Manager and head of your department, go over to your colleague's desk and reassure the new employee that your colleague is right, and they have nothing to worry about.
Tell Daisy that her personal data will be shared when necessary with third parties (such as credit reference agencies) that we know provide adequate safeguards to protect personal data.
Tell Daisy that her personal data will be shared when necessary with third parties (such as credit reference agencies) that are considered reputable by trusted sources.
Confidence


TASK1: Join Max and Daisy in the HR Office.
Correct! +10 Points
Brad - CEO of Ctel Enterprise
The GDPR regulation says that you may share personal data where the organisation receiving the data is proven to provide adequate safeguards.
Your firm is accountable for this and could be held liable if you shared data with a firm that did not have adequate safeguards in place and a data breach occurred.
Confidence


ALL TASKS COMPLETE.
Task List
Join Max and Daisy in the HR Office
Kopi has a letter for you.
Meet Mono in the kitchen.
Invite Tony out for lunch.
Task 5
Task 6
Confidence

APPENDIX F— SYSTEM USABILITY SCORE

	1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
1. I think that I would like to use this game frequently	P4	P1	P2, P5	P3	
2. I found the game unnecessarily complex			P2	P1, P3, P5	P4
3. I thought the game was easy to use		P4, P1	P5	P2, P3	
4. I think that I would need the support of a technical person to be able to use this game		P2	P1, P5	P3, P4	
5. I found the various functions in this game were well integrated			P5	P1, P2,P4	P3
6. I thought there was too much inconsistency in this game				P1, P2, P,3 P4	P5
7. I would imagine that most people would learn to use this game very quickly	P1	P2,P4, P5	P3		
8. I found the game very cumbersome to use				P1, P4	P2, P3, P5
9. I felt very confident using the game	P3, P4, P5	P2	P1		
10. I needed to learn a lot of things before I could get going with this game			P3	P2, P4	P1, P5

Participant	SUS Score
P1	30
P2	42.5
P3	42.5
P4	27.5
P5	25

SUS Average	

APPENDIX G –TRADITIONAL GAME SCORES

date	name	s1q1aw	s1q1bc	s1q2aw	s1q2bc	s1q2cw	s1q2dw	s2q1aw	s2q1bw	s2q1cc	s2q1dw	s3q1aw	s3q1bw	s3q1cc	s3q1dc	s4q1aw	s4q1bw	s4q1cc	s4q1dw	s5q1ac	s5q1bc	s5q1cc	s5q1dc	s5q1ew	s5q1fw
01/12/2021	Daphne	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/01/2022	Andy Madaki	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
10/01/2022	Andy Madaki	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
15/01/2022	Mike	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	1	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	1	1	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0
17/01/2022	Mahnoor Asif	0	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
17/01/2022	Joyce Akiga	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
18/01/2022	Ovo	0	1	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0
18/01/2022	Ovo	0	1	0	1	0	0	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0
19/01/2022	DCM	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
19/01/2022	Nnena	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
08/02/2022	Mahnoor Asif	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
08/02/2022	Goka	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0
08/02/2022	Robby	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
08/02/2022	Goka	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	1	1	1	0	0
08/02/2022	Pam	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
08/02/2022	Adnil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/02/2022	Tommy	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
08/02/2022	Jessica	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
08/02/2022	Joy	0	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0
08/02/2022	Joy	0	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0
08/02/2022	Monica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/02/2022	Obie	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
09/02/2022	Mimi	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
09/02/2022		0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0
09/02/2022		0	1	1	1	0	0	0	0	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	0
09/02/2022		0	1	1	1	0	0	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0
09/02/2022	Olanite Tayo	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
09/02/2022	Olanite Tayo	0	1	0	1	1	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
09/02/2022	Olanite Tayo	0	1	0	1	1	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
09/02/2022	Juliet	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0
09/02/2022	Juliet	0	1	1	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0
09/02/2022	littlepanda	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
16/02/2022	Naomi	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
10/03/2022	Bemy	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
18/03/2022	Beauty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18/03/2022	Beauty	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
18/03/2022	Beauty	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0
18/03/2022	Beauty	0	1	0	1	0	0	0	0	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0	0
27/03/2022		0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Traditional Learning Scores

s5q1gw	s5q1hw	s5q1iw	s5q1jw	s6q1aw	s6q1bc	s6q1cw	s6q1dw	s6q1ew	s7q1ac	s7q1bw	s7q2ac	s7q2bc	s7q2cc	s7q2dw	s7q2ew	s8q1aw	s8q1bw	s8q1cc	s8q1dw	s9q1aw	s9q1bw	s9q1cc	s9q1dw	s10q1aw	s10q1bw	s10q1cc	s10q1dw
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1
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0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0
0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	1	1	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	1	0	0	0	1	1	0	0	1	0
0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	0	1	1	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	1	0	0	0	1
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	0	0	1	0	0	1	0	1	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	1	1	1	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	0
0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	1	0
0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	1	0	0	0	1	0
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0	0	0	0	1	1	1	1	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	0
0	0	0	0	1	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	1
0	0	0	0	1	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	1	1
0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	1	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	1	1	0	1	1	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	1	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	0
0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	1	0	0	0	1	0	1	1	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	1	0	0	0	1	0	1	1	0	0
0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	1	0	1	1	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	1	0	0	1	0	0	0

[Traditional Learning Scores]()

APPENDIX H—ON THE JOB SERIOUS GAME SCORE

		Daisy 1	Daisy 2	Kopi	Stephen in th	Tony for luncl	Desk	Equality	(X) Who is qu	Mike and the	Festive mood	Monthly socia
date	name	s1q1	s1q2	s2q1	s3q1	s4q1	s5q1	s6q1	s7q1	s8q1	s9q1	s10q1
09/02/2022	TomTom	1	1	1	1	1	0	1	1	1	1	1
09/02/2022	Dee	0	1	1	0	1	1	0	1	1	0	1
09/02/2022	Ini	0	1	1	0	1	1	1	1	1	0	1
10/02/2022	Fidel	1	1	1	1	1	1	0	1	1	1	1
17/02/2022	V	1	0	1	1	1	1	1	1	0	0	0
18/02/2022	Kike	1	0	1	1	0	0	1	1	1	1	0
23/02/2022	Toyin	1	1	1	0	0	0	1	1	1	0	1
23/02/2022	Seyi	1	0	1	0	0	0	1	1	1	0	1
24/02/2022	Fifi	1	1	1	1	1	1	1	1	1	1	1
25/02/2022	Lovely	1	1	1	1	1	1	1	1	1	1	1
26/02/2022	Jamie	1	1	1	1	1	1	0	1	1	1	1
27/02/2022	Lynda	0	0	1	1	1	1	1	1	1	1	1
28/02/2022	Daisy	1	1	1	1	1	1	1	1	1	1	1
01/03/2022	Tolu	1	1	0	1	1	1	1	1	1	1	0
02/03/2022	Vanessa	1	0	1	1	1	1	1	1	1	0	1
03/03/2022	Akan	1	1	1	1	1	1	1	1	1	0	0
04/03/2022	Obi	1	1	1	1	1	1	1	1	1	1	1
05/03/2022	Mimi	1	0	1	0	1	1	1	1	1	1	1
06/03/2022	Dan	1	1	1	1	1	0	1	1	1	1	1
07/03/2022	Thifa	0	1	0	1	1	1	1	1	0	0	1
08/03/2022	John	1	1	1	1	0	1	0	1	1	0	1
09/03/2022	Sonny	1	1	1	1	1	1	1	1	1	1	1
10/03/2022	Vami	1	1	1	0	1	1	1	1	1	1	0
11/03/2022	Fon	0	0	1	1	1	1	1	1	0	1	0
12/03/2022	Kim	1	1	1	1	1	1	1	1	0	1	1
13/03/2022	Dave	1	1	1	1	0	1	1	1	0	1	1
14/03/2022	Miguel	0	1	1	1	1	0	1	1	1	1	0
15/03/2022	Ade	1	1	1	1	1	1	1	1	1	1	1
16/03/2022	Doo	1	1	1	1	1	1	1	1	1	0	1
17/03/2022	T	1	1	1	1	1	1	1	1	1	1	1

On the Job Serious Game Data