

User Perception of Gaming Element Effectiveness in a Corporate
Learning Application

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ABSTRACT

This Conversion Masters in Information Technology thesis gathered users' perceptions about eight gaming elements to determine their effectiveness on aspects of playability, enjoyment and intrinsic motivation needed in a gamified corporate learning application. The study focused on user opinions about a Progress Bar, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Storyline/Theme and Avatar. A gamification application containing these gaming elements was designed and developed to make the evaluation. The application entailed users learning four Information Technology Infrastructure Library (ITIL) processes needed to manage an information technology department in a telecommunications company.

The application design process considered the business goals, rules, target behaviours, time limits, rewards, feedback, levels, storytelling, interest, aesthetics, replay or do-overs, user types, activity cycles, fun mechanisms and development tools needed to create a coherent, addictive, engaging and fun user experience. Player types were determined using the Brainhex online survey. Federoff's Game Playability Heuristics model was used to measure the users' perceptions about the playability of the application. Sweetser and Wyeth's Gameflow model was used to measure perceptions about the gaming elements' contribution toward creating an enjoyable experience. Malone and Lepper's Taxonomy of Intrinsic Motivation for Learning was used to measure the gaming elements' ability to promote an intrinsically motivating learning environment.

Masterminds, Achievers, Conquerors and Seekers were the most prominent player types found in the Brainhex online survey for which the gamification application design then catered. The staff in the department play-tested the application to evaluate the gaming elements. Overall the Storyline/Theme, suited to Seekers and Masterminds, ranked as the most effective gaming element in this study. The users perceived artwork as an essential component of a gamified learning application. The Individual Leaderboard, suited to Conquerors, ranked very closely as the second most effective gaming element. The Storyline/Theme and Individual Leaderboard both performed the strongest against the criteria measuring the playability. The Storyline/Theme was by far the strongest from a gameflow perspective and the Individual Leaderboard from a motivation perspective. The Avatars ranked the worst across all the measurement criteria.

Based on quiz results, 86 percent of the staff in the department had learned the material from the gamified training prototype developed in this work. The findings from this study will therefore serve as input for developing a full-scale gamification learning application.

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List of Abbreviations

ITIL	Technology Infrastructure Library
SDT	Self Determination Theory
BP	Brownie Points
XP	Experience Points
APEX	Oracle Application Express
PL/SQL	Procedural Language/Structured Query Language
URL	Universal Resource Locator

CHAPTER 1

Introduction

1.1 Introduction

This chapter describes the research goals, relevance, problem statement, context and outline of this thesis. Digital games are experiencing universal growth, which is extending into the workplace. These games are often compelling because they arouse a sense of curiosity, challenge, fantasy and fun in users [1]. They also promote intrinsic motivation needed in educational environments [2].

1.2 Background

Gamification is increasingly used in education because it is believed to motivate learners to higher levels of achievement [6]. The amount of research on the subject is rapidly increasing [7]. The gamification of a learning process, known as Educational Gamification, is different to Game-based Learning, Simulation and Serious Games. In game-based learning, simulation and serious games, specific subject matter can be learnt indirectly by playing a game [8]. Educational gamification, which pertains to the implementation of gaming elements to make the process of learning from conventional sources (as opposed to games) more engaging, enjoyable and motivating forms the basis of this thesis. Learning environments like universities have used gamification to motivate students to perform certain actions needed for academic success. Less research, however, exists on comparing gaming element effectiveness in achieving a fun and engaging experience in a corporate learning environment.

1.3 Problem Statement

The aim of this study is to compare the effectiveness of eight gaming elements on aspects of playability, enjoyment and intrinsic motivation needed in a gamification corporate learning application. User opinions about a Progress Bar, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Storyline/Theme and Avatar were evaluated using a gamified learning application designed and developed for this purpose.

The concept of gamification, specifically in learning, is examined together with some of the psychological theory that underpins it. A literature review on gamification assesses its effectiveness and focuses on the capability of gaming elements to change behaviour and create positive learning outcomes. The study evaluates the gaming elements and user types required for an engaging gamification experience. A review of the design criteria for gamification guides the development of the application used to compare the gaming elements. The playability aspects of the gaming elements

were compared using evaluation criteria from a model developed by Federoff in 2002 [3]. The enjoyment aspects were analysed using criteria from Sweetser and Wyeth's Gameflow model [4]. Malone and Lepper's Taxonomy of Intrinsic Motivation for Learning was used for evaluating intrinsic motivation [5].

The concept of gamification, specifically in learning, is examined together with some of the psychological theory that underpins it. A literature review on gamification assesses its effectiveness and focuses on the capability of gaming elements to change behaviour and create positive learning outcomes. The study evaluates the gaming elements and user types required for an engaging gamification experience. A review of the design criteria for gamification guides the development of the application used to compare the gaming elements. The findings from this thesis will serve as input for developing a full-scale gamification application aimed at encouraging learning in a South African mobile telecommunications company.

By 2020, mobile traffic volumes are expected to be 1000 times greater than 2010, while billions of wirelessly-connected devices will exist [9]. Mobile telecommunications networks will grow in complexity to handle the new level of connectivity, and new knowledge will be needed to manage it. The department in this study is responsible for implementing and maintaining specific information technology tools required to manage the network. The staff in this department will, therefore, need to go through extensive ongoing training to maintain the skills necessary to deploy and operate the systems that manage a modern mobile network.

The department on which this study focuses is part of a South African mobile telecommunications company. The department needs to create an engaging learning environment for its staff members to motivate them to acquire the knowledge necessary. The team being studied experienced low rates of formal education and only used 60 percent of its training budget. Only 35 percent of staff regularly accessed free online learning materials. Team members often blamed busy work schedules for not undertaking training. According to a Gallup poll [10], little motivation and engagement lead to 63 percent of global workers not making positive changes in their workplace. Learning is an active and participatory process requiring continuous motivation [8]. Younger learners are often more motivated to learn while those who are older require more self-direction and autonomy [11]. Approximately 52 percent of staff members in the department were older than 41 years of age. This age group shows a significant drop in participation in workplace learning according to a study conducted in European countries [11].

The problem experienced in the department, therefore, presents an ideal opportunity to compare the ability of various gaming elements to create an engaging learning experience. Building an application

that gamified the learning of the Information Technology Infrastructure Library (ITIL) process framework used in the department will serve to support this comparison.

The findings from this thesis will serve as input for developing a full-scale gamification application aimed at encouraging learning.

1.4 Scope

The application implemented is a way of determining user perception of gamification element effectiveness and is constructed to ensure each element is included in a clear and straight-forward manner. The aim is to convey the fundamental function and purpose of that element. Interface design of the prototype is therefore not within the scope of this work. Once the users' views of element effectiveness is established, interface design will be a focus of the production gamified system that is subsequently built. Since an interface can impact on how users perceive gamification, the most straight-forward incorporation of each element was considered the best way of diluting this impact on element effectiveness comparison.

1.5 Thesis Outline

This thesis documents the design, development and evaluation of a gamification application aimed at increasing the staff members' motivation, engagement and enjoyment of learning knowledge needed to work effectively and efficiently. The thesis includes seven chapters. Chapter 1 introduced the thesis by stating its goals, relevance and problem statement. Chapter 2 provides the background on the concept of gamification. Chapter 3 describes the application developed to compare the gaming elements. Chapter 4 provides a technical description of the application designed to evaluate the gaming elements. Chapter 5 describes the setup for assessing the gaming elements. Chapter 6 provides the evaluation findings and Chapter 7 contains the conclusions of the thesis.

CHAPTER 2

Background

2.1 Introduction

This chapter describes the background work that underpinned the development of the gamification application used in this study to compare the impact of its eight gaming elements on playability, enjoyment and intrinsic motivation in a corporate learning environment. It shows the role of gamification in learning and its pitfalls, outlines the theory of human motivation that underpins gamification, describes user types in gamification environments and discusses the process of designing gamified applications.

Play in the form of digital games is currently experiencing universal growth [12]. The Internet, social media and the proliferation of mobile devices are fuelling this growth. According to Gartner [13], more than fifty percent of organisations will use gamification to enable their innovation processes by 2015. By 2018, the gamification market is expected to reach 5.5 billion US Dollars [14]. In a recent survey, 55 percent of people expressed an interest in working for an organisation that used games to increase productivity [15]. Gamification is clearly becoming an important tool in organisations, and this study focuses on its application in corporate learning.

2.2 Gamification

Games are systems that engage users in abstract rule-bound interactive challenges, generating feedback and tangible results, which lead to an emotional response [16]. A computer game is a system because of the interconnected nature of its elements such as a score driving users' behaviour and strategy. Users interact with the game and other users while being presented with challenging goals. Games are an abstraction of reality and contain rules that govern fairness [8]. Instant, direct, and clear feedback in a game aims to shape the user's behaviour and action to achieve an unambiguous win condition [16]. Games and gamification share these fundamental principles.

According to Deterding [43] gamification uses game design elements in nongame contexts. There are various definitions for gamification that describe how it uses fun and game-like elements to encourage learning and engagement. According to Deterding [43] gamification uses game design elements in nongame contexts. Kapp [6] defines it as the use of *“game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems.”* This definition shows that gamification can easily be extended to an educational domain to encourage learning and achieving mastery in a subject. As it relates to “mechanics”, gamification uses levels, badges, points, scores and time constraints as necessary building blocks to create engaging experiences, but cannot

be used in isolation to achieve this purpose [6]. The gamification user interface must be aesthetically pleasing to ensure users are engaged and immersed in it or else they may reject it entirely. “Game thinking” turns a task like learning into a social experience where people compete and collaborate around a defined objective in an artificial environment similar to their real life environment [17]. Gamification is aimed at engaging users and keeping their attention through immersing them in the experience. Engagement is therefore the most important aspect of the gamification experience. “People” in the definition relates to those directly targeted for the engaging experience such as learners in an educational context [8]. “Motivate Action” refers to providing meaning for the operations where the challenges are at the correct level of difficulty to promote participation [6]. Educational psychology forms the basis of “Promote learning” because it contains techniques like allocating marks to activities, giving corrective feedback and encouraging collaboration [8]. Gamification, however, provides an additional layer and method of joining these elements to create an engaging game space to motivate learners. “Solve problems” stems from the competitive and cooperative nature of games [6].

Gamification is versatile and can take various forms, which can span from including simple game mechanics in performance tracking to the full inclusion of work tasks in a virtual gaming environment [18]. Whether gamification is used as a surface application or applied in-depth, its primary objective is to change behaviour, to promote and enable innovation and to encourage people to develop their skills through training or other activities [19]. In so doing, it leverages the natural competitive nature of most people together with the desire to accomplish achievements, which boosts their esteem and social standing. Gamification is said to also satisfy the need for closure, and by completing the task and beating the game this is accomplished [20].

2.2.1 Key Ingredients in Gamification

Reeves and Read [18] devised ten principles for developing gamification applications described in Table 1: Gamified Application Principles. These principles aim to increase user experience and engagement.

Design Element	Description
Self-Representation with Avatars	The capability for the user to represent themselves within the media of the game and to exert control over the representation has a positive impact on the psychological factors of using the technology which allows the user to get more involved and engaged in the game.
Three-Dimensional Environments	These settings allow the user to experience the virtual space in the game in the same way as in the real world, which provides a wealth of experience.
Narrative Context	The narrative context organises the various game elements into a specific context, which helps to keep the user engaged.
Feedback	Feedback to the user in the form of organised progress and status indicators provides the user with quantitative feedback that increases their level of engagement.
Reputations, Ranks, Levels	Reputations, Ranks and Levels are critical in multi-user games because it creates a hierarchy in the game, which encourages competitive behaviour and increases engagement.
Marketplaces and Economies	The ability to create an artificial currency and market, which allows the user to transact and create economic value in conditions of scarcity leads to greater levels of user engagement.
Competition Under Rules that Are Explicit and Enforced	Rules are essential to the functioning of a game because they create a level playing field that promotes a sense of fairness in the play, especially when the rules are known and enforced.
Teams	Group games have become more popular than solo games. The personal interaction it affords is an engaging factor because it serves as an emotional outlet for the user.
Parallel Communication Systems That Can Be Easily Reconfigured	Verbal and written communication in the game is an enabler for social engagement which increases the satisfaction of the game.
Time Pressure	The pressure of completing tasks on time in the game can serve as a compelling factor, which improves the user's engagement with it.

Table 1: Gamified Application Principles

The abovementioned principles are largely agreed in the gamified application design domain. The specific context, goals and user preferences, however, requires consideration for each implementation. For example, careful consideration is needed to determine the right level of time pressure to apply in learning environments. Too much time pressure could cause frustration and lead to the user not focusing on the learning objectives instead rushing to meet the time demands. While affording the user too much time could lead to boredom.

2.2.2 Gamification Implementations

Gamification has experienced rapid growth as seen in the success of Treehouse, a virtual training academy, which uses gamification to motivate users to achieve greater learning outcomes to advance their careers [21]. Students can select a curriculum aimed at a particular outcome and then earn points and badges as they progress through the related courses. A substantial accumulation of points and badges can serve to impress potential employers and ultimately increase potential earnings [21]. In another application, Mint, a credit card provider company, uses gamification to indicate progress to users on specified goals like saving for a new car together with ranks and rewards aimed at changing customer behaviour [21]. Another gamification implementation is a game called INNOV8, which IBM created to teach users business process management by making them take decisions impacting a fictitious company [22]. Institutions around the world use INNOV8 to teach students skills to bridge the gap between information technology and business teams in an organisation to solve business problems, prioritise actions and build consensus [22]. The game allows students to understand the impact of their actions from the safety of a virtual environment.

2.3 Gamification in Learning

According to Hamari et al. [7] the implementation of gamification is most common in educational and learning environments. The application of gamification mechanics in a learning process comprises over 70 percent of research on gamification in education [7]. Game-based learning, forms less than ten percent of studies conducted [7]. Moreover, about sixteen percent relate to the integration of a serious game with a learning intervention [23].

According to Lee and Hammer [2] evidence suggests gamification adds value to learning processes through creating increased levels of learner motivation and engagement. The definition of gamification purposefully contains the concepts of motivation and engagement [24]. Research in the field often builds on results from previous investigations and experiments and the link between gamification, motivation and engagement is well founded [23]. Studies into the application of gamification in school and university courses predominate. The gamification of in-service training programs in companies, is however, also growing in prominence [23]. A significant focus is also placed on the importance of learning design in gamified systems [23].

Learning has clear outcomes requiring particular measures, and therefore gamification of this requires careful consideration [8]. Gamification can create participatory learning experiences that promote active learning and it can also combine the use of media sources like audio, images and text into learning experiences. It is, however, important to get the right balance between the gaming and learning aspects of the system. Gamification will only be successful in learning when it is implemented holistically through the inclusion and careful blending of gaming elements [6]. Glover [8] suggests certain key questions to determine whether it is suitable to apply gamification to a learning activity or process. The first issue is to identify whether motivation is the real hindrance to learning in the environment as opposed to boredom or anxiety [8]. In the latter case, the design of the learning activity should be addressed to resolve the reasons for the issue. Clover [8] further emphasises the importance of good learning design, thereby ensuring good pedagogical practices pitched at the correct level before adding the complexity of gamification to the process. The second question is to determine the behaviours to encourage or discourage, so incentives are created and sustained to promote the right habits [8]. The next question is to identify whether a particular activity in the learning process is suitable for gamification [8]. Events with clear checkpoints and outcomes, which will assist the learner to determine their progress and determine outstanding tasks, are most suited for gamification. The fourth question is to identify if the gamification of a learning activity is creating a parallel way of assessing performance [8]. Participants in the learning process must see and understand that the formal assessment of the learning process is decoupled from the gamification elements. Gamification of the learning process is there to increase the participant's motivation and is not a grading system. Hence a leader on a leaderboard could be a low achiever on the grading system. Next is to determine whether the gamified process would favour some learners over others [8]. The motivation garnered through gamification could vary amongst users to the point where it could be a demotivating factor. It is, therefore, important to make the gamification elements voluntary for the participant in the learning activity by allowing them to opt out. The sixth question is to determine the most appropriate rewards to maximise the learner's motivation [8]. The next question looks at whether gamification will cause students to spend a disproportionate amount of their time on some activities in the learning process [8]. Incentives should ensure participants do not spend too much time on a particular task through the implementation of timers and point limits. Artificial scarcity should be applied to points to increase its value. The rewards should ensure sufficient level of effort is required to attain them, especially in the case of badges [28].

2.3.1 Pitfalls of Gamification in Learning

The gamification of an educational experience alone cannot make it a rewarding experience instead it can merely enhance one that is already rewarding [8]. Gamification uses extrinsic recognition and rewards to increase motivation, but it can demotivate participants who are already very intrinsically

motivated [24]. Evidence exists for a reduction in learner achievement due to extrinsic rewards negatively impacting motivation [25]. Gamified components of a learning process must be made optional to avoid this effect while still serving its purpose for those with lower levels of motivation.

According to Zichermann [26] gamification can encourage compulsive and addictive behaviour among certain people. Learners could become fixated on gaming elements while compromising more important activities in the learning process. The design of gaming elements is, therefore, necessary to ensure learners do not dedicate too much time to it. Gaming elements such as leaderboards could also stoke competition and motivate some but not others [26]. The adverse effects thereof are discouragement, less engagement and less enjoyment of the learning process [8]. Learners should be allowed to compete against their internal goals and gain reward for improvement to overcome this issue [8].

2.4 Theory of Human Motivation

According to Ryan and Deci [27] motivation is the factor which "moves people to do something". Motivation can range in level and orientation to the extent where some may have little and others an abundance of motivation in the same situation [27]. Intrinsic and extrinsic motivation are the main types of human motivation [27]. Gamification combines aspects of intrinsic and extrinsic motivation to increase the engagement and enjoyment of performing tasks.

2.4.1 Intrinsic Motivation

Intrinsic motivation exists when an action brings inherent satisfaction and joy [27]. The aspects of fun and challenge ingrained in the task make people want to perform it. The ability to satisfy the psychological needs for competence, autonomy and relatedness lead to intrinsically motivated action [27]. According to Werbach and Hunter [28] games satisfy all the psychological conditions needed for intrinsic motivation. As it relates to autonomy, user participation is voluntary, while the accomplishment of goals allows for the feeling of competence and the ability to share achievements provides the fulfilment of relatedness [28].

2.4.2 Extrinsic Motivation

Extrinsic motivation exists when an action brings detachable and instrumental value [27]. Extrinsic motivation differs from intrinsic motivation because it results in action performed not for its pure enjoyment but rather for its instrumental value [27]. An example is a child who does her homework to avoid going to detention. Extrinsic motivation is also far less persistent and sustainable. It is, however, important because people are often required to perform tasks for which they are not intrinsically motivated [27]. Although extrinsic motivation is less powerful than intrinsic motivation, the two may

still play a complementary role, especially in an educational environment to increase learners' motivation. Hence the right combination and balance of extrinsic rewards contained in gaming elements can lead to intrinsic motivation for learning a particular subject.

2.4.3 Theoretical Frameworks for Motivation

Six key theoretical models describe the relationship between intrinsic and extrinsic motivation [6]: ARCS Model, The Theory of Intrinsically Motivating Instruction, Instructional Design Principles for Intrinsic Motivation, The Taxonomy of Intrinsic Motivation, Operant Conditioning and Self-Determination Theory.

2.4.3.1 Self-Determination Theory (SDT)

Edward Deci and Richard Ryan developed SDT as a cognitive theory providing a framework for understanding intrinsic motivation and its importance. It approaches motivation from the perspective of the human mindset as opposed to behaviourist theories which advocate extrinsic motivation as the way to move people to action [27]. SDT asserts that although people are naturally proactive in growing themselves, their external environment is a major determining factor. As such the theory outlines the conditions needed to maximise motivation as being the following [27]:

- Autonomy: Acting on one's will in congruence with one's objectives, wants, values, and identity;
- Competence: A growing ability to drive change in the world; and
- Relatedness: Creating intimate connections with others.

In cases where the above conditions are satisfied, people tend to be intrinsically motivated.

2.4.3.2 The Taxonomy of Intrinsic Motivation

The Taxonomy of Intrinsic Motivation is a combination of Lepper's Instructional Design Principles for Intrinsic Motivation and Malone's Theory of Intrinsically Motivating Instruction [5]. The theory focuses on internal motivation and interpersonal motivations. Regarding internal motivation it addresses the following aspects [5]:

- Challenge: Relates to the goals, uncertain outcomes, feedback and self-esteem of participating in the game;
- Curiosity: Relates to the sensory and cognitive inquisitiveness evoked in the game;
- Control: Relates to the contingency, choice and power afforded to the user in the game; and
- Fantasy: Pertains to the emotional and cognitive aspects of fantasy and the combination of fantasy and learning the desired skills in the game.

Regarding interpersonal motivations the theory addresses the following aspects [5]:

- Cooperation: Users working together to achieve a goal;
- Competition: Users competing against each other to achieve a goal; and
- Recognition: Making achievements visible to all users, so they recognise the effort needed to achieve the desired level of mastery.

2.4.4 State of Flow

A person experiences a state of flow when something captures their complete attention and imagination for an extended period [29]. In this state, the person has no intrusive thoughts, loses track of time and experiences sustained focus, pleasure, and enjoyment. Mihaly Csikszentmihalyi, a psychologist, extensively studied the state of flow and determined the following requirements for its existence [29]:

- Clear goals;
- No distractions;
- Direct feedback; and
- Continuous challenges.

Activities must stay in the flow channel so people do not discontinue because of boredom caused from it being too easy or frustration from too much difficulty [29]. (See Figure 1: The Flow Zone.) Flow is an important aspect that must be present in gamification applications to ensure an engaging experience. In case where the user is not kept in the flow channel they may lose interest in the gamification exercise and hence its underlying objectives will not be met.

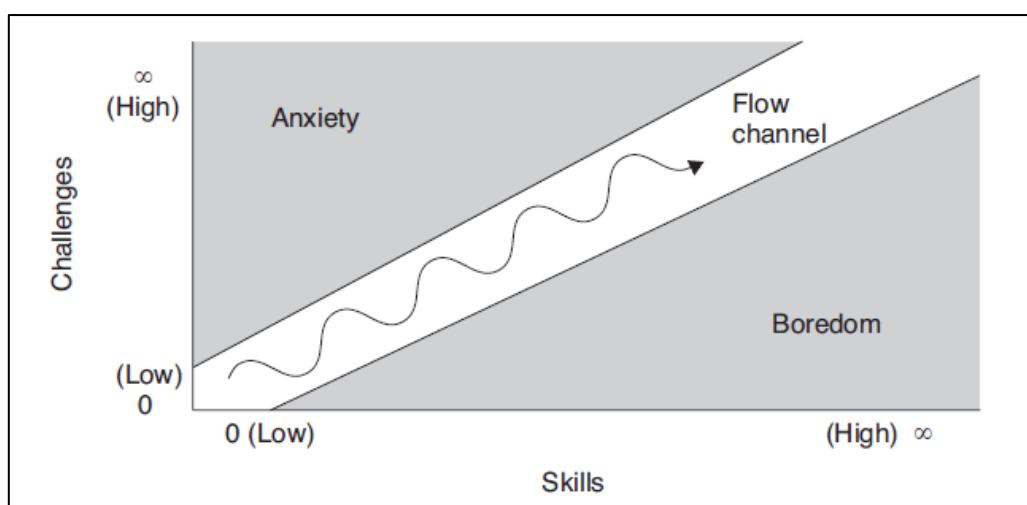


Figure 1: The Flow Zone [29]

2.4.5 Relationship between Motivation and Learning

Intrinsic motivation is an important aspect of education because it contributes to improved learning and stimulates creativity [27]. Learner motivation is a major issue in education and is often addressed inadequately, yet it is an essential factor for achievement and as an outcome in itself [30]. Active involvement and commitment to the learning process is a result of a learner's motivation to learn. The development of goals, beliefs and attitudes in learners is critical for their participation and contribution in learning [30]. The commitment of students to continuously improve their knowledge is as important as achievements in specific learning interventions.

There is an increase in studies about the effectiveness of particular gaming elements, which also extends to learning environments. Individual studies have shown that uncertainty is a major factor in improving motivation when associating learning and playing games [31]. This was demonstrated in an experiment that showed the willingness of ten to eleven-year-old children to game the attainment of points while participating in a maths quiz [31]. The uncertainty brought about in games in these experiments not only increased the levels of enjoyment and engagement in the participants but also increased their levels of learning [31].

Research has also shown that factors promoting intrinsic motivation are more important than extrinsic motivation in the case of learning [6]. Extrinsic factors like badges, points, and rewards can lead to demotivation if they are not setup equitably and transparently, and little learning takes place if the user pays too much attention to achieving the reward. Students were less efficient and logical in solving a problem when offered a reward, which increased in subsequent experiments [32]. In cases where rewards were offered students also tended to choose simpler challenges, which would make it easier to achieve the reward [32]. The existence of extrinsic rewards, therefore, hurt the performance of the students in these experiments. An experiment conducted with nursery school children showed that extrinsic rewards had caused the children to display less of the desired behaviour [1]. Hence people sometimes only perform actions for its extrinsic reward. A meta-analysis of 128 studies concluded that rewards aimed at controlling behaviour increased monitoring, evaluation and competition, which undermines intrinsic motivation [33]. Extrinsic motivators do, however, have a role to play in learning, especially when learners do not find interest in the learning exercise [32]. Studies found that in certain cases extrinsic rewards can enhance intrinsic motivation and are only moderately negatively correlated [34]. Self-Determination Theory provides a framework to add autonomy, competence and relatedness to the gamification design, where extrinsic motivators can be used to provide feedback on performance that is intrinsic [6].

Avatars allow users to customise their game character to resemble them to a certain extent, which studies found is an effective way of influencing their behaviour [6]. Studies showed that avatars could change people's perceptions. For example, subjects in a study placed in the avatar of an old person

showed less stereotyping of the elderly compared to those put in the avatar of a young person [35]. In a similar experiment, people experiencing an avatar of themselves eating healthily and exercising adopted the same behaviour in real life as compared to the control group in the experiment [35]. In a further study, students seeing an ageing avatar of themselves started investing for retirement [36]. In a learning environment, it is better to use both an “expert” avatar and “motivational” avatar as opposed to a combined “mentor” avatar [6]. The research found figurative information delivered from two distinct sources was better understood [37].

2.5 Player Types

People play games for different reasons and in different ways. The reasons for playing games may include; satisfying a competitive nature, an enjoyment of challenges, a need for socialising and a need for exploration. Users interact with a game differently whether it promotes competition, cooperation or a combination of both [6]. Gamification systems view traditional application users as players because they aim to make an activity more like a game. The motivational factors influencing users are an important consideration to ensure the success of a gamification application. The gamification design must be adapted to suit the “player type” being targeted as opposed to the person in their standard capacity [38]. For example, a very competitive game is not useful if the players/users are of the non-competitive type. Richard Bartle [39] identified four player personality types, “Achievers”, “Explorers”, “Socializers” and “Killers” defined in Table 2 below.

User Type	Description
Achievers	Play to win and are goal driven. Enjoy gathering points, badges and levels. They are not inclined to show off results to others. Proportionately this user type represents ten percent of users.
Socializers	Enjoy interacting with others in a virtual world. Proportionately this user type represents the vast majority of users.
Explorers	Enjoy interacting with the surroundings and like discovering new areas and knowledge about it. Proportionately this user type represents ten percent of users.
Killers	Play to win and are goal driven but like acting on other users by dominating, attacking, killing or make their life difficult in the virtual environment. Proportionately this user type represents one percent of users.

Table 2: Bartle Player Types

Despite its criticisms and origins in Massively Multiuser Online Role-Playing Games Bartle’s model remains one of the most prominent and well-understood player typology frameworks [40].

The Bartle Model is limited because user types are not mutually exclusive and it cannot be validated as it is not empirically based [41]. The Brainhex survey instead does not view player types as mutually exclusive, and it extends the Bartle model to include categories for Seeker, Survivor, Daredevil and Mastermind, while replacing the Killer category with Conqueror [42]. The survey also highlights “Exceptions”, which are gaming attributes players dislike [42]. The Mastermind category contains the “No Mercy” exception, meaning users in this category rarely cares about hurting the feelings of other players. Examples of the Exceptions found in the Brainhex survey included:

- No pressure: You dislike being asked to perform under pressure, preferring to take your time so you can make the right decision.
- No mercy: You rarely if ever care about hurting other players' feelings - mercy is for the weak!
- No fear: You do not enjoy feeling afraid, preferring to feel safe or in control.

Table 3: Brainhex Player Types describes the Brainhex player types [42]:

User Type	Description
Seeker	Seekers are motivated by an interest mechanism and are curious about the game world and enjoy moments of wonder.
Survivor	Survivors enjoy a sense of terror and fear.
Daredevil	Daredevils benefit from the thrill of the chase, the excitement of risk taking and playing on the edge.
Mastermind	Masterminds enjoy solving puzzles, creating strategies and making efficient decisions.
Conqueror	Conquerors enjoy behaving forcefully to defeating difficult foes, struggling to achieve victory and beating other users.
Socialiser	Socialisers find people are the primary source of enjoyment in the game and they enjoy communicating, helping and being around people they trust.
Achiever	Achievers are explicitly goal-oriented and are compulsive about achieving long-term goals and ticking off accomplishments. Achievers prefer games that have an ultimate completion.

Table 3: Brainhex Player Types

The target player classes for the gamification application in this study were defined using the Brainhex survey technique because it is comprehensive, readily available and easy to use.

2.5.1 Skill Levels

The skill level of users is a critical consideration to attract novices and retain experienced users in the gamification experience. Novices have to be guided gently by making the experience attractive and appealing to them through scaffolding [6]. The first task in the gamification process should not be too challenging, and the novice should be recognised and encouraged once they have completed a task by receiving a reward. It is also important that the gaming interface is easy and intuitive to make it easy for novices to get accustomed to it.

Once users can competently engage in the game, then they have reached an expert level allowing them to interact with the game for longer periods and achieve greater success [6]. Well-designed games deliver new tasks, content and challenges, which keep users engaged at the expert level for extended periods and keeps them returning to it [6]. Unique rewards, items and levels not accessible to novice users increase the level of intrigue for experts. Users reaching the highest level in the game have accomplished all its tasks and have in-depth knowledge, which they should be encouraged to share with other users while receiving recognition [6].

2.6 Gamification Design

The gamification application design process is critical for developing engaging applications, which are user-friendly, fun and motivating. There is a lack of research-based guidance for designing gamified systems despite the growth in the field [43]. Effective game design combines art and science to make design choices that promote the development of a coherent, addictive, engaging and fun user experience [28]. Many of the existing frameworks are derived from other related backgrounds like game design and motivational theory but are largely congruent in the steps followed in the design process. The steps include defining business goals, rules, identifying target behaviours, time limits, rewards, feedback, levels, storytelling, interest, aesthetics, replay or do-overs, describing user types, designing activity cycles, designing fun mechanisms and selecting appropriate development tools [28]. All these steps are interlinked and must be addressed to create a fun and engaging gamified learning environment [6]. Any omission will erode this interrelationship and will negatively impact the effectiveness of the application. The following section describes these steps in more detail.

2.6.1 Business Goals

Gamification applications must contain clear and unambiguous goals, which relate to specific outcomes instead of generic business goals. Gaming elements must motivate the user to engage with the learning challenges and not just scoring in the game [44]. Clearly stated goals also generate

greater levels of motivation in the gamification and learning process [20]. For example, participants must be made aware of how many points they need to attain a certain level or badge. The ability to evaluate the effort required to achieve a goal and the points or badges associated with it serves as a motivating factor [20]. Short term goals create higher levels of motivation because they are easier for participants to understand and achieve. The long-term goals and the effort needed to attain these should, however, be made apparent to the participant [20]. People are willing to expend greater effort on goals which are more complicated and not too easy to achieve when these goals are clearly stated. Finally, it is essential to implement gaming elements in a way that promotes the process of working toward a goal instead of only its attainment.

2.6.2 Rules

Rules are necessary and have to be known and enforced to create a level playing field that promotes a sense of fairness in the play [18]. Rules are crucial to the existence of games because this creates a useful framework and governs the actions of the users [6]. Rules pertain to the number of users allowed, scoring points and the permissions granted in the game [6]. According to Salen and Zimmerman [45] rules have to limit user action, be explicit, clear, common, fixed, binding and repeatable.

2.6.3 Target Behaviours

Games usually evoke three primary user behaviours namely conflict, competition or cooperation [45]. In the case of conflict, the user either competes with other users or against the game itself. Competition relates to users struggling against each other within the environment of the game in a zero sum game. Conflict can exist in a single player game, whereas competition requires a multi-player environment. The gaming environment must stimulate individual performance without hindrance from other users [6]. In games based on cooperation, users have to work together to achieve a mutual objective. Users' success is dependent on the amount of collaboration they exercise. The target behaviours sought in a gamification application must support its goals and must be concrete and measurable [28]. Once the desired actions are identified, quantifiable metrics to measure these must be developed. These metrics are ultimately used to provide the player with feedback on their actions in the gamified system [28]. The metrics must support the desired behaviour and must relate to the relative value to the organisation. For example, completing a course might be 10 points but completing it within a certain timeframe might be 15 points. Defining the metrics is not a static exercise, and needs refinement throughout its lifecycle [28].

The creation of "win states" is another type of success metric [28]. The user must, however, not lose interest or become despondent as they reach the win state. Temporary or localised win states can be used to overcome this issue [28].

2.6.4 Time

Time serves as an essential element to motivate users to take action. A visible clock counting up or down creates a positive psychological impact and pressure, which focuses the user on the goal of the game [6]. Time can also serve to simulate a pressurised work situation. It is a vital resource, which the user has to prioritise and apportion to achieve the required objectives. The users can also have the opportunity to trade or exchange time for other resources in the game [6]. The pressure of completing tasks on time in the game can serve as a compelling factor, which improves the user's engagement with it [18].

2.6.5 Rewards

Badges and points are often necessary for the gamification process and require integration with other gaming elements. Points are a necessary game mechanic due to their simplicity, speed and visible feedback, which guide the user's behaviour in the gamification process [46]. The user's motivation improves as they increase their points in the game while leaderboards allow for the comparing of achievements [47]. Badges are used to quantify progress through challenge and scarcity [47]. It may also be used as a surprise reward to encourage users who only partially meet a challenge.

The integration of reward structures and other gamification elements must be carefully planned to maximise their effectiveness and should not become the primary focus of the gamification process [6]. For example, the fun factor of being at the top of a leaderboard often revolves around informing other users about it instead of just accumulating the required points.

2.6.6 Feedback

Feedback to the user in the form of organised progress and status indicators provides the user with quantitative information that increases their levels of engagement [18]. Feedback in games provides users with information on progress toward their goal. It also guides the user to the desired behaviour needed to achieve the game's intended objective.

2.6.7 Levels

Levels in a game relate to the user's proximity to the end goal of the game, the degree of difficulty in the game or level of experience gained while playing the game. These levels may occur simultaneously as the user progresses through the game [6]. Levels are usually as a result of gathering points in the system; access to parts of the game pertains to user privileges based on progress, behaviour, etc. Power refers to control the user exerts in configuring the game [47].

Unlocking is a gaming mechanic, which allows the user to control the game content based on their past performance, which allows for a more flexible experience [47].

2.6.8 Storytelling

Stories create a meaningful context for the gamification experience, which promotes greater user enjoyment and engagement [6]. Tasks contained in the storyline must be closely related to the duties in the learning process to maximise the effect of the storyline in the game which increases the likelihood that the user acquires the behaviours and actions taught [6]. The narrative of the story can, therefore, serve as a risk-free environment in which the user can experiment and acquire new knowledge. The storyline of the game also allows for a fun factor, which increases the learners' enjoyment in the process and avoids the boredom factor. Stories also improve the retention of knowledge.

2.6.9 Interest

Game flow and the sequence of events is critical to maintaining user interest in the gamification process [6]. The experience must keep the user's attention, which starts from the point when an attempt is made to capture it. The user's interest should strengthen as time spent in the experience increases. According to Schell [48] something of interest should hook the user, and after that, a presentation of the underlying purpose of the game can occur. The gamification design should allow heightened interest in the game to coincide with the learning objectives. The learner exits the process at an increased level of interest having also satisfied the sequence of learning objectives. A continuous cycle of checking user interest must be implemented to fine tune the sequence of events to ensure users are fully engaged in the game [48].

2.6.10 Aesthetics

Art and visual aspects must sustain user engagement and provide an exciting experience. Visuals require the correct alignment and detail to ensure a pleasing experience [28]. Captivating aesthetics in a game helps to keep the user riveted [6]. The combination of art and other gaming elements can create a very engaging experience for the users.

2.6.11 Replay or Do-Over

The replay or do-over is a vital aspect of gamification because it creates a safe environment for users to fail and encourages exploration, curiosity and discovery-based learning [6]. Users learn crucial lessons from their failures and achieving the winning condition without a replay or do-over is often dissatisfying. For a user to enjoy the game, they must feel that something was accomplished and

achieved. A sense of real accomplishment prevails after a few failures, which makes the experience more fun and memorable [49].

2.6.12 User Definition

It is important to identify the players (users) in the gamified system because they have different levels of motivation [28]. Achieving the targeted behaviours and goals may require different tactics. A lack of desire or capability may lead to incomplete tasks. A lack of desire needs an engagement-oriented approach, while a lack of ability requires gently walking the user up the difficulty curve [6]. Such a segmentation of the system ensures it is appropriate for multiple user types. The most effective gamified systems cater for all user types and use avatars to represent those [28]. The lifecycle through which the user traverses in the game also need to be given careful consideration in the design. The usual user progression is to start as a novice then to advance to being a regular and ultimately becoming an expert [6]. Novices typically require more assistance and encouragement in the system, regulars need to be presented with compelling content to keep them engaged, and experts need to be presented with hard challenges that reinforce their status [6]. Users are at different levels throughout the lifecycle of the game but are skewed toward the expert level as it matures [28].

2.6.13 Create Activity Cycles

Successful games usually traverse through various loops and branches instead of following a linear path [28]. The creation of activity cycles is an effective way to model the system because it consists of the user performing an action, which in turn invokes another action and continues in this pattern [28]. Engagement loops and progression stairs represent the two types of activity cycles. The engagement loop provide a low-level description of the user's actions, the reasons for those actions and the corresponding system response, while the progression stair provides a high-level overview of the user's journey [28]. The "Engagement Loop" entails the user receiving feedback from their actions, reinforced through awarding points that in turn motivates further user action [28]. Feedback is essential in driving the user and should be visible and immediate. Points, leaderboards, levels, and achievements are all examples of such feedback. An essential building block of a gamification system is engagement loops used in conjunction with progression stairs [28]. Progression Stairs consider the fact that the game experience for users changes as they move through the system, which means challenges have to escalate in level to keep the user engaged [28].

2.6.14 Implement Fun Mechanisms

Creating an enjoyable experience for the user is critical when piecing together all the components of a gamification system. The aesthetic appeal and amount of fun the user experiences in the game is a key factor in determining if they will return to the game [28]. The acid test is to determine if the users will go back to the system in the absence of an extrinsic reward. Fun experiences consist of four

categories, 1) hard fun like the challenge of a puzzle, 2) easy fun which is casual enjoyment, 3) experimental fun which is about trying out new experiences and 4) social fun derived from interaction with others [28]. The types of fun offered in a gamified system are dependent on its context and user types.

2.6.15 Select Appropriate Tools

The final step in the gamification design process is to choose the right development tools to develop the application [28]. The right combination of business, people and technology skills is needed to develop an effective gamification system.

2.7 Conclusion

A clear link exists between motivation and learning theory and the use of gamification can result in improved motivation to conduct learning. Gamification can make a significant contribution to creating fun and engaging learning environments. The design of gamification applications, however, requires careful consideration to ensure the correct balance of gaming elements. Balanced and complementary gaming elements have the ability to improve a learner's intrinsic motivation, thereby increasing the likelihood of their success in learning. The design of gamified learning applications requires a methodical approach that takes into consideration the context in which it will operate. It must also support the needs of its users to achieve success.

CHAPTER 3

Gamification Application Description

3.1 Introduction

This chapter describes the gamification application developed for this thesis. It covers the business objectives, target behaviours, user types, gaming elements and fun mechanisms used in the gamification application. The aim of designing and developing the application is to compare the effectiveness of eight gaming elements on aspects of playability, enjoyment and intrinsic motivation needed in a gamification corporate learning application. User opinions about a Progress Bar, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Storyline/Theme and Avatar were evaluated using a gamified learning application designed and developed for this purpose.

3.2 Business Objectives

The gamification application aims to increase the level of engagement and learning of 4 ITIL service management processes recently implemented in the telecommunications department. The availability management, incident management, release management and change management ITIL processes serve as an essential guide for staff in the department to perform their operational duties. The uptake in learning these processes has been very slow because staff feel they are too busy with other tasks. The gamification application aims to create an engaging learning environment. It includes the eight gaming elements that would subsequently be compared to determine their impact on playability, enjoyment and motivation. The business objectives were as follows:

- To create an engaging training experience to compel staff members to apportion more time to training and self-development;
- To complete the learning of the 4 ITIL processes;
- To foster healthy competition for acquiring knowledge; and
- To create a spirit of teamwork in learning.

The gaming elements implemented in the gamification application were designed to support staff members in achieving the abovementioned objectives.

3.3 Design

The aim of the gamification application is to encourage staff members in the department to engage in the behaviour of learning the ITIL processes. Staff has to sign-up for the gamification application where they capture their demographic details together with a login username and password. After

login, users got background on the gamified learning application and choose whether to join the game. The application content rendered to users who selects the gamified version contains all the learning materials and gaming elements. The content presented to users who do not choose the gamification version includes only the learning materials. The gamified learning application consists of eight gaming elements, namely; a Storyline/Theme, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Progress Bar and an Avatar. Glover's [8] key questions to determine the suitability of applying gamification to learning were applied to the design of the gaming elements in the application.

3.3.1 Player Definition

The gaming elements most suited to the player classes identified in the Brainhex survey are experience points, badges and an in-game currency (suited to the Achievers), puzzles or riddles (tailored to the Masterminds), progress bars and leaderboards (tailored to the Conquerors), and a storyline and visual artwork (tailored to the Seekers). These elements are, therefore, incorporated in the application.

3.3.2 Storyline/Theme

The Storyline/Theme of the gamified learning application is known as "The Great Escape" and places the user in the role of a time traveller who travels to the ancient Egyptian Pyramids. When the time traveller tries to return to the present, their time machine breaks leaving them trapped. A wicked high priest then holds the user hostage in the "Pyramid of Time" and will only release them to the present providing they can solve an ancient riddle. The riddle in the storyline is *"what can be found in the Pyramid of Time that you would not see if you looked at it and if you saw it you would not see anything else, but it has great power to make anything happen and then return it to normal later."* The user has to solve the riddle within 8 hours, and an incorrect answer will leave them enslaved to the wicked high priest for eternity.

The user has to search the chambers of the Pyramid of Time, represented by the 4 ITIL Service Management processes to find clues to the riddle. The users receives the relevant process training material upon entering the chamber. They have 2 hours to study the process and complete a quiz about it. The quiz consists of 5 multiple choice questions. The user receives two clues to resolve the riddle after completing the training on each process and providing at least 4 correct answers to its quiz. The answer to the riddle was the word "IMAGINATION". After completing the training on a quiz the user had to complete a simple phrase, which gave them some of the letters of this word, such as the clue "What's the missing letter of the word MO_IVA_E?" After obtaining all the clues, players had all the letters, and simply had to anagram these. So the game's winning condition could be reached

after the user had completed the training on all four processes. The application allows the player to answer the riddle only after they completed all the quizzes.

The famous Indiana Jones movie plots inspired the application theme. It creates a sense of intrigue, adventure and mystery. The pictures and artwork in the application depicts the ancient pyramids to stimulate a sense of mystery. The Storyline/Theme suits the “Seeker” user class prevalent in the department. The need to find clues to solve the difficult riddle appeals to the “Mastermind” user class also found amongst staff members.

3.3.3 Experience Points

The users are awarded experience points (XP) on completion of each quiz. The total amount of XP available in the game is 90. The XP varies based on the difficulty and importance of each ITIL process. Users receive a maximum of 5 XP if they get 4 or more answers correct on the incident management process quiz, 15 XP each for the release and problem management processes and 25 XP for the change management process. They receive half XP if they get less than four answers correct, but more than 2. They receive a quarter of the XP if they get less than two answers correct, which is aimed at motivated the users to continue with the learning process. The users could complete a bonus quiz on each process containing three additional questions and if they get 2 or more answers correct they get an additional 50% of the XP available.

3.3.4 Individual Leaderboard

The Individual Leaderboard is designed to encourage users to compete in a fun way, by displaying the Top 10 users and their points. The Leaderboard displays only the top 10 to motivate users to achieve this position while not discouraging those further down from achieving the learning objectives. It also displays the “Gamename” instead of the user’s real name to provide them with a further level of comfort with this gaming element.

3.3.5 Departmental Leaderboard

The Departmental Leaderboard is designed to encourage teamwork and competitiveness amongst departments. The Departmental Leaderboard shows the total amount of XP for the top 4 users belonging to each department, as it is important to be fair to departments with fewer staff.

3.3.6 Avatar

When signing up and selecting to be part of the competitive game, the user could select an Avatar to represent them in the game. There are multiple Avatars to select with different attributes and characteristics. Each Avatar has a picture that best described it. See Figure 2: Sample Avatar.

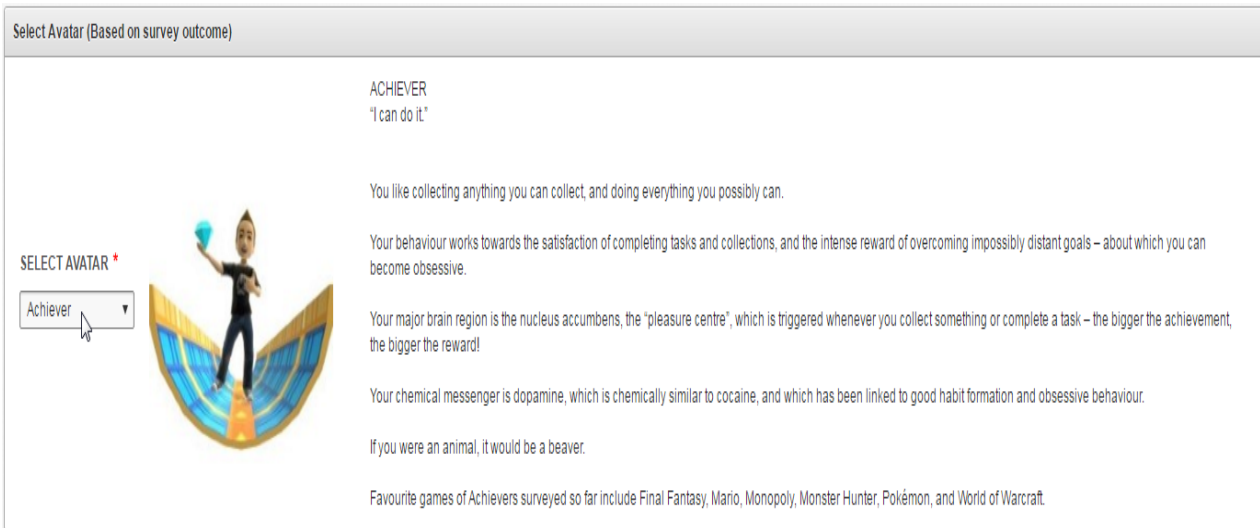


Figure 2: Sample Avatar

3.3.7 Badges

The users receives a motivational “Welcome” badge upon signing up for the game. The application also contains two further “Performance Badges”. These badges are earned when the user reaches 30XP and 60XP. See Figure 3: Sample Badges.



Figure 3: Sample Badges

3.3.8 In-Game Currency

An in-game currency, Brownie Points (BP), is implemented in the application. Users are given 1 BP at the beginning of the game and earn 10 BP for every XP scored. The following trades are possible:

- Quiz Do-overs: These allow users three additional chances at completing a quiz;
- XP Sharing: The user can share their XP with members of their departments; and
- Time-off: Users can exchange BP for time off work (half a day).

3.3.9 Artwork

The artwork aims to support the Storyline/Theme in the application. The Home Page displays four pieces of artwork namely a pyramid, the high priest and his lair, as well as a caricature of Indiana Jones. See Figure 4: Sample Artwork.

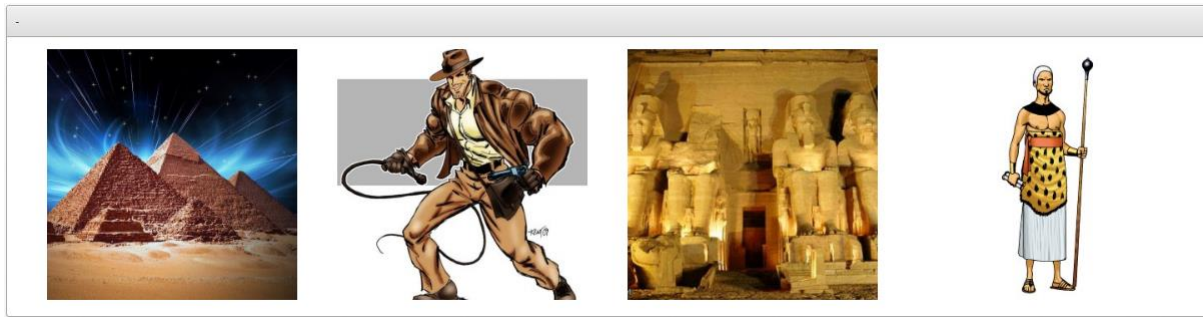


Figure 4: Sample Artwork

The user is shown pieces of Artwork in the Trades Page depicting a money pyramid, a scale and text indicating the amount of BP needed to make trades. See Figure 5: Sample Artwork II.



Figure 5: Sample Artwork II

Another piece of artwork on the Great Escape Page "Mission Completed" appears once the user completed a quiz. See Figure 6: Sample Artwork III.



Figure 6: Sample Artwork III

3.3.10 Timer

A timer is visible to the users throughout the game. The timer starts when the user commences with a process. See Figure 7: Timer. The timer is visible while the user studies the process learning material and while they complete a quiz. The timer stops once the quiz answers are submitted.

Duration * 0 hours 3 minutes 28 seconds

Figure 7: Timer

3.3.11 Implementation of Fun Mechanisms

The theme aims at creating fun and intrigue in the gamified learning application. The storyline places the user in the situation of having to answer a riddle within a defined timeframe to make the great escape from the tyranny of the high priest. The artwork in the application shows pictures of the ancient pyramids, which supports the game's theme and aims to create a fun experience. The users are able to select an Avatar to represent them in the game, which sought to increase the fun and enjoyment of the experience. The Avatars provides an abstract reflection of the Hexbrain user classes identified. The creation of metadata presented in drop down boxes makes it easy for users to capture information accurately.

3.4 Functional Description

The gamification application aims to deliver a fun gaming experience while engaging its users with the ITIL process training materials. The application consists of a Login, Registration, Home, Gaming, Progress, Trades and Help function. See Figure 8: Application Functional Flow.

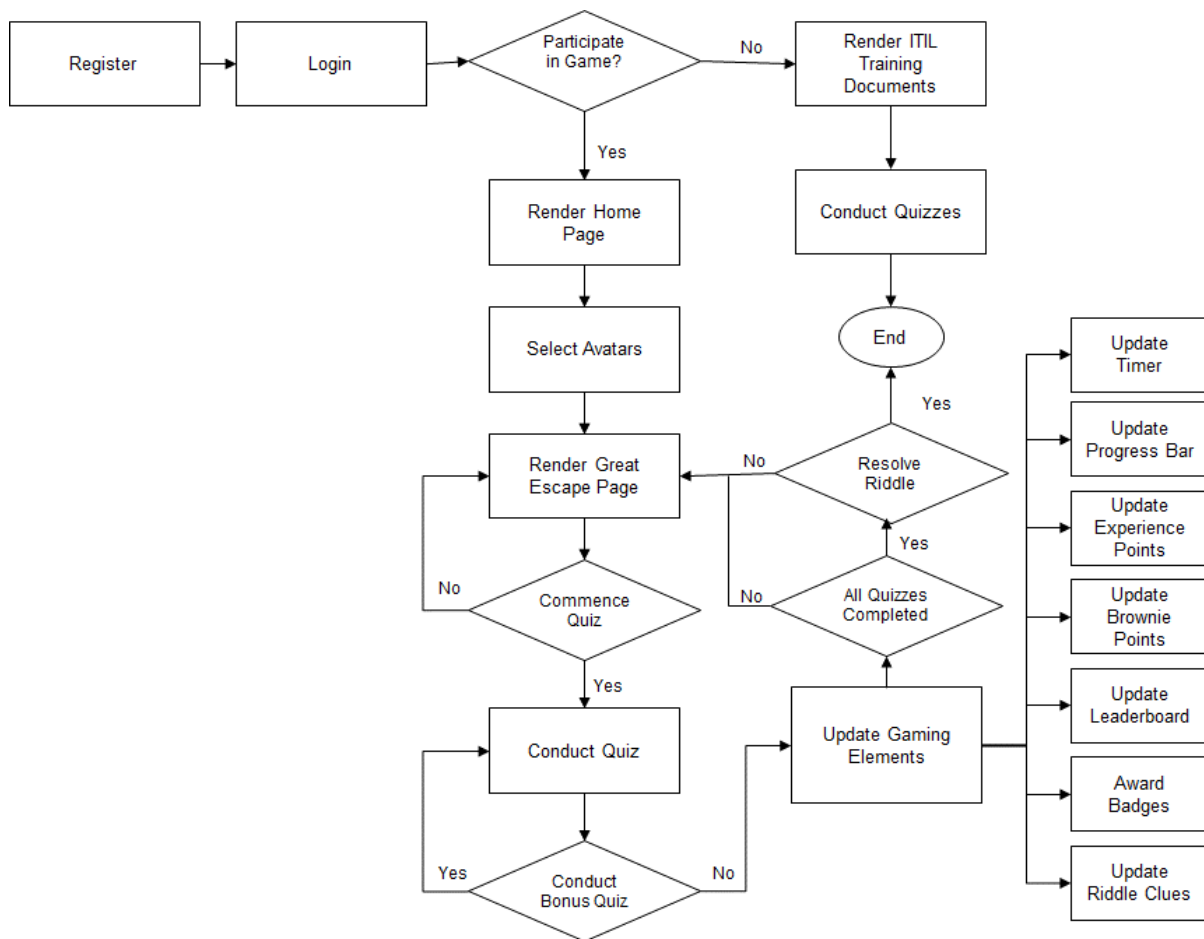


Figure 8: Application Functional Flow

3.4.1 Login Function

The Login function renders when the user evokes “The Great Escape” universal resource locator. Returning users are required to enter their “Gamename” and “Password” credentials to access the game. Users without login credentials are prompted to register. The login credentials are looked up and authenticated in the application’s database. The Login page does not contain any artwork to keep it clean and straightforward. See Figure 9: Login Page.

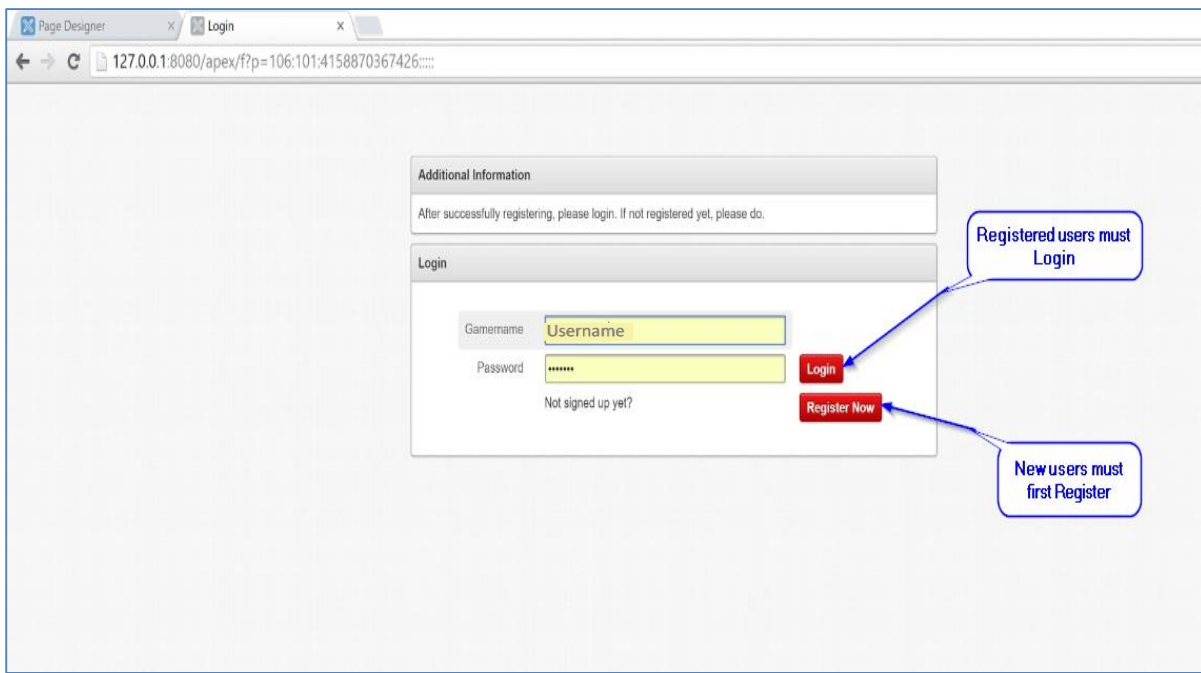


Figure 9: Login Page

3.4.2 Registration Function

The Registration function is evoked from the Login function and serves to register users for the game. The first step in the registration process is for the user to choose if they wanted to participate in the gamification experience. This choice allows the user the freedom to access the learning material without being pressurised to take part in the gamification experience. The users, who opted to join the competitive game, goes to a sub-function to choose an Avatar to represent them. See Figure 10: Avatar Selection. None of the users opted out during the experiment.

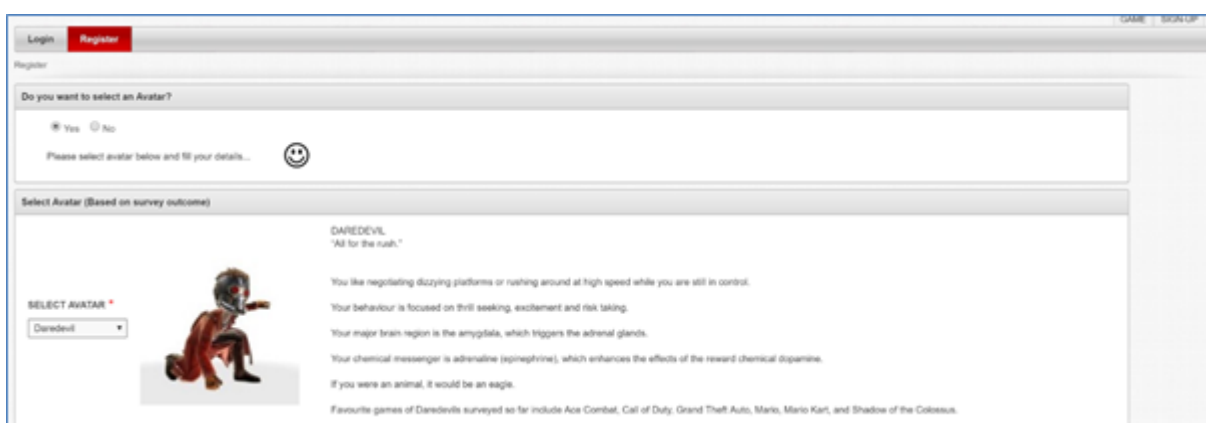


Figure 10: Avatar Selection

Once the user completes the Avatar selection, they are directed back to the main registration page to capture their Gamename, Employee Name, Location, Email Address, Employment Type, Company,

Job Title, Password, Manager, Department and Division. The information captured on the registration page is used to populate the gaming elements. See Figure 11: Registration Page.

The screenshot shows a registration form with the following fields and options:

- Do you want to partake in the competitive game?** (Radio buttons for Yes and No)
- Employee Details:**
 - GameName: *
 - Employee Name: *
 - Employee Surname: *
 - Location: *
 - Email Address: *
 - Employment Type: Permanent, Contractor
 - Company: *
 - Job Title: *
 - Password: *
 - Confirm Password: *
 - Manager: *
 - Department: *
 - Division: OSS

Callouts in the image:

- One callout points to the "Yes" radio button, stating: "By taking part of the full game, users will have access to functions like choosing avatars and competing in the OSS Leaderboard".
- Another callout points to the "Submit" button, stating: "All the fields are mandatory. To capture Gomer details, the user needs to submit information".

Figure 11: Registration Page

3.4.3 Home Page Function

Users are directed to the Home Page once they register and complete the login. See Figure 12: Home Page Function. The Home Page contains five functional regions. The "Game Storyline" region provides users with an overview of the Storyline/Theme included in the application. The "Game Rules" region provides all the rules of the game and describes the scoring and the winning condition of the game. The "Make Great Escape" region contains artwork that prompts the user to start the game. It also contains a "Start" button that launches the first ITIL process which the user has to learn. The "Win Condition" region includes the riddle and a field for the user to enter their answer. The "Game Artwork" region includes artwork related to the storyline/theme of the game, which aims to make the Home Page a fun experience.

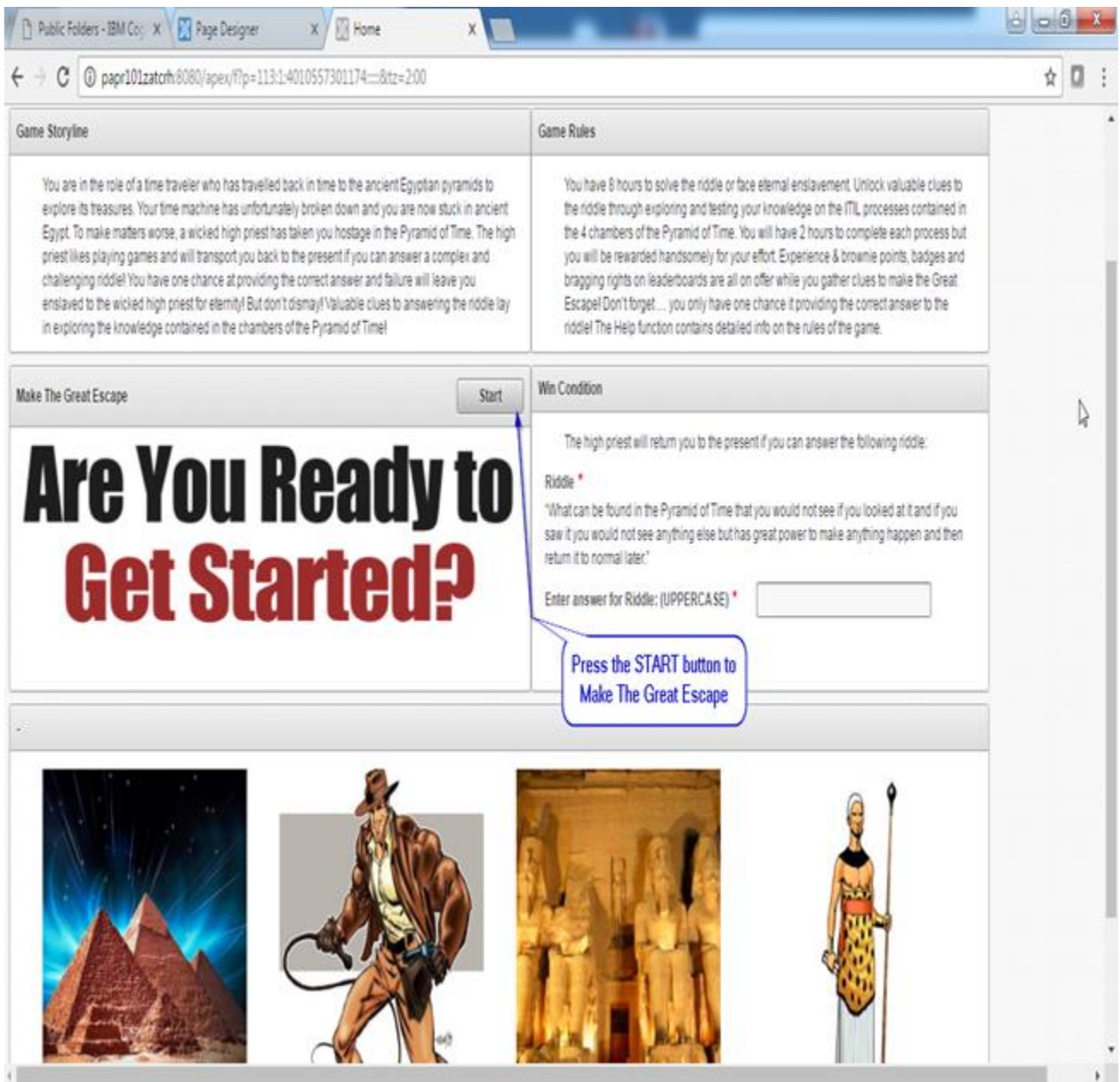


Figure 12: Home Page Function

3.4.4 Game – “Make Great Escape” Function

The Game – “Make Great Escape” function activates when the users presses the “Start” button on the home page. See Figure 13: Game – Make Great Escape Function. The function contains the ITIL course material and quizzes, which the users has to complete. The function includes a region for each of the ITIL learning materials. The time allowed, experience points and bonus points available for completing the learning of the process is displayed before the user completes the learning. Once the user completes the process learning and quiz, the XP achieved together with artwork indicating completion is displayed.

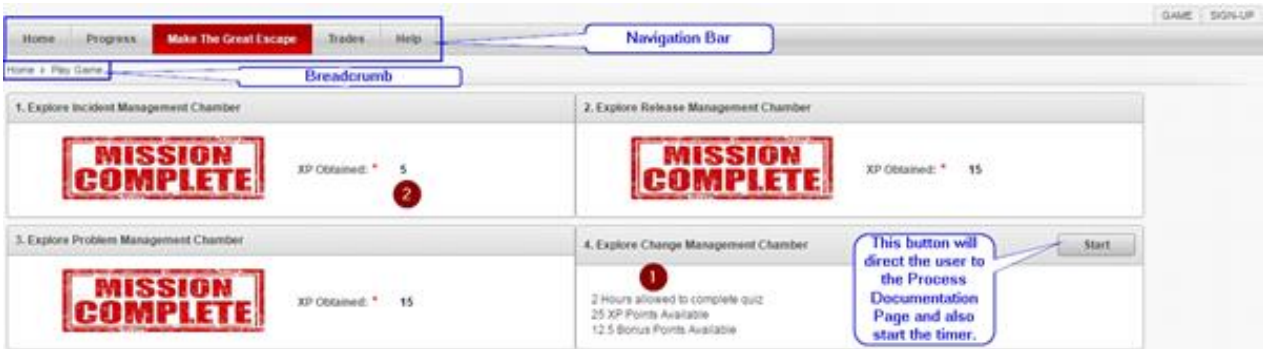


Figure 13: Game - Make Great Escape Function

The start button on the region launches a document containing the learning material for the related ITIL process. See Figure 14: Process Documentation Page. The user is able to scroll through the training material, while the time spent doing so displays on the page. The page also contains a “Next” button that launches the quiz for the process.



Figure 14: Process Documentation Page

The Quiz Page shows the duration of the time the user spends learning the process and prompts them to indicate whether they would like to answer bonus questions. See Figure 15: Quiz Page and Figure 16 Bonus Questions. The user has to select answers to the multiple choice questions contained in the quiz. Once completed the users submits their answers for evaluation in the database of the application.

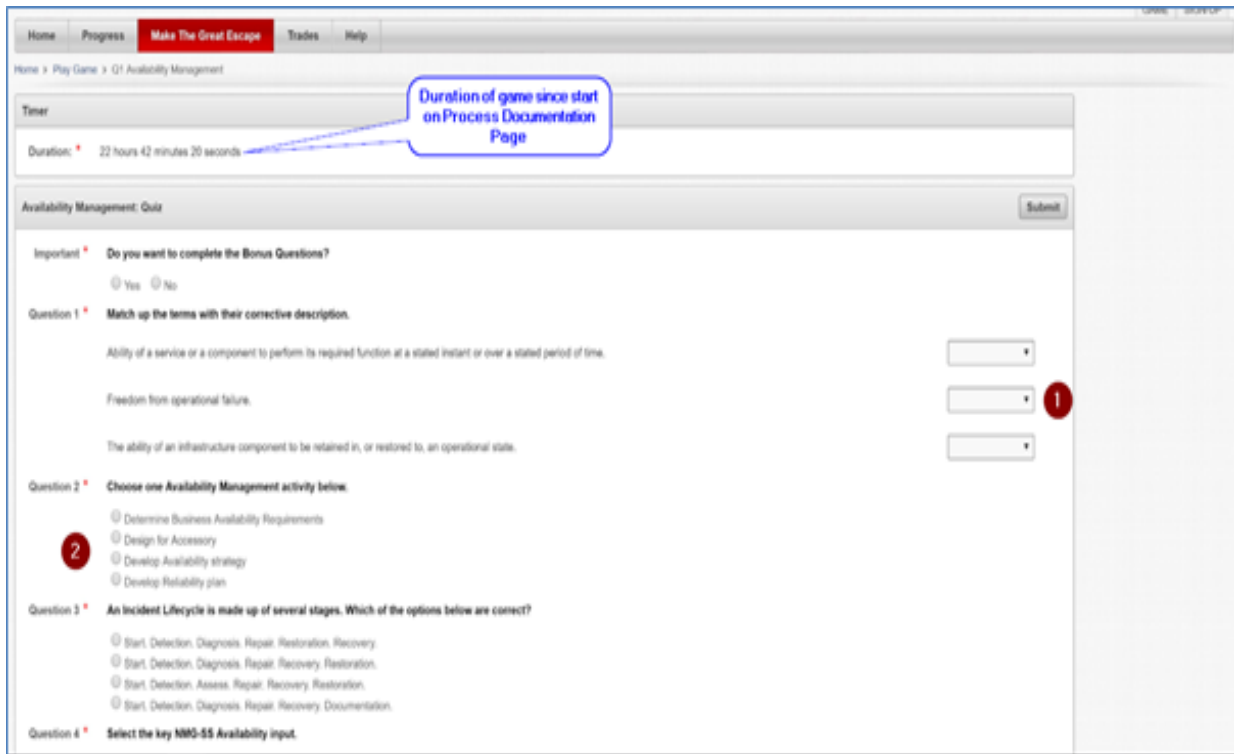


Figure 15: Quiz Page

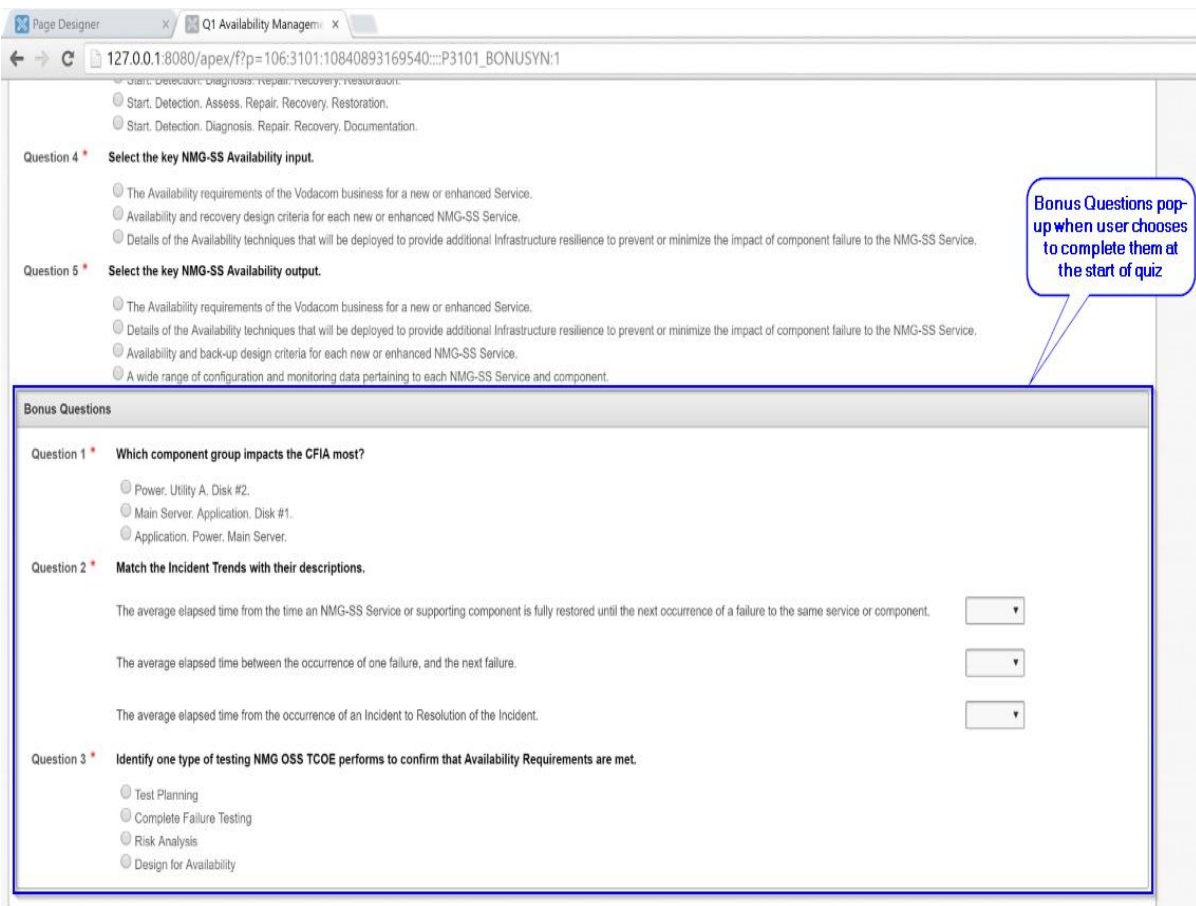


Figure 16: Bonus Questions

The user is provided with feedback on their achievements immediately after submitting their answers, through a pop-up screen showing their results. See Figure 17: Feedback Page. The page displays a congratulatory message, the test score, duration, BP and XP achieved. It also contains fun artwork aimed at praising the user's achievement. The page also includes an "Advance" button that launches the Game – Make Great Escape page.

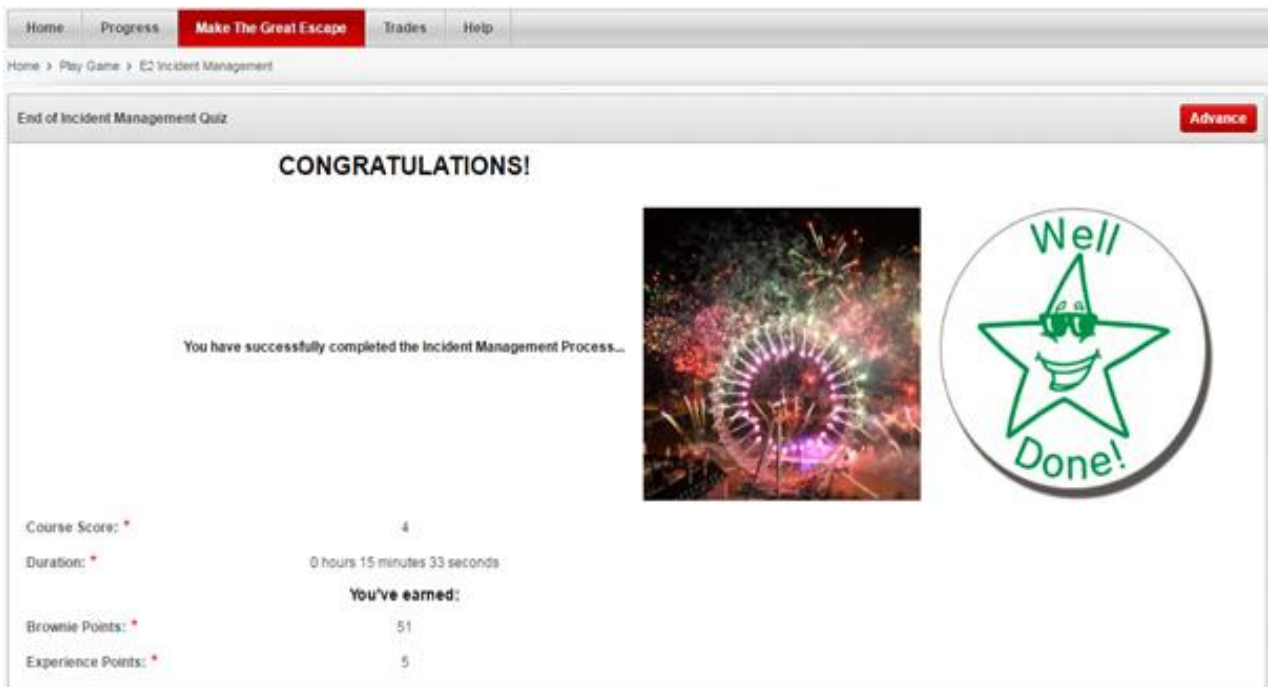


Figure 17: Feedback Page


3.4.5 Progress Function

The Progress Function in the application contains all the information on gaming elements included in the application. It includes six regions that displays updates on the Avatar, Progress Bar, Individual Leaderboard, Departmental Leaderboard, Badges and Riddle Clues the user collected. These regions are updated immediately after a related action takes place to ensure the user receives instant feedback on their actions in the game. See Figure 18: Progress Function.

Home **Progress** Make The Great Escape Trades Help

Home > Progress

Gamer Info Next Course




Username

Click on "Next Course" to start new course

Experience Points: * **5** Brownie Points: * **51**

Progress Bar




1

Individual Leaderboard (Top 10)

POS.	GAMERNAME	DEPARTMENT	POINTS
1	LIENTJIE	Customer Experience & Performance Management	30
2	THOR	Service Delivery	29
3	SPIDERMAN	Element & Fault Management	25
4	THEHULK	Portals & Development	22
5	IRONMAN	Element & Fault Management	22
6	CAPTAIN AMERICA	Customer Experience & Performance Management	21
7	TEST	Service Delivery	20
8	BATMAN	Element & Fault Management	20

3

Badges



2

Departmental Leaderboard

POS.	DEPARTMENT	POINTS
1	Element & Fault Management	82
2	Customer Experience & Performance Management	51
3	Service Delivery	49
4	Planning & Configuration Management	25
5	Architecture & Governance	22
6	Portals & Development	22

1 - 6

Riddle Clues

Write down your Riddle Clues :) * Riddle Clue: *
The 1st and 2nd letters of the word "MAGNIFICENT"




Figure 18: Progress Function

3.4.6 Trades Function

The Trades function in the application provides the users with the capability to trade their BP for quiz do-overs, XP sharing with colleagues in the same department or time off work. It shows the amount of BP needed for each trade and allows the user to make a selection based on their available BP balance. Once the trade is made the BP balance is updated and the user receives the exchange.

3.4.7 Help Function

The Help function in the application provides the users with a brief overview of gamification and its purpose in the process of learning. It also shows the rules, scoring and update mechanisms behind each of the gaming elements to guide the users' behaviour in the game. These are shown in a few application regions containing plain text.

CHAPTER 4

Implementation

4.1 Introduction

This chapter describes the technical implementation of the gamification application discussed in this thesis. It describes the technical architecture, development environment, database and coding of certain functions.

4.2 Technical Architecture

The components, interfaces and data of a system are encapsulated in the properties (ease of use, reusability, extensibility, etc.) of its software architecture [50]. Architectural styles refer to constraints placed on elements which restrict the roles/features and relationships it is allowed [51]. The following are key elements that software architectures should support [50]:

- Performance;
- Scalability;
- Simplicity;
- Modifiability;
- Visibility;
- Portability; and
- Reliability.

The gamified learning application is developed using a web-based architecture using Oracle Application Express (APEX), which works in close collaboration with Oracle SQL Developer to satisfy the principles mentioned above. Oracle SQL Developer is used for creating the database tables. The Google Chrome browser is used to render the application. See Figure 19: Application Architecture Overview.

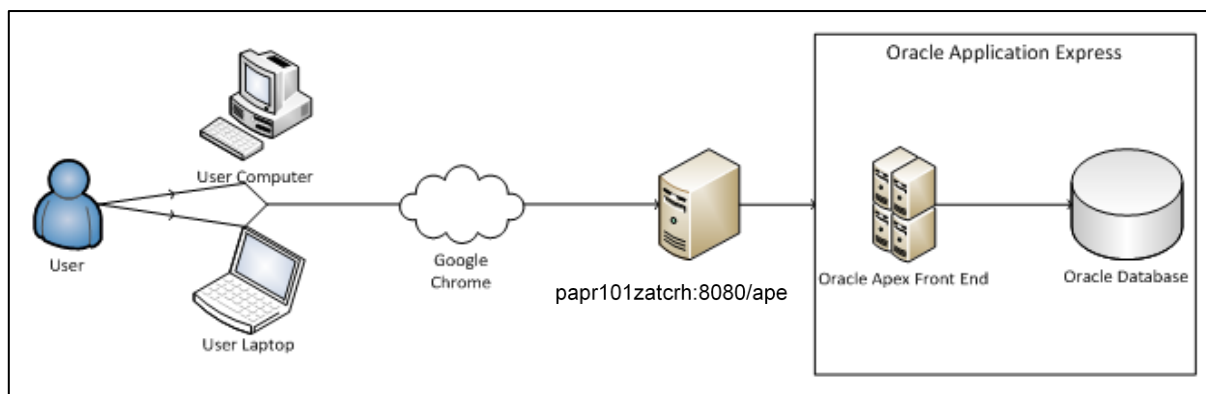


Figure 19: Application Architecture Overview

4.3 APEX Overview

Oracle APEX is an application development tool used to create database driven web applications that run on an Oracle database system [54]. It uses a declarative programming paradigm in the form of PL/SQL to link reports, charts and data entry forms [54]. APEX supports a large number of form controls (radio groups, checkboxes, etc.) and applications are rendered from data stored in database tables [54]. The application resides within an Oracle database and consists of data in tables and PL/SQL code [54].

4.4 Application Database Overview

The application uses an Oracle relational database management system to collect, store, and retrieve its data. The database contains five main tables, which are listed below.

- *EMPLOYEE* - PLAYER INFORMATION TABLE
- *EMP_BADGE* – BADGES TABLE
- *EMP_COURSES* – COURSE TABLE
- *EMP_PIC* - AVATAR TABLE
- *EMP_RID* – RIDDLE TABLE

4.4.1 Employee Table

The Employee table includes columns to hold data about user information, points, and marks.

4.4.1.1 User Information Columns

The user captures the fields in database columns about user information during the registration process. See Figure 20: User Information Fields

* GAMERNAME	VARCHAR2 (100 BYTE)
EMPNAME	VARCHAR2 (100 BYTE)
EMPSURNAME	VARCHAR2 (100 BYTE)
EMPOSITION	VARCHAR2 (100 BYTE)
EMPTYPE	VARCHAR2 (100 BYTE)
COMPANY	VARCHAR2 (100 BYTE)
VEMAIL	VARCHAR2 (100 BYTE)
PASSWORD	VARCHAR2 (100 BYTE)
DEPTNAME	VARCHAR2 (100 BYTE)
DIVISION	VARCHAR2 (100 BYTE)
LOCATION	VARCHAR2 (100 BYTE)
CON_PASSWORD	VARCHAR2 (100 BYTE)
COMPETITIVE	VARCHAR2 (20 BYTE)
AVYESNO	VARCHAR2 (20 BYTE)
MANAGER	VARCHAR2 (100 BYTE)
PIC_AV	NUMBER (38)

Figure 20: User Information Fields

4.4.1.2 Points Columns

The columns relates to points in the Employee table is used to the store the XP and BP, which the users attain in the application. See Figure 22: Points Columns

BP	NUMBER (38,20)
XP	NUMBER (38,20)

Figure 21: Points Columns

4.4.1.3 Quiz Columns

The columns relates to quizzes in the Employee table is used to store the marks users attained in the quizzes as well as the time it took to complete the learning module. See Figure 22: Quiz Columns.

AVMAN	NUMBER (38)
AVMAN_START	TIMESTAMP
AVMAN_END	TIMESTAMP
INMAN	NUMBER (38)
INMAN_START	TIMESTAMP
INMAN_END	TIMESTAMP
REMAN	NUMBER (38)
REMAN_START	TIMESTAMP
REMAN_END	TIMESTAMP
PRMAN	NUMBER (38)
PRMAN_START	TIMESTAMP
PRMAN_END	TIMESTAMP
CHMAN	NUMBER (38)
CHMAN_START	TIMESTAMP
CHMAN_END	TIMESTAMP
AVMAN_DUR	VARCHAR2 (100 BYTE)
INMAN_DUR	VARCHAR2 (100 BYTE)
REMAN_DUR	VARCHAR2 (100 BYTE)
PRMAN_DUR	VARCHAR2 (100 BYTE)
CHMAN_DUR	VARCHAR2 (100 BYTE)

Figure 22: Quiz Columns

4.4.2 Badges Table

The badges table (EMP_BADGE) holds badge information like the actual file. B_MIMETYPE is the format of the badge file. B_XP is the amount of XP needed to attain the badge. B_CODE functions is a code being referenced by other tables or columns. See Figure 23: Badges Table.

B_ID	NUMBER (38)
BADGE	BLOB
B_NAME	VARCHAR2 (50 BYTE)
B_MIMETYPE	VARCHAR2 (100 BYTE)
B_DESC	VARCHAR2 (500 BYTE)
TIMESTAMP	TIMESTAMP
B_XP	NUMBER (38)
B_CODE	VARCHAR2 (20 BYTE)

Figure 23: Badges Tables

4.4.3 Course Table

The courses table (EMP_COURSES) holds information about the courses/learning material contained in the application. The course material is held in PDF file format. See Figure 24: Course Table.

C_ID	NUMBER (38)
PDF	BLOB
C_NAME	VARCHAR2 (150 BYTE)
C_MIMETYPE	VARCHAR2 (50 BYTE)

Figure 24: Course Table

4.4.4 Avatar Table

The avatar table (EMP_PIC) holds the data about the avatars available in the application together with a picture of the Avatar and its description. See Figure 25: Avatar Table.

PIC_ID	NUMBER (38)
PIC	BLOB
PIC_NAME	VARCHAR2 (100 BYTE)
PIC_MIMETYPE	VARCHAR2 (100 BYTE)

Figure 25: Avatar Table

4.4.5 Riddle Table

The riddle table (EMP_RID) holds information about the riddle in the storyline of the application such as the riddle description and clues. See Figure 26: Riddle Table.

R_ID	VARCHAR2 (20 BYTE)
R_DESC	VARCHAR2 (300 BYTE)
R_ANS	VARCHAR2 (50 BYTE)
R_CODE	VARCHAR2 (20 BYTE)

Figure 26: Riddle Table

4.4.6 Entity Relationship Diagram (ERD)

The XP column in the EMPLOYEE table references the B_XP column in the EMP_BADGE table. The AVMAN, INMAN, REMAN, PRMAN and CHMAN (course marks) references the C_ID (course ID) column in the EMP_COURSE table. The PIC_AV (avatar column) references the PIC_ID column in the EMP_PIC table. Users receives riddle clues based on their progress in the learning exercise. Hence the EMP_LVL column references the R_CODE (riddle code) in the EMP_RID table. The relationship between the columns of these tables is shown below in Figure 27: ERD Diagram.

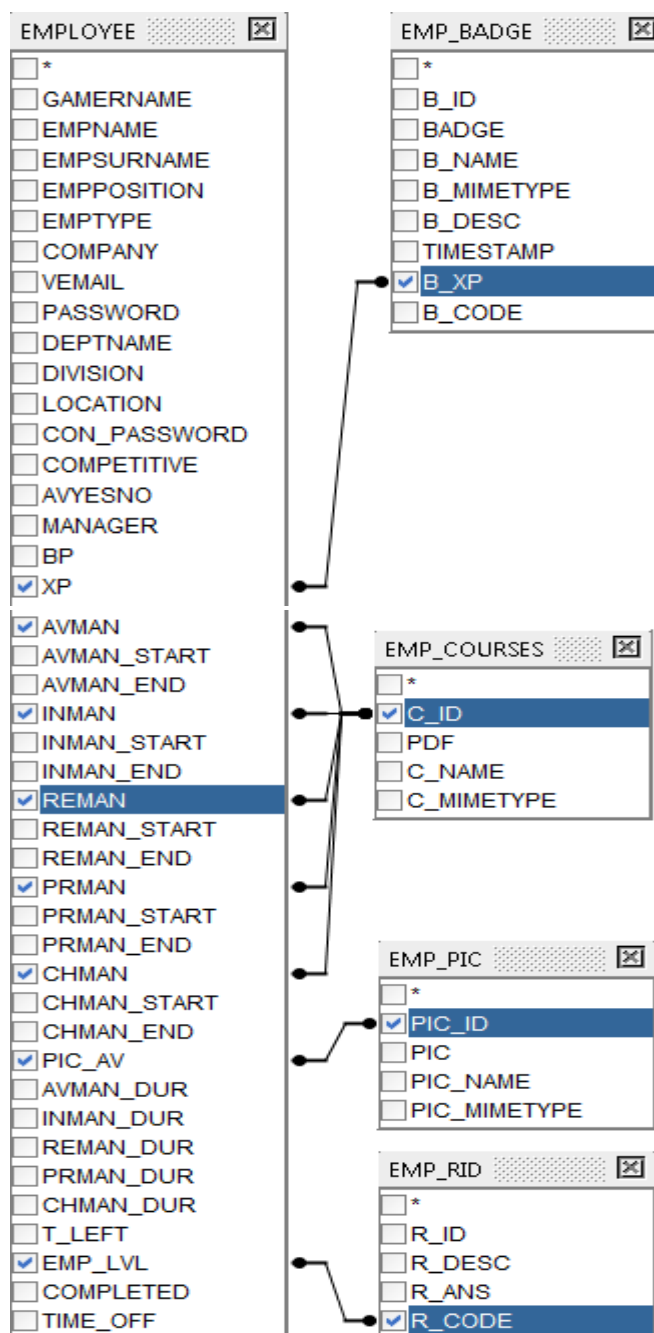


Figure 27: ERD Diagram

CHAPTER 5

Evaluation Setup

5.1 Introduction

This chapter describes the evaluation used to compare the users' perceptions of the gaming elements' effectiveness in the corporate learning application developed in this study. The following sections will describe the setup used for the experiment design, approval, evaluation framework, data collection and user feedback analysis.

5.2 Research Design

The gamification application described in Chapters 3 and 4 serves as a platform to test and gather users' perceptions about the effectiveness of the chosen gaming elements. The users received a face-to-face briefing about the concept of gamification, and its possible application in the department's corporate learning process before the design of the application started. They were also invited to participate in the Brainhex survey to determine the player types in the department. The users participated in the survey on a voluntary basis and seventy-three of the seventy-eight users who participated in the evaluation completed it.

The application is designed and developed to assess the gaming elements. The users received a demonstration of the application, highlighting its gaming elements, once it was completed. Seventy-six of the seventy-eight users that participated in the experiment attended the session where they also got an explanation of the evaluation procedure. The two users who did not attend were briefed on an individual basis. The application was loaded in a test environment, which was accessible via a universal resource locator (URL). An email was sent to the seventy-eight users formally inviting them to participate in the evaluation. The invite reiterated the concept of gamification and its implementation in the application. It also provided a URL that directed users to the application and another directing them to the online evaluation questionnaire.

Play-testing the application involved learning the 4 ITIL processes (availability management, incident management, release management and change management) to which the gaming elements are applied. The seventy-eight users were given 14 days to play-test the application and to provide their evaluation feedback. The play-testing period of 14 days was to ensure the users had sufficient time to test and evaluate the application considering their busy work schedules. This also allowed for the experiment to take place in the typical work environment, which is fluid and not controlled. The total

time needed to complete the game was 8 hours, which meant the users could conduct multiple iterations of testing. The users, however, only had one opportunity to evaluate the application. A reset of the application database occurred every four days to allow the users multiple play-test opportunities before providing their evaluation feedback. The users were given a schedule of the resets and given sufficient warning to limit interruptions to their testing. During the evaluation period, three resets occurred. The system tracked the users' activities in its log files and on average users play-tested the application twice. Users could, however, provide a fair evaluation after only one iteration of play-testing.

After the 14 day play-test period, a meeting was held with the seventy-eight users to thank them for their participation and to provide them with a high-level summary of the evaluation results. Most of the users verbally expressed enjoyment in participating in the evaluation at that meeting, and showed support for developing a full-scale gamified learning application.

5.3 Research Approach

The research approach uses qualitative measures to assess the users' perceptions about the eight gaming elements contained in the application. The evaluation includes a Progress Bar, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Storyline/Theme and Avatars. The Brainhex online survey determined the player types in the environment, which guided the selection of these gaming elements. No accepted convention exists to measure the effectiveness of gaming elements and these are typically formulated for individual studies [55]. Therefore, an evaluation framework measuring the users' perceptions about the playability, enjoyment and the gamified application's ability to promote intrinsic motivation was formulated for this study. It uses established industry models as input; including, Federoff's Game Playability Heuristics model to measure the users' perceptions about the playability of the application [3]. Sweetser and Wyeth's Gameflow model forms basis for measuring perceptions about the gaming elements' contribution toward creating an enjoyable experience [4]. Malone and Lepper's Taxonomy of Intrinsic Motivation for Learning is used to measure the gaming elements' ability to promote an intrinsically motivating learning environment [5]. These models are used for fully developed applications and the specific functionality contained in the gamified learning application developed for this study deemed certain of the criteria, such as effective error handling, irrelevant.

5.3.1 User Type Assessment

The identification of user types is an important aspect of designing effective gamification systems. The Brainhex online user classification survey was used to determine the common user types in the department. A workshop was conducted with the seventy-eight users that discussed the importance

of identifying user types in gamification systems and provided a demonstration of the Brainhex survey. The users also received an email invitation with a URL link to the Brainhex survey.

5.3.2 Federoff's Game Playability Heuristics

Federoff's Game Playability Heuristics model is used to compare the gaming elements contained in the application from a playability perspective. The model was developed in 2002 and focuses on gaming applications through balancing traditional aspects of usability testing, like effectiveness and efficiency, with those unique to a gaming environment, like the playability and enjoyment of the interface. This balance is needed to ensure the users remain engaged and do not become bored due to an over emphasis on an effective and efficient interface [3]. The measurements target an exciting, captivating and riveting experience. Federoff's [3] model consists of 3 components namely, the game interface, game mechanics and gameplay. See Appendix 1: Playability Heuristics. Each component consists of measurement criteria, which are adapted based on the specific functionality of the application and formulated into a questionnaire for evaluation. For example, the application contains limited functionality to control error prevention and recovery through the use of warning messages. Hence the evaluation criteria around this capability is not included in this study.

5.3.3 Gameflow Heuristics

Sweetser and Wyeth's Gameflow model is used to compare the gaming elements contained in the application from an enjoyment perspective. The model, developed in 2005, combines aspects of various models to create a focus on the concept of flow that forms the basis of user enjoyment. Enjoyment is of vital importance to the success of games and relates to users having a pleasant experience that they would want to repeat and recommend to others [4]. The Gameflow model consists of eight elements namely concentration, challenge, skills, control, clear goals, feedback, immersion and social interaction [4]. See Appendix 2: Gameflow Heuristics. Each element consists of 3 to 7 measurement criteria. These are adapted based on the functionality of the application and formulated into a questionnaire for the evaluation. For example, the application contains no functionality to enable social interaction like chats between users. Hence the evaluation criteria around this capability is not included in this study.

5.3.4 Intrinsic Motivation Heuristics

Malone and Lepper's [5] Taxonomy of Intrinsic Motivation for Learning is used to compare the gaming elements from an intrinsic motivation perspective. The model considers measures about the challenge, curiosity, control, fantasy and interpersonal motivations related to intrinsic motivation. Challenge assesses goal setting and whether the gamification experience continuously and optimally challenges the user with the level of difficulty it presents [5]. Curiosity measures if the gamification application increases sensory and cognitive curiosity in learning the ITIL processes. Control estimates feelings of self-determination and control that the user possesses in the experience. Fantasy measures emotional and cognitive aspects, which increase intrinsic motivation. Interpersonal motivation considers cooperation, competition and recognition measures. See Appendix 3: Intrinsic Motivation Heuristics. Each component consists of measurement criteria, which are customised for the gamification application and formulated into a questionnaire for the evaluation. For example, the application contains no functionality to allow the user to create powerful effects in the game. Hence the evaluation criteria around this capability is not included in this study.

5.4 Participants in Experiment

Seventy-eight staff members, equating to approximately 86 percent, of the department, participated in the evaluation. Twenty-nine of the users were female, and 49 were male. The age grouping of the users is shown below in Figure 28: Age Grouping.

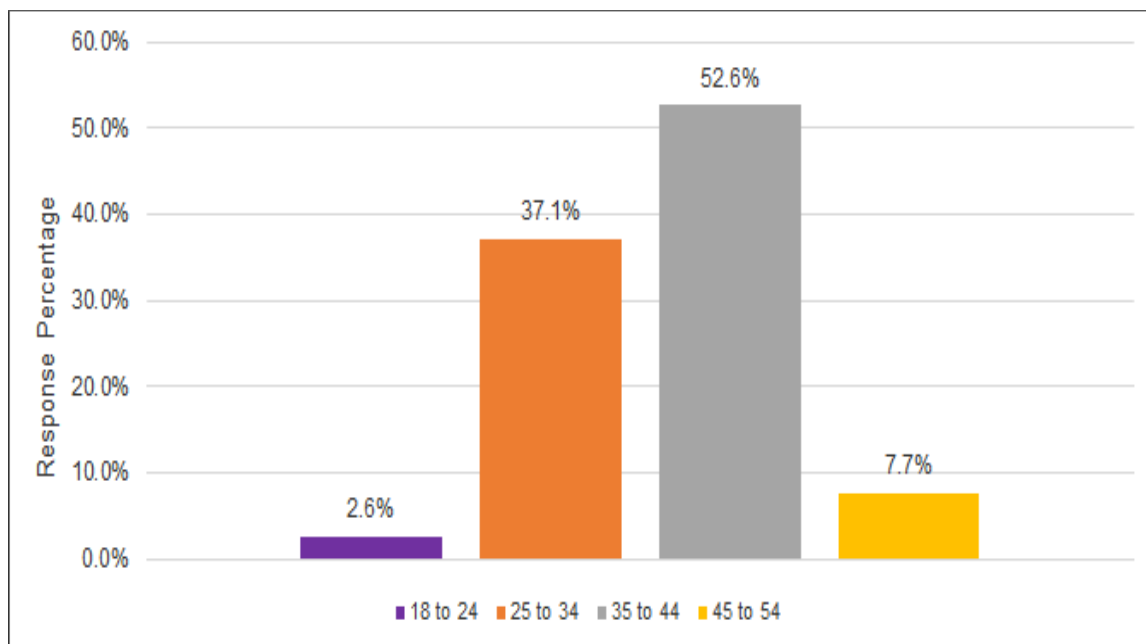


Figure 28: Age Grouping

The application focuses on learning four key ITIL processes used in the department of which the participants have varying levels of knowledge. 5.1 Percent of staff had no knowledge, 42.3 percent

had basic knowledge, 37.2 had average knowledge, 10.3 had good knowledge, and 5.1 percent had very good knowledge of the processes.

The users' prior exposure to gamified learning applications is shown below in Figure 29: Learning Gamification Application Exposure. Due to the lack of exposure, the users were provided with an extensive briefing and assistance during the experiment. Help files are also included in the application to assist users.

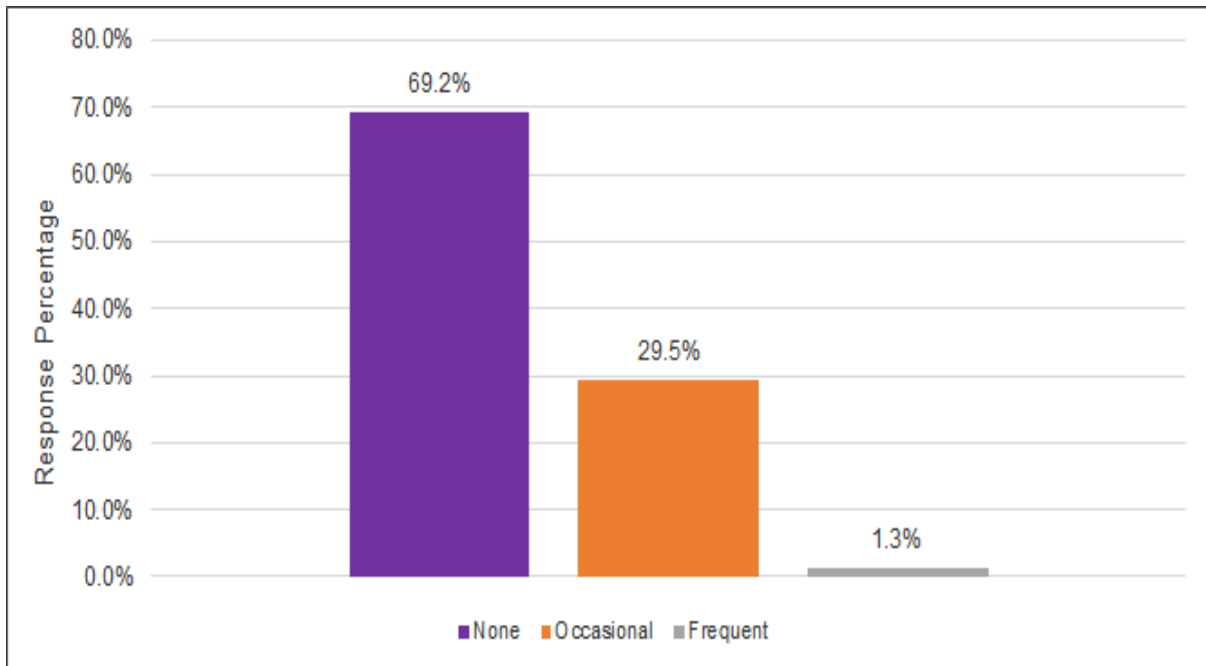


Figure 29: Learning Gamification Application Exposure

5.5 Data Collection

5.5.1 User Types

The users completed the Brainhex online survey to determine their user types. They emailed a summary of their profiles for recording in a spreadsheet. The design and development of the application incorporated information obtained from the survey.

5.5.2 Gaming Elements

The users were requested to capture their evaluation of the application in an online survey tool. The author was able to view the completion status of the users in the game as well as the response rate to the survey questionnaires. A group message was sent to all the users at the end of each day to complete the survey where it was still outstanding. A one hundred percent response rate on the survey was achieved and all the users provided the requested feedback in the given time. Once the experiment completed the data was downloaded from the online survey tool for analysis. The online

survey contained four sections namely a General, Playability, Gameflow and an Intrinsic Motivation questionnaire.

The General Questionnaire consists of 5 questions aimed at gathering data about the users' gender, age, ITIL process knowledge, experience with gamification systems and sense of empowerment about the choice of participating in the game. See Appendix 4: General Questionnaire.

The Game Playability Questionnaire based on Federoff's model consists of 27 questions. It collects data from the game interface, game mechanics and gameplay elements used to compare users' perceptions about the gaming element effectiveness from a game playability perspective. See Appendix 5: Game Playability Questionnaire.

The Gameflow Questionnaire based on Sweetser and Wyeth's model consists of 10 questions. It collects data about the concentration, challenge, control, feedback and cooperation elements used to compare the users' perceptions about the gaming element effectiveness from an enjoyment perspective. See Appendix 6: Gameflow Questionnaire.

The Intrinsic Motivation Questionnaire based on Malone and Lepper's model consists of 11 questions. It collects data about the goals, self-esteem, sensory curiosity, recognition, contingency and flow elements used to compare the users' perceptions about the gaming element effectiveness from an intrinsic motivation perspective. See Appendix 7: Intrinsic Motivation Questionnaire.

5.6 Data Analysis

The qualitative data gathered in the survey was coded and categorised according to the game playability, gameflow and intrinsic motivation heuristics. The data was analysed to identify patterns and relationships. The research findings were summarized and linked to compare the gaming elements.

5.7 Ethical Considerations

A senior operations executive of the mobile telecommunications company gave his consent for the assessment. The users in the department agreed verbally to participate in the experiment and to provide the required inputs. The users participated in the experiment on a voluntary basis and the confidentiality of their inputs was guaranteed. They received an upfront indication of the time needed to take part. The users sent their assessment of the gaming element effectiveness on an anonymous basis.

CHAPTER 6

Evaluation Findings

6.1 Introduction

This chapter describes the evaluation findings to compare the users' perceptions about the gaming element effectiveness in the gamification application. The game playability, gameflow and intrinsic motivation heuristics described in Chapter 5 will form the framework for discussing the findings.

6.2 User Type Findings

Eighty-four users responded to the Brainhex online survey. 28 Percent of the responses were from females and 72 percent from males. Masterminds, Achievers, Conquerors and Seekers were the most prominent player types found. Twenty users were identified as Masterminds, eighteen as Achievers, seventeen as Conquerors and fourteen as Seekers. Most of the users, therefore, enjoyed working on challenging problems and puzzles, were goal-oriented and motivated by long-term achievements, enjoyed beating others while struggling against and defeating difficult foes and enjoyed sensory information and memory association.

The gaming elements most suited to the player classes identified in the Brainhex survey are experience points and in-game currency (suited to the Achievers), the storyline riddle (tailored to the Masterminds) as they like solving puzzles, and the riddle is a puzzle, progress bars and leaderboards (tailored to the Conquerors), and a storyline and visual artwork (tailored to the Seekers).

The Brainhex results also reported exceptions on 12 of the 84 survey responses, which described what players dislike about playing games. The main exceptions categories were "No Fear" (users do not enjoy feeling afraid, preferring to feel safe or in control), "No Punishment" (users dislike struggling to overcome seemingly impossible challenges and repeating the same task over and over) and "No Mercy" (users rarely if ever care about hurting other users' feelings).

6.3 Game Playability Findings

This section discusses the users' perceptions about the effectiveness of the gaming elements against Federoff's Game Playability Heuristics. The game interface, game mechanics and gameplay components of the model serve as the framework for discussing the findings. Seventy-eight users assessed the game playability aspects of the corporate learning gamification application.

Figure 30 shows the number of users who experienced the playability aspects considerably (responded “extremely so” or “very much”), moderately, or of little (responded “slightly” or “not at all”) consequence to the objectives of the gamification application. Users found the gaming elements intuitive and contributing to a competitive experience. They felt the Timer did not provide sufficient pressure but the other gaming elements supported the unpredictability needed to create an engaging experience. The users felt the Storyline/Theme, and the winning condition in it, created an engaging experience. The gaming elements were seen as well weighted and fair reward existed for the users’ efforts.

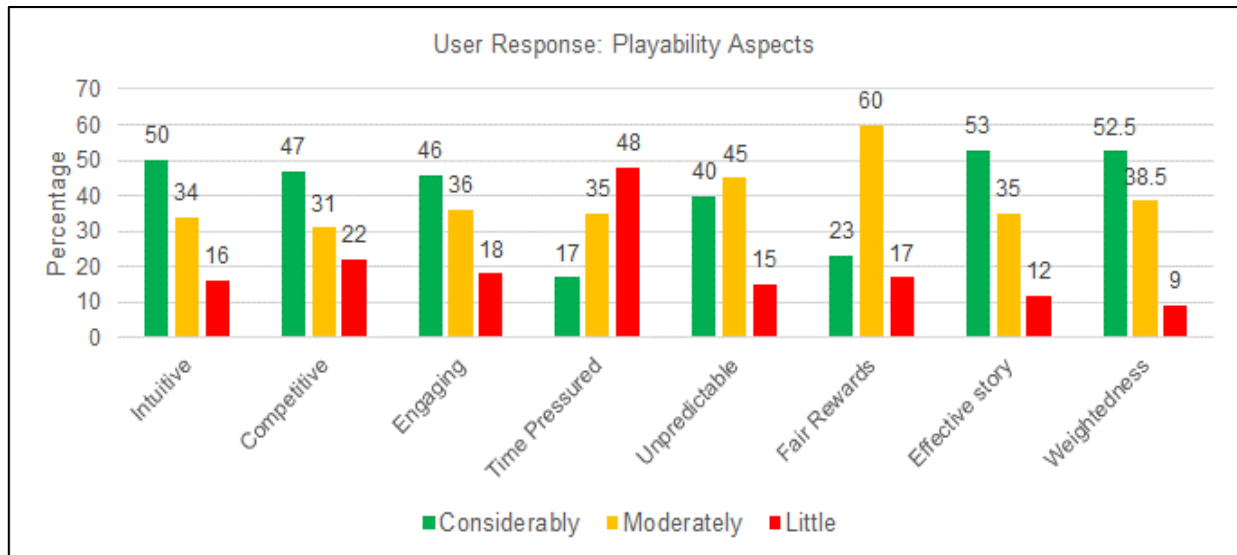


Figure 30: User Response Playability Aspects

6.3.1 Gaming Interface Findings

The gaming interface results show the users’ perceptions about the gaming elements’ capability to help them identify their score/status in the game, be intuitive and incorporate art to support the game’s goals.

The users perceived the Storyline/Theme as providing the greatest visibility on their progress in the learning exercise. This related to the number of clues collected to answer the riddle in the game. The Progress Bar was the second most effective gaming element from this perspective. A change in the Progress Bar was a direct result of completing a part of the learning contained in the game. The Departmental Leaderboard was third but was only marginally better than the Individual Leaderboard and Badges. The Avatar gaming element was perceived as the least effective against this measurement. (See Figure 31: Ranking of Gaming Elements – Visibility)

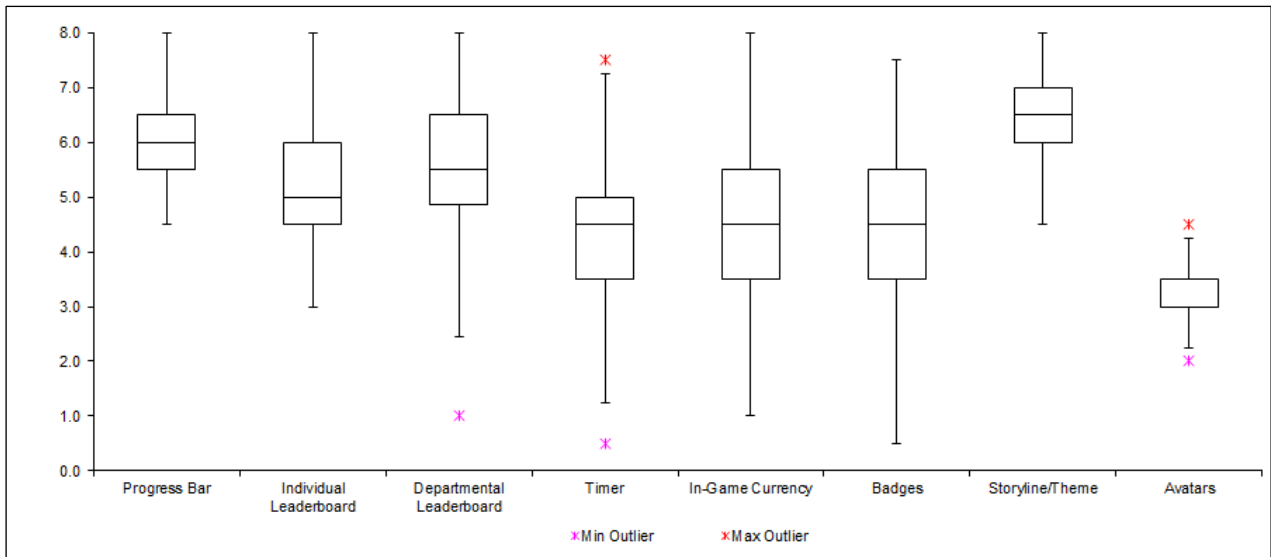


Figure 31: Ranking of Gaming Elements – Visibility

Over 64 percent of the users perceived the visual art in the gaming interface as essential for enhancing the impact of the gaming elements. Less than 15 percent of users felt artwork was not necessary. The users’ perceptions about the importance of visual art were consistent with its theoretical underpinnings and the Brainhex player class findings.

6.3.2 Game Mechanics Findings

The gaming mechanics results show the users’ perceptions about the gaming elements’ capability to feel natural, have the right weight/momentum and to get them involved quickly and easily. It included specific findings of the competition, cooperation, engagement and weighted-ness toward supporting the application’s learning objective.

The Individual Leaderboard was perceived to generate the most competition. Figure 32 shows the ranking of the gaming elements regarding the competitiveness it created. The users ranked the gaming elements one to eight in terms of its contribution to competitiveness, with one indicating the worst and eight the best ranking.

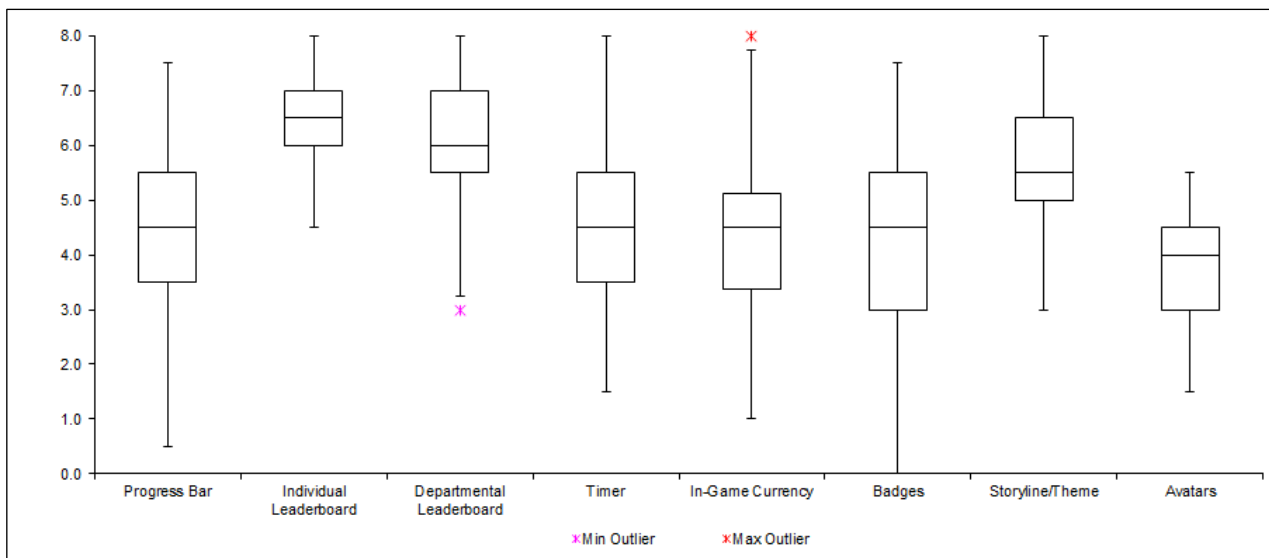


Figure 32: Ranking of Gaming Elements – Competitiveness

The application functionality to trade BP for sharing XP amongst users in the same department aimed at fostering cooperation. Nobody, however, used this feature and most of the users felt it had little impact on promoting cooperation. Users instead preferred to use their BP to make trades for quiz do-overs and time-off work. In terms of engagement, the Storyline/Theme was the most engaging gaming element. Figure 33 shows the percentage of users who chose each gaming element as the best one at engaging them with the training material.

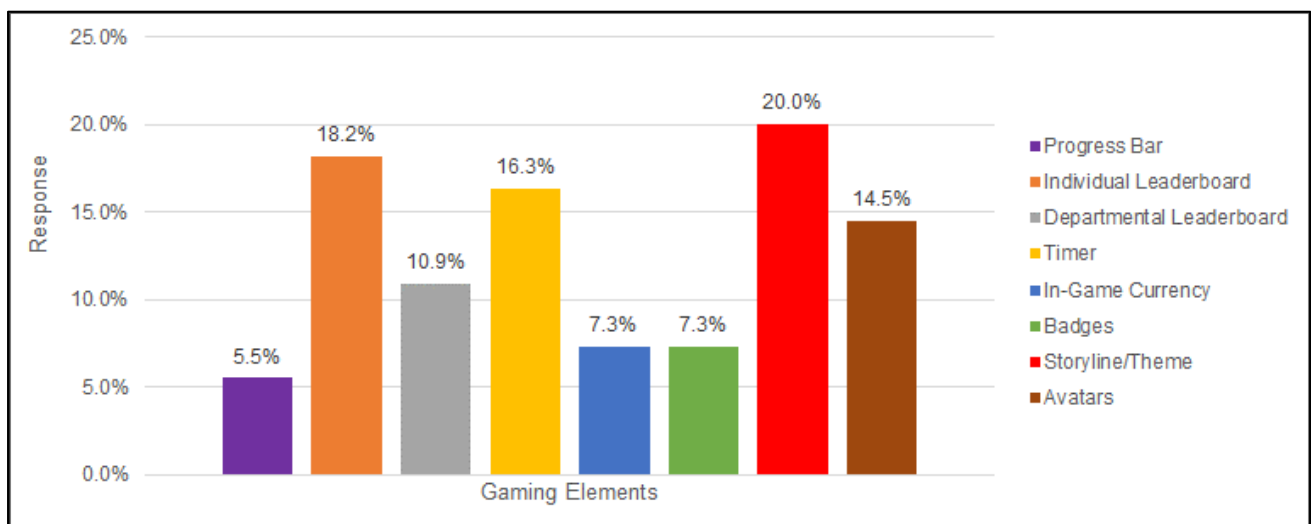


Figure 33: Impact of Gaming Elements – Engagement

The users ranked the gaming elements one to eight regarding its weighting toward achieving the learning objectives in the application, with one indicating the least and eight the most. The Storyline/Theme (7.2) was ranked the best. The Departmental Leaderboard with a ranking of 6.6 was second, and the Individual Leaderboard (6.1) followed it closely. The Progress Bar had a ranking of 5.2 and was followed by the In-Game Currency (5.1), Badges (4.8) and Avatars (4.5). The Timer (4.4)

was ranked the least weighted gaming element. Most of the users completed the game well within the allotted time of 8 hours, which could have led to the negative perception about the Timer.

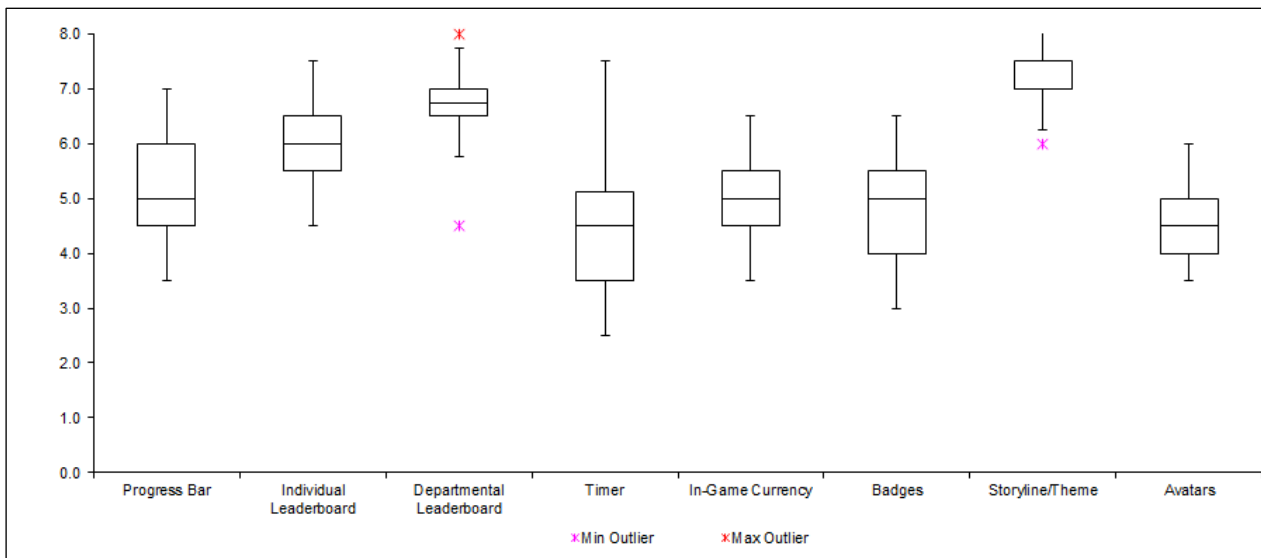


Figure 34: Impact of Gaming Elements – Weighted-ness

Figure 35 was the ranking of the gaming elements in terms of encouragement during the gamification experience.

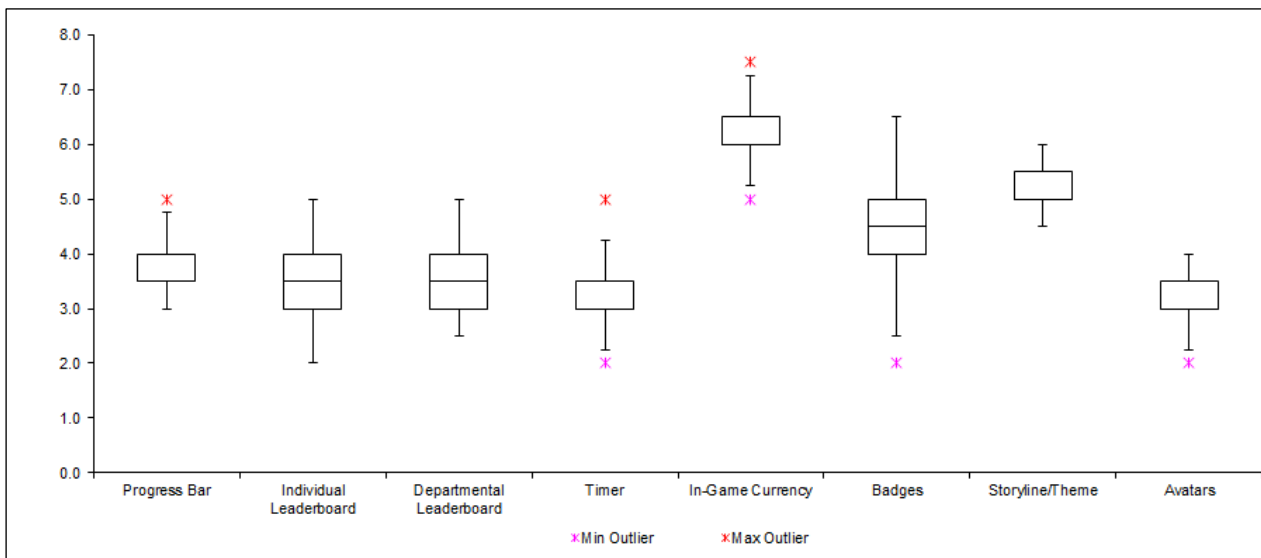


Figure 35: Impact of Gaming Elements – Cooperation

6.3.3 Gameplay Findings

The gameplay results show the users' perceptions about the gaming elements' capability to apply the correct level of pressure, have an unexpected outcome (unpredictability), offer rewards, promote fairness, contain a great storyline and ensure the users acquire the learning.

The Timer gaming element, which allotted users 8 hours (2 hours per ITIL process) to complete the game was best positioned to create pressure in the application. The Timer was set too leniently and

did not create sufficient pressure. The time allotted was, however, set to ensure it was sufficient for everyone to learn the material, while also limiting work time spent on playing the game. Since most of the users completed the game well within the allotted time more careful consideration will have to be given to this aspect in future. The Individual Leaderboard and Departmental Leaderboard generated the most unpredictability in the application in terms of the outcome of the game. Having an unpredictable outcome of the winning condition of the game made it more engaging for the users. The Progress Bar generated the least unpredictability. The In-Game Currency provided the best reward, and the Individual Leaderboard followed it closely. Achievements against the Timer provided the least reward. The Individual Leaderboard and Timer were the fairest gaming elements. Fairness was perceived in the conversion of marks achieved in quizzes to XP, which reflected in the Individual Leaderboard. Figure 36 shows the percentage of users who chose each gaming element as the best one at creating fairness in the gamification application.

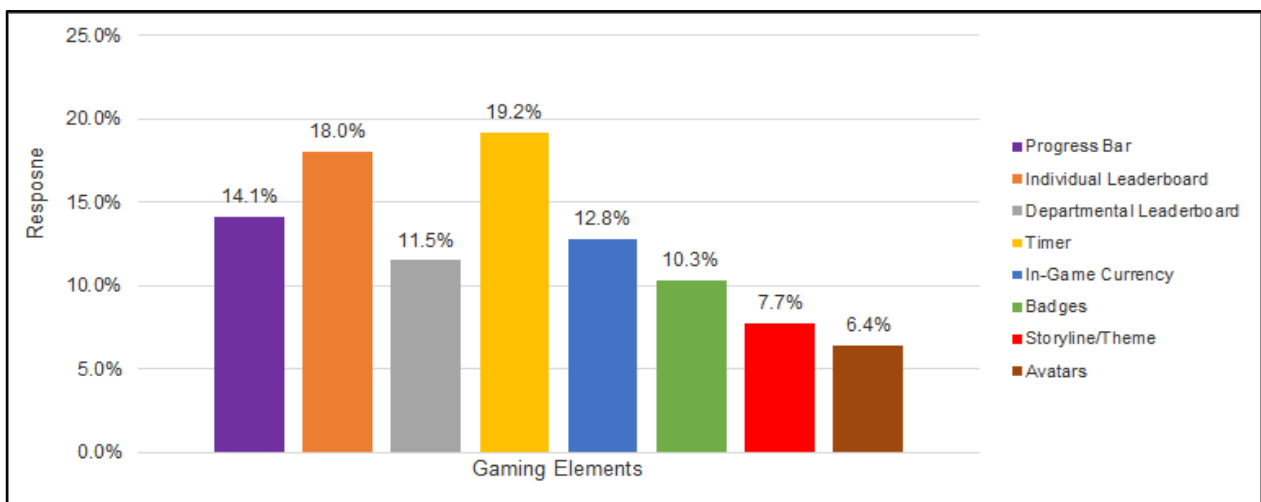


Figure 36: Comparison of Gaming Elements – Creating Fairness

More than 73 percent of the users felt the gaming elements encouraged them to solve the problems presented in the learning material. It also grabbed their attention and kept them engaged with the learning exercise. The gaming elements also kept them engaged and focused on applying their best effort in answering the quizzes.

6.4 Gameflow Findings

This section discusses the users' perceptions about the effectiveness of the gaming elements against Sweetser and Wyeth's Gameflow model. The various elements of the model, concentration, challenge, control, feedback and social interaction, will serve as the framework for presenting the findings.

Figure 37 shows the number of users who experienced the gameflow aspects considerably (responded "extremely so" or "very much"), moderately, or of little (responded "slightly" or "not at all")

consequence to the objectives of the gamification application. The majority of the users felt the gaming elements improved their level of concentration and focus on the learning objectives. They also felt the gaming elements provided a sufficient challenge to keep them engaged. The challenge experienced was diminished, because the timer in the game was set too leniently allowing users sufficient time for completion.

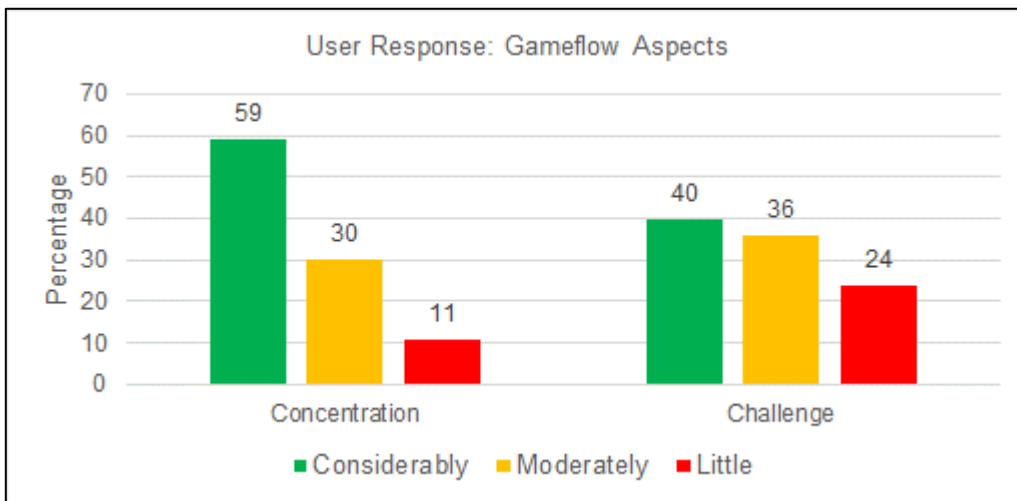


Figure 37: User Response Gameflow Aspects

Figure 38 shows the average ranking of the gaming elements regarding the control it provided the users in the gamification application. The users ranked the gaming elements one to eight in terms of its contribution to control, with one indicating the least and eight the most. The Storyline/Theme grabbed and maintained the users' concentration better than any of the other gaming elements. The Individual Leaderboard and Departmental Leaderboard was ranked second and third, respectively. The Timer was the least effective in focusing the users' concentration on the learning objective of the application. The users perceived the Storyline/Theme provided them with the greatest feeling of control. The Avatar gaming element provided the least amount of control, despite a design expectation that it would achieve this objective. (See Figure 38: Comparison of Gaming Elements – Control)

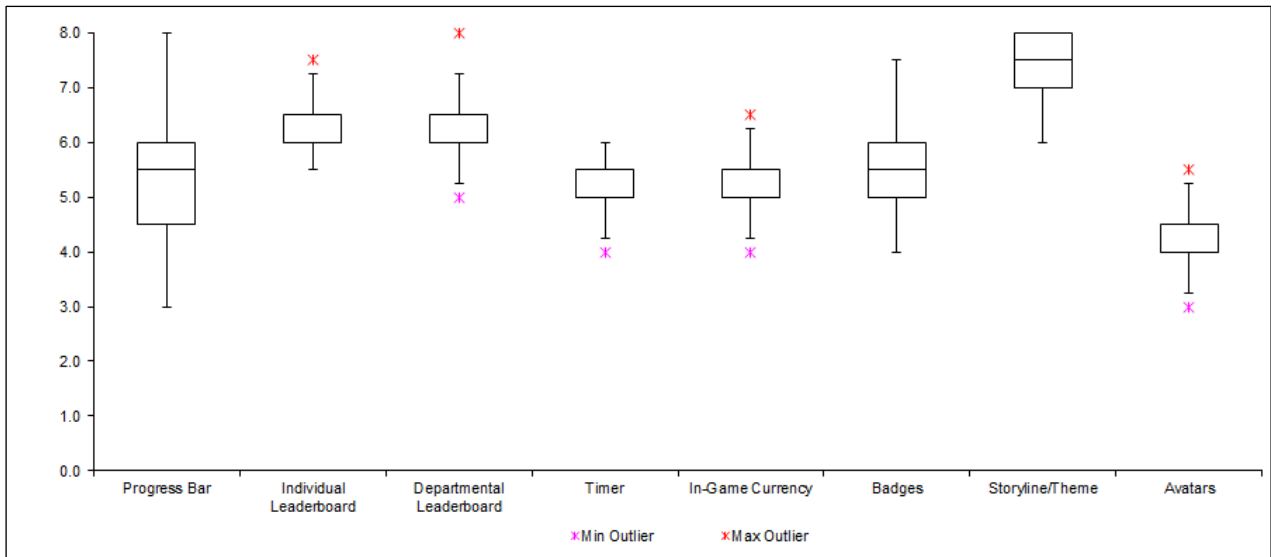


Figure 38: Comparison of Gaming Elements - Control

The users ranked the gaming elements one to eight regarding the level of feedback it provided on their progress in the game, with one indicating the least and eight the most. The Storyline/Theme (7.3), which included the accumulation of riddle clues to achieve the winning condition in the game had the best ranking. The Individual Leaderboard (6.2) was second and the Departmental Leaderboard (5.8), Progress Bar (5.6) and Badges (5.4) followed. The Avatar (4.2) ranked the worst regarding feedback. The Individual Leaderboard was perceived as providing the users with the best feedback on their scoring in the game. (See Figure 39: Comparison of Gaming Elements – Feedback)

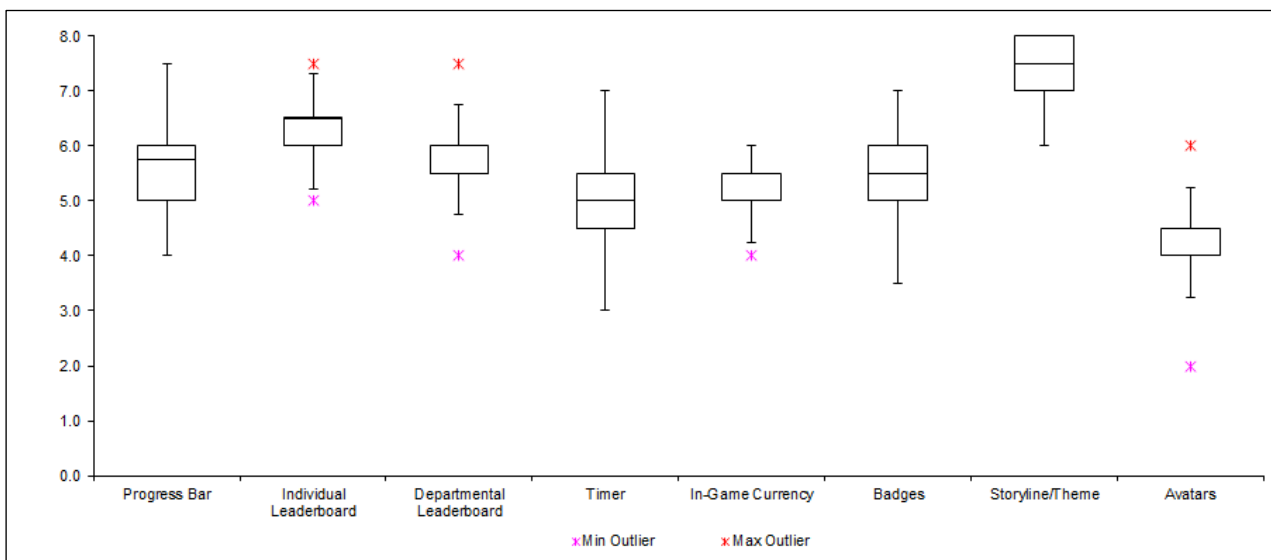


Figure 39: Comparison of Gaming Elements - Feedback

6.5 Intrinsic Motivation Findings

Figure 40 shows the number of users who experienced the motivational aspects considerably (responded “extremely so” or “very much”), moderately, or of little (responded “slightly” or “not at all”) consequence to the objectives of the gamification application. Most of the users believed the gaming elements demonstrated and promoted the goals of the application. They felt it provided a sense of competence, sensory curiosity, responsiveness and flow that kept them immersed in the learning process. The difficulty level in the gamified ITIL processes increased as the user progressed and the system provided them with positive feedback to promote feelings of competence. The gamification experience promoted sensory curiosity through creating an interactive learning experience. A responsive learning environment was created where the user received feedback on their actions in the game.

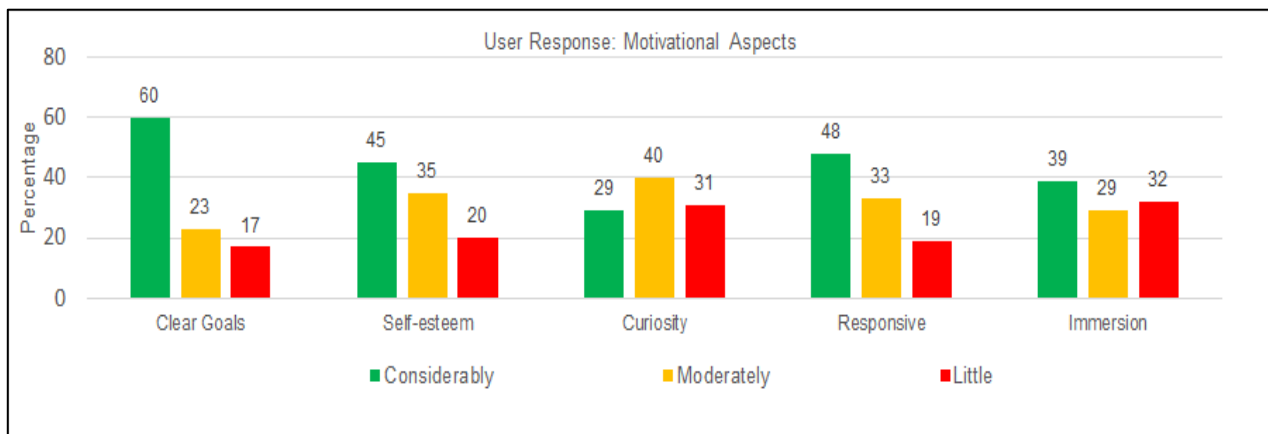


Figure 40: User Response Motivational Aspects

Figure 41 shows the ranking of the gaming elements regarding its ability to have focused the users on the goals of the gamification application. The users ranked the gaming elements one to eight in terms of its contribution to goal orientation, with one indicating the least and eight the most. The Storyline/Theme provided users with the best clarity on the goal of the game. The Progress Bar provided the worst clarity. The Storyline/Theme was the best at driving the users toward achieving the learning goals.

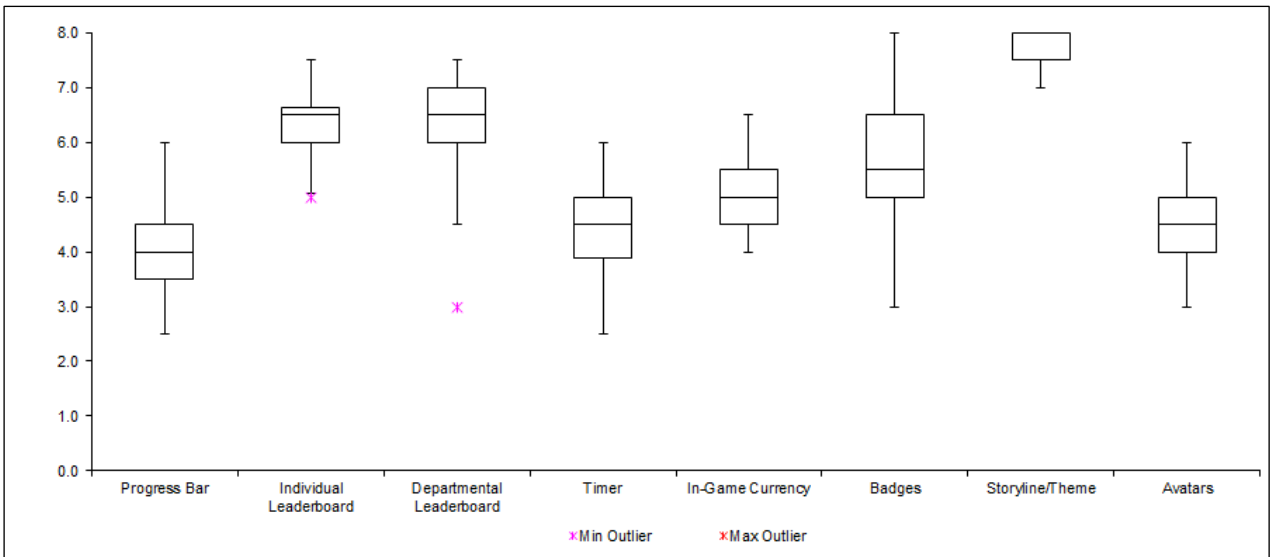


Figure 41: Comparison of Gaming Elements – Goal Orientation

The Individual Leaderboard was perceived to promote the feeling of competence better than any of the other gaming elements. The Avatar was least successful in achieving this objective. The Individual Leaderboard provided the user with the best recognition of their achievement in the learning process. The Departmental Leaderboard produced the second best recognition. The Avatar generated the least sense of recognition. Competing on the Leaderboard also created the greatest level of flow in the application. The Timer and Avatar gaming element produced the least amount of flow. (See Figure 42: Comparison of Gaming Elements – Competence)

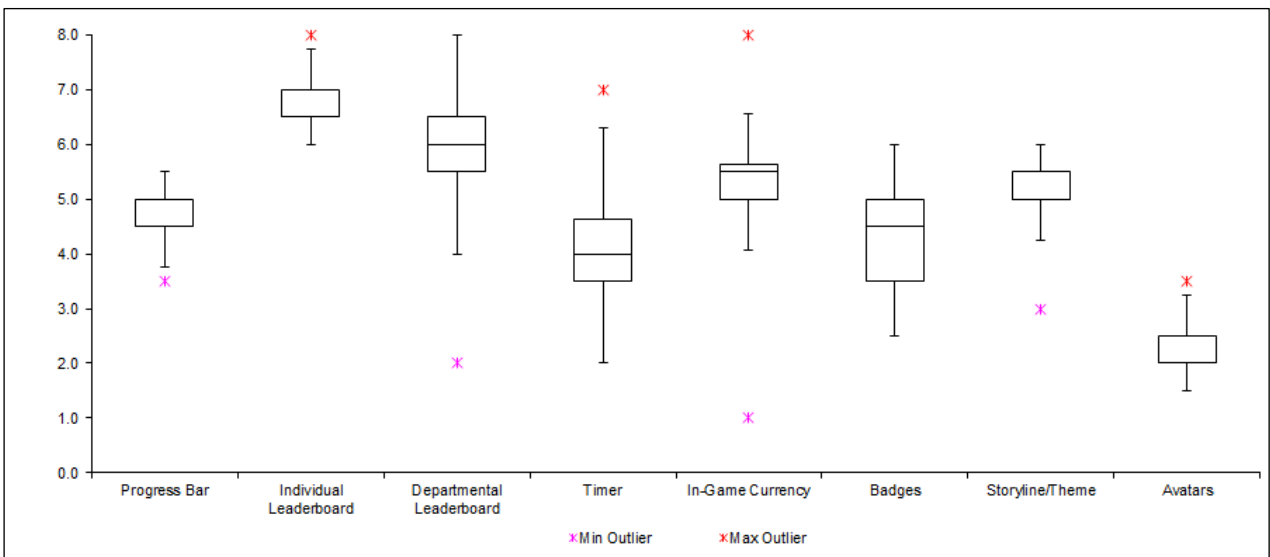


Figure 42: Comparison of Gaming Elements – Competence

6.6 Conclusion

Overall the Storyline/Theme ranked as the most effective gaming element across all the measurement criteria used in this study. It was well suited for the Seeker user type and the riddle it contained was suited for the Masterminds. The users perceived artwork as an essential component of a gamified learning application, which further confirms the prevalence of the Seeker user type in the environment. The Individual Leaderboard ranked very closely as the second most effective gaming element and was suited for the Conqueror user type found in the department. The Individual Leaderboard and Storyline/Theme both performed the strongest against the criteria measuring the playability of the application. The Storyline/Theme was by far the strongest from a gameflow perspective and the Individual Leaderboard from a motivation perspective. The Avatars ranked the worst across all the criteria. The poor performance of the Avatar could be due to its simplistic design not having catered to the needs of the users. (See Figure 43: Best and Worst Gaming Elements).

		Progress Bar	Individual Leaderboard	Departmental Leaderboard	Timer	In-game Currency	Badges	Storyline/ Theme	Avatar
Playability	Progress Visibility							**BEST**	Worst
	Competition		**BEST**						Worst
	Engagement	Worst						**BEST**	
	Weighting				Worst			**BEST**	
	Unpredictability	Worst	**BEST**	**BEST**					
	Rewards				Worst	**BEST**			
	Fairness		**BEST**		**BEST**				Worst
Gameflow	Concentration				Worst			**BEST**	
	Control							**BEST**	Worst
	Feedback							**BEST**	Worst
Motivation	Goal Clarity	Worst						**BEST**	
	Self-esteem		**BEST**						Worst
	Recognition		**BEST**						Worst
	Flow (Immersion)		**BEST**		Worst				Worst

Figure 43: Best and Worst Gaming Elements

Based on the overall results of this study, the creation of a gamified corporate learning application in the department, must include a Storyline/Theme and Leaderboard to cater for the Seekers, Masterminds and Conquerors in it. The other gaming elements, with the exception of the Avatar, can support these elements to create a fun and engaging learning environment.

Chapter 7

Conclusion

7.1 Introduction

This thesis assessed users' perceptions about eight gaming elements to determine its effectiveness on aspects of playability, enjoyment and intrinsic motivation needed in a gamified corporate learning application. User opinions about a Progress Bar, Individual Leaderboard, Departmental Leaderboard, Timer, In-Game Currency, Badges, Storyline/Theme and Avatar were evaluated using a gamified learning application designed and developed for this purpose. Gamification is fast growing and can significantly contribute to making learning environments more fun and engaging. Its use in education is increasing because it can motivate learners to higher levels of achievement. Therefore, it can serve as a mechanism to encourage continuous learning in employees whose organisations are dependent on it for survival and improved profitability. Gamified learning applications must, however, balance the use of extrinsic motivators contained in gaming elements to improve the intrinsic motivation needed in learning. The following section will conclude this thesis with the key learnings from the gamified corporate learning application design and evaluation process, limitations of the study and suggestions for future work.

7.2 Findings

7.2.1 Design Process

The careful design of gamified learning applications is a critical factor for its success. A holistic training approach with defined outcomes where gamification is a means to its end is needed. The department in this study created such a training approach that allowed users to contextualise the gamification of the ITIL processes a lot better. Clarity on the learning objectives supported by the gamification design process is essential. Alignment between the goals contained in the gamified learning application and the learning objectives is required.

Identifying the common user types, using a tool like Brainhex, is important to ensure the gamification application is suited to its users. In-depth workshops and discussions with users are, however, useful to refine the user types and to adapt them to the environment. Creating a fun experience is the most important guiding principle for creating a theme/storyline for a gamified application. There are many sources like film, reality television, game shows and games that can inspire a fun storyline. The artwork must align and increase the fantasy world created in the storyline. The Internet is an excellent source for images and artwork. A simple scoring mechanism that is easy to understand is necessary.

It is important to involve the users of the system early in the design process to generate ideas and design suggestions.

7.2.2 Technical Implementation

A gamified application architecture requires careful consideration to ensure it can support the unique capabilities needed. The tools used must support rapid development and the ability to create fun graphical user interfaces. A modular development approach can allow for the reuse of the core components in the application like the scoring mechanism thus enabling the rapid development of different storylines/themes. The developer's time and effort are thus spent working with the users and training department on creating a fun and engaging interface. In cases where the gamified application does not include the learning material covered, tight integration is required with the system hosting it. Such an integration enables a more user-friendly experience without traversing multiple applications to conduct the necessary learning.

7.2.3 Evaluation

The assessment framework used in this study was effective in measuring user perception about the gaming elements. It evaluated a broad spectrum of gaming element characteristics. According to the Brainhex results, experience points, badges and in-game currency (for Achievers), riddles (for Masterminds), progress bars and leaderboards (for Conquerors), and a storyline and visual artwork (for Seekers) are the gaming elements most suited to the department's environment.

A survey conducted by TalentLMS [56] in the e-learning domain found the following most and least preferred gaming elements:

Most preferred:

- Progressing to different levels (30%);
- Points/scores (27%);
- Real time feedback on performance (26%);
- Progress bars (25%); and
- Activity feeds (24%).

Least preferred:

- Competition with friends (13%);
- Virtual gifts (12%);
- Being part of a story/ narrative (11%);
- Avatars (3%); and
- Virtual currencies (2%).

The users' preference for a point-based system/leaderboards and dislike for avatars is consistent between TalentLMS survey and this study. The users' preference for being part of a story/narrative found in this study, however, varies with survey.

7.3 Limitations

Due to time constraints, the gamified corporate learning application discussed in this study contained limited functionality. The application did not contain multiple levels which could have improved user engagement and allowed for more risk taking. The application did not sufficiently cater for functionality to assess collaboration between users. An interesting assessment of the collaboration potential between experienced and novice users, therefore, was not possible. The impact of social interaction in the form of user chats and other social media was also not incorporated. Hence the recognition afforded through social interaction could not be tested. These limitations should constitute the basis of future studies on this subject together with those discussed in the following section.

7.4 Future Work

The gamified application discussed in this thesis supported the learning of procedural knowledge contained in the ITIL service management processes it covered. Hence, the users learnt about the triggers, tasks, activities, controls and outputs related to the availability management, incident management, release management and change management ITIL processes. The department like most other corporate environments, however, also requires learning knowledge that is declarative, conceptual, rules-based and based on soft skills [6]. Declarative knowledge is grounded in facts, conceptual knowledge in ideas, events or objects with common attributes, rule-based knowledge in relationships between concepts while soft skills inform social interactions [6]. The complex nature of corporate learning environments may require multiple knowledge types with varying levels of competency in a single application. Gaming elements require adjustment based on the types of knowledge supported. For example, gaming elements based on organising, association, repetition, stories, re-playability and trivia are best suited for acquiring declarative knowledge while role playing and board games are best suited for rule-based knowledge [6]. Designing a fun and engaging gamified learning application that supports a training curriculum containing learning material on all knowledge types will require careful and in-depth investigation in a future study.

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APPENDICES

A. Appendix 1: Playability Heuristics from [3]

Game Interface	A user should always be able to identify their score/status in the game
	Do not expect the user to read a manual
	Art should speak to its function
Game Mechanics	Mechanics should feel natural and have correct weight and momentum
	Get the user involved quickly and easily
Gameplay	The game should have an unexpected outcome
	Play should be fair
	The game should give rewards
	Pace the game to apply pressure to, but not frustrate the user
	Create a great storyline
	One reward of playing should be the acquisition of skill

B. Appendix 2: Gameflow Heuristics from [4]

Element	Criteria
Concentration	<ul style="list-style-type: none"> • Provide stimuli from different sources • Provide stimuli worth attending to • Quickly grab the user' attention and maintain their focus throughout the game • No distraction from tasks user wants/needs to concentrate on
Challenge	<ul style="list-style-type: none"> • Challenge match the users' skill levels • Challenge increases as users progress through the game and increase skill level
Control	<ul style="list-style-type: none"> • Users feel a sense of control over the game interface • Users feel a sense of control over their actions, strategies and feel free to play the game their way
Clear Goals	<ul style="list-style-type: none"> • Overriding goals are clear and presented early • Intermediate goals are clear and presented at appropriate times
Feedback	<ul style="list-style-type: none"> • Users receive feedback on their progress toward their goals • Users receive immediate feedback on their actions • Users always know their status or score
Social Interaction	<ul style="list-style-type: none"> • The game supports competition and cooperation among users • The game supports social interaction between users

C. Appendix 3: Intrinsic Motivation Heuristics from [5]

Category	Measurement
I. Individual Motivations	
a. Challenge	<p><u>Goals</u></p> <ul style="list-style-type: none"> • Present clear and fixed goals • Provide short-term and long-term goals <p><u>Uncertain Outcomes</u></p> <ul style="list-style-type: none"> • Uncertainty of outcome may be produced using: • Variable difficulty levels • Multiple levels of goals • Hidden information selectively revealed <p><u>Performance Feedback</u></p> <ul style="list-style-type: none"> • Performance feedback should be frequent, clear, constructive and encouraging <p><u>Self-esteem</u></p> <ul style="list-style-type: none"> • The activity should employ graded difficulty levels and positive feedback techniques to promote feelings of competence • The activity should employ personally meaningful goals that have instrumental, fantasy or social relevance for the learner
b. Curiosity	<p><u>Sensory Curiosity</u></p> <ul style="list-style-type: none"> • The activity should promote interactive exchange with the learner <p><u>Cognitive Curiosity</u></p> <ul style="list-style-type: none"> • Instructional techniques cause learners to be surprised and intrigued by paradoxes, incompleteness or potential simplifications
c. Control	<p><u>Contingency</u></p> <ul style="list-style-type: none"> • The activity should provide a responsive learning environment <p><u>Choice</u></p> <ul style="list-style-type: none"> • The activity should provide and emphasise moderately high levels of choice over various aspects of the learning environment • Personalization of the activity may enhance perceptions of choice <p><u>Power</u></p> <ul style="list-style-type: none"> • The activity should permit the learner to produce powerful effects

<p>d. Fantasy</p>	<p><u>Emotional Aspects</u></p> <ul style="list-style-type: none"> • Fantasies should be designed to appeal to the emotional needs of learners • Fantasies should encourage identification with imagined characters or contexts <p><u>Cognitive Aspects</u></p> <ul style="list-style-type: none"> • Fantasies should provide appropriate metaphors or analogies for the material presented for learning <p><u>Endogeneity</u></p> <ul style="list-style-type: none"> • Fantasies should have an integral, endogenous, relationship to the material to be learned
<p>II. INTERPERSONAL MOTIVATIONS</p>	
<p>a. Cooperation</p>	<ul style="list-style-type: none"> • The appeal of the activity may be enhanced by enlisting the motivation to cooperate with others • Endogenous cooperative motivation may be produced by segmenting the activity into inherently interdependently parts
<p>b. Competition</p>	<ul style="list-style-type: none"> • The appeal of the activity may be enhanced by enlisting the motivation to compete with others • Endogenous competitive motivation may be produced by creating an activity in which competitors' actions affect each other
<p>c. Recognition</p>	<ul style="list-style-type: none"> • The appeal of the activity may be increase if the learner's efforts receive social recognition • Endogenous recognition motivation may be produced by activities that provide natural channels for students' efforts to be appreciated by others

D. Appendix 4: General Questionnaire

1. What is your gender?

Answer Options

Female

Male

2. What is your Age?

Answer Options

18 to 24

25 to 34

35 to 44

45 to 54

3. What is your knowledge level of the ITIL processes implemented in the department?

Answer Options

Non-existent

Basic

Average

Good

Very Good

4. What is your prior experience with gamified learning systems?

Answer Options

None

Occasional

Frequent

5. Did the choice of participating in the gamification exercise increase your feeling of autonomy in learning the 4 ITIL processes?

Answer Options

Extremely So

Very Much

Moderately

Slightly

Not at All

E. Appendix 5: Game Playability Questionnaire

1. Game Interface: Rank the gaming elements in terms of providing you with visibility on your progress against the learning objectives in the game. (1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

2. Game Interface: How intuitive were the gaming elements contained in the game?

Answer Options

Extremely easy
Very easy
Moderately easy
Slightly easy
Not at all easy

3. Game Interface: How important was the artwork (pictures) contained in the application in enhancing the effect of the gaming elements?

Answer Options

Extremely Important
Very Important
Moderately Important
Slightly Important
Not at all

4. Gaming Mechanics: What level of competition did the gaming elements create in promoting the learning objectives in the game?

Answer Options

Extremely competitive
Very competitive
Moderately competitive
Slightly competitive
Not at all competitive

5. Game Mechanics: Rank the gaming elements in terms of the competitiveness it brought to achieving the learning objectives in the game. (1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

6. Gaming Mechanics: What level of cooperation did Brownie point sharing create between you and your departmental colleagues?

Answer Options

Extreme Cooperation
Much Cooperation
Moderate Cooperation
Slight Cooperation
No Cooperation

7. Game Mechanics: How well weighted were the gaming elements in supporting the goals of the game?

Answer Options

Extremely well
Very well
Moderately well
Slightly well
Not at all well

8. Game Mechanics: How well weighted were the gaming elements in supporting the learning goals of the game? (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

9. Game Mechanics: Did the gaming elements engage you quickly and easily with the learning material in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

10. Game Mechanics: Which of the gaming elements engaged you with the process of learning the ITIL training material quickest and easiest?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

11. Gameplay: Did the pressure of the 2 hour limit per process in the Timer gaming element serve to engage you with the learning material in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
None at All

12. Gameplay: Were the gaming elements sufficiently unpredictable to increase your level of engagement in the process of learning the ITIL training material in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

13. Gameplay: Which gaming element contributed most to creating an unpredictable outcome while learning the ITIL process material in the gamification application?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

14. Gameplay: Which gaming element provided the best reward for your efforts in learning the ITIL process material in the gamification application?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

15. Game Mechanics: Rank the value the In-Game currency trades permitted regarding creating a rewarding experience while learning the ITIL process material contained in gamification application? (1 to 3, where 1 is the least and 3 the most).

Answer Options

Quiz Do-Overs
Experience Points Sharing
Time-off

16. Gameplay: Did the gaming elements serve as a fair reward for learning the ITIL process training material contained in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

17. Gameplay: Which gaming element promoted the most fairness thereby encouraging your engagement with learning the ITIL process material in the gamification application?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

18. Gameplay: Did achievement in the gaming elements present the correct level of difficulty to promote learning of the ITIL processes?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

19. Gameplay: Achievement in which gaming elements presented the correct level of difficulty to promote learning of the ITIL processes?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

20. Gameplay: Did finding the winning condition of the game (the answer to the riddle) provide for an engaging experience while learning the ITIL process training material?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

21. Gameplay: Did the rest of the gaming elements support the Storyline/Theme portrayed in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

22. Gameplay: Did the gamification experience improve your understanding of the ITIL processes?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

23. Fun Experience: Did the gaming elements provided an element of surprise while learning the ITIL process training material in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

24. Fun Experience: Select the gaming elements that created the most fun and excitement while you learnt the ITIL process training in the gamification application?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

25. Value: Select the gaming elements that provided you with the most value while competing in the game? (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

26. Problem Solving: Did the gaming elements encourage you to resolve problems while learning the ITIL processes training material?

Answer Options

Extremely So

Very Much

Moderately

Slightly

Not at All

27. Improved Understanding: Did the gaming elements encourage you to achieve correct answers in the quizzes of the ITIL learning materials?

Answer Options

Extremely So

Very Much

Moderately

Slightly

Not at All

F. Appendix 6: Gameflow Questionnaire

1. Concentration: Select the gaming elements that grabbed and maintain your focus while learning the ITIL processes in the gamification application? (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

2. Concentration: Select the gaming elements that distracted you most from learning the ITIL processes material?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

3. Concentration: Were the gaming elements contained in the gamification application effective in increase your concentration levels to achieve the learning objectives in the game?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

4. Concentration: Select the gaming elements that made you concentrate and focus while learning the ITIL processes in the gamification application.

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

5. Challenge: Did the setup of gaming elements complement your skill level in the ITIL processes?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

6. Challenge: Did the gaming elements present an increased challenge as you progressed in learning the ITIL learning material in the gamification application?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

7. Challenge: Rank the gaming elements in challenging you while learning the ITIL process training material. (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

8. Control: Rank the gaming elements in providing you with a sense of control while learning the ITIL process training material. (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

9. Feedback: Rank the gaming elements in providing you with feedback while learning the ITIL process training material. (Rank 1 to 8, where 1 is the least and 8 the most).

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

10. Feedback: Which gaming element was the best scoring mechanism while learning the ITIL process training material and competing in the game?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme (Riddle Clues)

G. Appendix 7: Intrinsic Motivation Questionnaire

1. Goals: Was the goal of learning the ITIL processes in gamification application clearly demonstrated in the gaming elements?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

2. Goals: Which gaming element provided you with the best clarity on the goal of the gamification application?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme

3. Goals: How much did the gaming elements drive you towards the goal of learning the ITIL processes?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at All

4. Goals: How well did the gaming elements drive you towards the goal of learning the ITIL processes? (Rank 1 to 8, where 1 is the least and 8 the most).

Gaming Element

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

5. Self-esteem: Did the feedback generated by the gaming elements promote a feeling of competence that promoted learning the ITIL process material?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

6. Self-esteem: Which gaming element encouraged you to learn the ITIL processes by promoted a feeling of competence in you?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

7. Sensory Curiosity: Did the Storyline/Theme and visual effects in the game evoke a level of curiosity that promoted learning the ITIL process material?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

8. Recognition: Which gaming element encouraged you to learn the ITIL processes by providing you with social recognition?

Answer Options

Progress Bar
Individual Leaderboard
Departmental Leaderboard
Timer
In-Game Currency
Badges
Storyline/Theme
Avatars

9. Contingency: Did the game provide a responsive environment for learning the ITIL processes?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

10. Flow: Did you realise how much time passed while playing the game?

Answer Options

Extremely So
Very Much
Moderately
Slightly
Not at all

11. Flow: Select the gaming elements that kept you most immersed in learning the ITIL processes.

Answer Options

Progress Bar

Individual Leaderboard

Departmental Leaderboard

Timer

In-Game Currency

Badges

Storyline/Theme

Avatars

H. Appendix 8: Gamified Application Implementation Detail

Application Logic

The following section contains the APEX coding of some functions in the application.

Registration Page

The APEX code below was used to capture the users' registration details

```
#1 DECLARE
#2 username VARCHAR(100);
#3 ename VARCHAR(100);
#4 surname VARCHAR(100);
#5 location VARCHAR(100);
--- more variable declarations here ---
#19 BEGIN
#20 comp1 := :P102_COMYESNO;
#21 av1 := :P102_AYESNO;
#22 pic := :P102_NEW_11;
--- more variables being assigned values here ---
#37 U_REGISTER(UPPER(username), ename, surname, job_title, emp_type, company, email,
      u_password, dept_name, division, location, con_password, comp1, av1, manager, pic, emplvl);
#38 END;
```

In the abovementioned code segment, lines 3-18 were variables declared, with their data type and size. Line 20-36 were variables given values, which were field values the user captured in an application form. Line 37 is the storage sequence of the values in the database.

Home Page

The APEX code developed to validate if users entered the correct answer to the Riddle is shown below.

```
#1 DECLARE
#2 text VARCHAR(50);
#3 validation VARCHAR(50);
#4 numberdb NUMBER(7);
#5 user VARCHAR(50);
#6 BEGIN
#7 user := NVL(v('APP_USER'),USER);
#8 text := :P1_ANSWER;
#9 if text = 'IMAGINATION'
#10 Then
#11 validation := 'CORRECT!';
#12 numberdb := '1';
#13 Else
#14 validation := 'INCORRECT!';
#15 numberdb := '0';
#16 END IF;
```

```

#17 :P1_VALIDATION := validation;
#18 UPDATE EMPLOYEE
#19 SET COMPLETED = numberdb
#20 WHERE GAMERNAME = user;
#21 COMMIT;
#22 END;

```

In the abovementioned code segment, lines 2-5 were new variables declared. Lines 7-8, gave values to variables. Lines, 9-16 checked the answer to the Riddle using an IF Statement. If the answer is "IMAGINATION", then it displays as "CORRECT!" and "numberdb"=1. If that condition was not met, then it displayed "INCORRECT!" and "numberdb"=0. In line 17 "validation" was given a field value. In lines 18-19 was where the database field "Completed" is updated with whatever value was given for "numberdb".

Game Function

Below is the APEX code that started the timer once the users evoked the "Start" button on the Game function.

```

#1 DECLARE
#2 startin TIMESTAMP := CURRENT_TIMESTAMP;
#3 user VARCHAR(50);
#4 BEGIN
#5 user := NVL(v('APP_USER'),USER);
#6 UPDATE EMPLOYEE
#7 SET INMAN_START = startin
#8 WHERE GAMERNAME = user;
#9 COMMIT;
#10 END;

```

Trades Function

Below is the APEX code used to exchange BP for a Quiz Do-Over. Similar coding routines were used to exchange BP for sharing XP and Time-off.

```

#1 DECLARE
#2 user VARCHAR(50);
#3 trades NUMBER(5);
#4 bp NUMBER(5);
#5 newbp NUMBER(5);
#6 tratext VARCHAR(50);
#7 doover NUMBER(5);
#8 BEGIN
#9 user := NVL(v('APP_USER'),USER);
#10 SELECT BP
#11 INTO bp
#12 FROM EMPLOYEE
#13 WHERE GAMERNAME = user;
#14 doover := '75';
#15 IF :P4_TRADESR = '75'
#16 THEN
#17 newbp := bp - doover;
#18 END IF;
#19 UPDATE EMPLOYEE
#20 SET BP = newbp

```

```
#21 WHERE GAMERNAME = user;  
#22 COMMIT;  
#23 END;
```

In the abovementioned code segment, lines 2-9 contained the variables declared. In lines 10-13 a value is selected from the database and given to the "bp" variable. In line 21 the amount of BP needed to do over a quiz is set to 75. In lines 19-21 a UPDATE command was issued to the database to update the user's BP to the new value.