THE ROLE OF GAMIFICATION IN THE FACILITATION OF STUDENT ENGAGEMENT: AN EXPLORATORY INDUSTRIAL PSYCHOLOGY APPLICATION

by

Samantha Adams

Dissertation presented

for the

Degree of Doctor of Philosophy (Industrial Psychology)

in the

Faculty of Economic and Management Sciences

at

Stellenbosch University

Supervisor: Prof. Ronel Du Preez

April 2019

The financial assistance of the National Research Foundation (NRF) and Harry Crossley Foundation towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the NRF or the Harry Crossley Foundation.

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Samantha Adams **April 2019**

ABSTRACT

Student engagement has been identified as a significant predictor of student success. With the current drive to improve student success and graduation rates in South African higher education institutions, the potential that enhanced student engagement and learning experiences hold for increasing student success provides a strong rationale for research in this area. One potential avenue for enhancing student engagement is gamification. The popularity of gamification as a learning tool to foster engagement has grown exponentially over the past decade. Gamification is understood as the application of game thinking and game design to non-game environments, products and services, e.g. education. The goal of gamification is to promote motivation and engagement, as well as provide an engaging experience in numerous contexts. Educational gamification holds much potential for supporting and enhancing authentic learning experiences. Despite the initial positive wave of research, more recent studies are reporting inconclusive or mixed results of the efficacy of gamification use in education. This emphasises the need for theoretical and rigorous empirical investigations of gamified interventions in education. In addition, the application of educational gamification to the development of student engagement and student success has received limited attention in the South African context.

This study sought to propose a framework of educational gamification design principles for the facilitation of student engagement. The investigation was guided by the principles of the Design Based Research (DBR) approach. DBR is characterised by iterative cycles of analyses, design, evaluation and revision activities that serve to develop and improve teaching and learning technologies. Through this approach a gamified online learning environment was created, evaluated and revised, within two Industrial psychology modules, over three iterative cycles. The pragmatic paradigm supported the used of mixed methods in the examination of the influence that gamification had on student engagement. Qualitative focus group interviews were employed to elicit participant perspectives and experiences. Student engagement was also evaluated quantitatively through a questionnaire compiled to measure the dimensions of the construct (i.e. behavioural, emotional and cognitive engagement) and was used in a within-subjects experimental design. Supporting data was also collected through documentation, activity logs and website analytics.

The findings supported the development of a framework of design principles and design guidelines derived from the design and evaluation process to develop the interventions. These

principles and guidelines present key features and insights required for gamifying learning environments that facilitate student engagement. The findings also emphasised the dynamic interplay between the dimensions of student engagement as well as how they are influenced by game elements. Cross case comparisons highlighted the influence that factors such as enjoyment, context and group characteristics have on the perceived success and effective use of educational gamification. Even though limited support was found to corroborate clear casual effects of the gamified intervention on student engagement, the study demonstrated that educational gamification principles can facilitate student engagement - but must be carefully tailored, and seamlessly integrated with the learning environment. Most importantly, educational gamification can support and enhance behaviours that are conducive to learning, but require relevant and meaningful learning activities in combination with carefully considered reward and feedback mechanisms.

The study provides practical and theoretical insights that are transferrable from the context in which it was conducted. This research also highlighted challenges and limitations associated with educational gamification usage and student engagement research and thus offered suggestions for avenues for further investigation.

OPSOMMING

Studente-betrokkenheid is geïdentifiseer as ’n belangrike voorspeller van studentesukses. Met die huidige strewe om studentesukses en gradueringstempo in Suid-Afrikaanse hoër onderwysinstellings te verbeter, bied die potensiaal wat verhoogde studentebetrokkenheid en verbeterde leerervarings inhou ’n sterk rasionaal vir navorsing in hierdie area. Een potensiële weg vir die bevordering van studentebetrokkenheid is *gamification*/spel[1]. Die gewildheid van *gamification* as ’n leer- hulpmiddel om betrokkenheid te bevorder, het die afgelope dekade eksponensieel gegroei. *Gamification* word verstaan as die toepassing van speldenke en spelontwerp op nie-spelverwante omgewings, produkte en dienste, byvoorbeeld onderwys. Die doel van *gamification* is om motivering en betrokkenheid te bevorder, asook om ’n deelnemende ervaring in talle kontekstete bied. Opvoedkundige *gamification* hou baie potensiaal in vir die ondersteuning en verbetering van outentieke leerervarings. Ten spyte van die aanvanklike vlaag positiewe navorsing, rapporteer meer onlangse studies onbevredigende of gemengde resultate in die doeltreffendheid van die gebruik van *gamification* in die onderwys. Dit beklemtoon die noodsaaklikheid van teoretiese en streng empiriese ondersoeke na gevorderde intervensies in die onderwys. Daarbenewens het die toepassing van opvoedkundige *gamification* in die ontwikkeling van studentebetrokkenheid en -sukses in die Suid-Afrikaanse konteks beperkte aandag gekry.

Die doel van hierdie studie was om ’n raamwerk van opvoedkundige ontwerpbeginsels vir *gamification* voor te stel vir die fasilitering van studentebetrokkenheid. Die ondersoek is aan die hand van die beginsels van die Ontwerpgebaseerde Navorsingsbenadering gedoen. Ontwerpgebaseerde Navorsing (OBN) word gekenmerk deur iteratiewe siklusse van ontledings, ontwerp, evaluering en hersieningsaktiwiteite wat daarna streef om onderrig- en leertegnologieë te ontwikkel en te verbeter. Deur hierdie benadering is ’n *gamified* aanlyn leeromgewing binne twee bedryfsielkunde-modules oor drie iteratiewe siklusse geskep, geëvalueer en hersien. Die pragmatiese paradigma het die gebruik van gemengde metodes ondersteun in die ondersoek van die invloed wat *gamification* op studentebetrokkenheid gehad het. Kwalitatiewe fokusgroeponderhoude is aangewend om deelnemer perspektiewe en ervarings te dokumenteer. Studentebetrokkenheid is ook kwantitatief geëvalueer deur middel

[1] Daar is nie ’n algemeen aanvaarde term vir die woord *gamification* in Afrikaans nie. *Gamification* is die gebruik van spelontwerpelemente in nie-spel kontekste.

van ’n vraelys wat saamgestel is om die dimensies van die konstruk te meet (naamlik gedrags-, emosionele- en kognitiewe-betrokkenheid). ’n Binne-groep eksperimentele ontwerp is gebruik. Ondersteunende data is ook ingesamel deur middel van dokumentasie, aktiwiteitslogboeke en webwerf-analise.

Die bevindinge ondersteun die ontwikkeling van ’n raamwerk van ontwerpbeginsels en ontwerpsriglyne wat uit die ontwerp- en evalueringsproses verkry is om die intervensies te ontwikkel. Hierdie beginsels en riglyne bied sleutelkenmerke en -insigte wat nodig is vir die (*gamifying*) omskakeling van leeromgewings wat studentebetrokkenheid bevorder. Die bevindinge het ook die dinamiese wisselwerking tussen die dimensies van studentebetrokkenheid beklemtoon, asook hoe dit beïnvloed word deur spelelemente. Kruisgevalvergelykings beklemtoon die invloed wat faktore soos genot, konteks en groepseienskappe op die waargenome sukses en effektiewe gebruik van opvoedkundige spel het. Alhoewel beperkte ondersteuning vir kousale verbande tussen die intervensie en studente-betrokkenheid verkry is, is daar duidelike aanduidings dat die beginsels van opvoedkundige *gamification* wel studente-betrokkenheid kan fasiliteer. Opvoedkundige *gamification* moet versigtig toegepas word en soomloos geïntegreer word met die leeromgewing. Belangriker nog, opvoedkundige *gamification* kan gedrag bevorder wat bevorderlik is vir leer, maar vereis relevante en betekenisvolle leeraktiwiteite in kombinasie met deeglik oorwoë belonings- en terugvoermeganismes.

Die studie bied praktiese en teoretiese insigte wat oordraagbaar is vanuit die konteks waarna dit uitgevoer is. Hierdie navorsing het ook klem gelê op uitdagings en beperkinge wat verband hou met die opvoedkundige gebruik van *gamification* in studentebetrokkenheidsnavorsing en bied dus voorstelle vir verdere navorsing.

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ACKNOWLEDGEMENTS

Throughout my PhD journey I was inspired by a simple quote by R.S. Grey: “She believed she could, so she did” but as much as this project asked of me, none of it would have been possible without God’s grace and the amazing support system I am blessed with.

I would like to thank:

My supervisor, Prof Ronel du Preez, for passionately and patiently guiding, supporting and encouraging me. Your drive, authenticity, kindness and leadership are inspiring and I am so grateful to have walked this path with you.

My family, especially my parents Peter and Shirley Adams, who instilled in me the value of education, hard work and perseverance, and my siblings Robyn, Kirstin and Ryan. Thank you all for your sacrifices, prayers, and unconditional love, support and understanding you have provided throughout this journey.

Nicol, you motivate and inspire me to strive for and achieve more each day. Thank you for your consistent love and encouragement, and especially the chocolates and hugs provided when obstacles became overwhelming.

My Departmental heads, Prof Johan Malan and Prof Aletta Odendaal; my mentor, Prof Estian Calitz; colleagues and friends who provided, guidance, encouragement and invaluable support in various forms.

Prof Martin Kidd, for his patient and expert assistance with the statistical analyses.

The translators, transcribers, language and technical editors who played a role in moulding and refining my work.

My colleague and friend, Magda Barnard, who brought my ideas to life and went above-and-beyond with her technical and administrative support. You have been an absolute blessing. I sincerely appreciate everything you have done for me.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Higher education has become a benchmark of the progress and prosperity of a country. Attaining this level of education is generally associated with improved wellbeing outcomes, employment and labour market opportunities, as well as improved earning potential (Reddy, Bhorat, Powell, Visser, & Arends, 2016). With the wide range of complex social, political and economic challenges faced by an evolving global society, universities, in particular, are ideally placed to link, access and influence the dynamic shared perspectives of knowledge. Universities therefore have a central role to play in serving the needs of society by promoting and facilitating the enhancement of human potential and social development (GUNi, 2018). More specifically, as an organisation, a university serves to provide a holistic tertiary education experience of knowledge acquisition, development, dissemination and utilisation.

In South Africa the higher education (HE) system is tasked with mobilising and effecting human resource development through effective skills level training in the process of producing, acquiring, internalising and applying new knowledge (Ministry of Education, 2001). Moreover, opportunities that contribute to the maturation of their students' social, cultural and psychological development are also required. Within the greater context of the development and transformation of the South African (SA) society, the university has a pivotal role in driving socio-economic development and cohesion and promoting and defending multiculturalism (Department of Higher Education and Training [DHET], 2016). This requires the development of well-rounded and skilled citizens adding social, cultural and scientific value to society. These efforts are seen to facilitate and support both institutional and national goals.

The SA national strategic imperatives are set forth in the National Development Plan (NDP) 2030 (National Planning Commission [NPC], 2011), based on the findings of the Diagnostic Report of the NPC that was released in June 2011. In response to the country's identified achievements and highlighted shortcomings, the NDP sets objectives aimed at reducing poverty and inequality in the next twenty years. The underlying impetus is to create a cycle of growth and development, i.e.

> "The national plan has to attack the blight of poverty and exclusion and nurture economic growth at the same time; creating a virtuous cycle of expanding opportunities, building capabilities, reducing poverty, involving communities in their own development, all leading to rising living standards" (NPC, 2011, p. 2).

Of the nine central challenges identified (see NPC, 2011), two have received the highest priority, namely increasing employment and improving the quality of education. These two priorities are emphasised in the plan as the key objectives against which all targets and actions for HE development should be benchmarked.

At the heart of the NDP, is the drive to empower SA citizens through the expansion of economic opportunity by way of investment, but more importantly, the development of human capital (NPC, 2011). In this context, development is defined as "a process of continuously raising the capabilities of all citizens particularly those that were previously disadvantaged" (NPC, 2011, p.5). The emphasis on the improvement of individual capabilities invariably necessitates a paradigm whereby individuals strive towards self-improvement through the acquisition of skills and education. The provision of which, together with basic services, security and housing needs, as well as jobs, all contribute towards generating a sustainable income (NPC, 2011). Through appropriate education that qualifies people to engage in gainful employment, citizens should be empowered to improve their own lives.

The improvement of the quality of education is underpinned by the notion that students who are not afforded a quality education are withheld from meaningful and gainful employment, which ultimately affects business and the economy. The role of higher education institutions (HEIs) therefore lies in the facilitation of student development in becoming suitably qualified, skilled and employable graduates. Moreover, the NDP highlights the role of a university as the developer of the nation including the functions of the production of new knowledge and the provision of opportunities for social mobility (NPC, 2011).

A number of challenges exist within SA's current education system, and the NDP has outlined proposals for the development of the knowledge economy, aimed at all role players across all levels of the system (NPC, 2011) According to Fisher and Scott (2011), the current state of the SA education system has done little to improve the number of learners who gain access to higher education (i.e. participation rates). The quality of education provided at primary and secondary level of the system ultimately affects the quality and success of learners at tertiary level (Spaull, 2012). Even though reform at lower levels of the education system is desperately

required, the primary objective at tertiary level is to improve the quality of graduates who leave HEIs. Institutions are therefore challenged to strive to be "world-class centres of excellence at the cutting edge of technology" (NPC, 2011 p. 19) by promoting research and development and a high calibre of teaching that are required to improve the quality of higher education.

To this end, the DHET has called for a more targeted focus on student success and quality teaching (Stellenbosch University [SU], 2014). The measurement of success in higher education is framed within the metric analysis of graduation and success rates that are used as a proxy for university performance (Lewin & Mawoyo, 2014). In the most recent report by the DHET, the graduation rate[2] of students at public HEIs increased by 39.7% between 2009 to 2016, which translates into 203 076 graduates in 2016, an increase of 57 692 since 2009 (Council on Higher Education [CHE], 2018, p. 4; DHET, 2018, p. 2). In the same period, success rates[3] have increased across all population groups from an average of 77.1% in 2009 to 83% in 2016, for contact mode students, in particular (DHET, 2018, p. 25). Distant mode students reflected a similar increasing trend (62.7% to 67.6%). Despite the positive trends observed, these numbers mask a myriad of challenges and shortcomings that still plague the SA education system.

The pertinent challenges highlighted at the *Second National Higher Education Transformation Summit* in 2015 (DHET, 2016) included the need to increase enrolment, decrease the number of dropouts in undergraduate courses, and increase the ability of students to complete in or close to the minimum regulation time. These challenges reflect systemic shortcomings throughout the education system. In the General Household Survey (GHS): Focus on Schooling 2016 (see Department of Basic Education [DBE], 2018), significant progress was reported in the basic education sector over the last two decades with close to universal access to schooling (for learners of compulsory school-going age) being achieved. However, when examining the cohort born between 1990 and 1992, only 48.6% attained a Grade 12 pass (Louw, 2017.). The achievement rate of learners who wrote the National Senior Certificate (NSC) examinations over the last seven years (2010 to 2017) has consistently remained above 70%. However, only 28.7% of the 534 484 matriculants who had passed qualified to apply for degree studies (DBE,

[2] Graduation rates are calculated as the number of graduates divided by a headcount enrolment within a specified year

[3] Success rates are calculated as "FTE (full-time equivalent) passes divided by FTE enrolments. The success rates shown are, therefore, weighted averages for contact and distance courses for each population group" (DHET, 2018, p. 25).

2017, p. 54). An examination by the DBE (2018) of the 19–23-year-old cohort revealed that only 7% of this group were enrolled at a university or university of technology and 15% were at an institution of further education. Alarmingly, 64% of this cohort were not participating in any form of post-school education at the time of the survey, and the remainder were still enrolled in school (DBE, 2018, p. 11). In the global competitiveness report for 2017–2018 (Schwab, 2017), South Africa was ranked 114th out of 137 countries for the quality of its education system and more specifically 85th out of 137 countries in terms of the quality of its higher education and training system. In comparison to countries of a similar development standing (e.g. Brazil) these figures are relatively low and highlight the improvements required for the attainment of the goals set by the NDP (NPC, 2011; Schwab, 2017).

The challenges and shortcomings of the SA education system also have a marked effect on the quality of learners entering higher education. Once these learners enter the university system their chances of success may be hampered due to their lack of academic preparedness for the challenges of this new environment. In a study commissioned by Higher Education South Africa (HESA), it was found that many students lack the ability to read, write and comprehend effectively (Academy of Science of South Africa [ASSAf], 2010). Moreover, in 2013, the CHE found that only a quarter of students were likely to graduate within the allotted time, and 48% of contact students would complete their degree within five years (Ndebele et al., 2013, p. 15). Despite steady increases in access and participation at HEIs, the system is still plagued by high failure, repetition and dropout rates also referred to as the "revolving door" syndrome (Ndebele et al., 2013, p. 27). These issues are but a fraction of the hurdles that hamper the attainment of the national development goals. In light of these trends, Prof. Derek Swartz advocated for a "focus on student success through the creation of conducive and stimulating environments involving a spectrum of developments such as academic support, more flexible learning paths and academic structures, and the creation of stability in universities with the most vulnerable groups" (DHET, 2016, p. 5). To this end, the present study reflected on the question: how do we increase student success within higher education given the realities of the current education system in South Africa?

Turning to the HE literature, student performance and student success are generally intertwined with academic achievement and the completion of a degree and are associated with the metric outcomes of graduation and success rates. However, more extensive definitions of student success do exist, together with a focus on the educational experience as well as the

competencies, skills and attitudes that are acquired (Youssef & Dahmani, 2008). The term 'student success' is a broad concept but is generally understood as the outcome of activities and efforts towards "academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational objectives, and post-college performance" (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007, p. 10). The conceptualisation and measurement of the construct not only defines the role of the student but also that of the institution. Hence, student success constitutes, firstly, the time and effort invested in curricular and non-curricular activities, and, secondly, the structure and provision of institutional support (i.e. resources, services and learning opportunities) with which students are encouraged to engage and of which they must make use (Kuh, 2009).

In a similar vein, student success may involve the articulation of core skills or competencies of successful graduates, viz. generic graduate attributes (Barrie, 2007). The development and application of graduate attributes are seen to reflect institutional efforts in developing a well-rounded graduate who will contribute to society and facilitate an inclusive view of student success. This approach is important given the current SA context and the vision of the NDP. The overarching definition of graduate attributes is thus outlined as follows:

> "The qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses." (Bowden, Hart, King, Trigwell, & Watts, 2000, p. 217).

Graduate attributes are institution-specific, student focused and acquired via the formal academic programmes as well as informal or co-curricular campus experiences. The development of graduate attributes is a process of acquisition that is nurtured over time and through individual experiences at a tertiary institution. The goal of this process is to not only deliver employable individuals but also instil qualities that "prepare graduates as agents for social good in an unknown future" (Bowden et al., 2000, p. 217). The role of the institution is pivotal to the achievement of these goals and denotes the need for active efforts to ensure that graduate attributes are an innate feature of the university's teaching and learning experience (Hughes & Barrie, 2010).

With the focus on improving student success rates extensive research has been conducted to identify predictors of student success (e.g. Kuh, 2009; Strydom, Mentz, & Kuh, 2010; Webber, Krylow, & Zhang, 2013). These predictors are dealt with in detail in the subsequent literature review. Nevertheless, research in this area has identified academic performance, preparation and motivation as significant predictors of a student's likelihood to graduate (Pascarella & Terenzini, 2005; Strydom et al., 2010). However, the current state of the education system and quality of the learner entering tertiary education make these predictors difficult to apply without excluding an even greater number of students (Strydom & Mentz, 2010). Student engagement has received much support as a fourth predictor or contributing factor to student success (Cuseo, 2012; Pike, Kuh, & Massa-McKinley, 2009; Strydom & Mentz, 2010; Strydom et al., 2010). Extensive research has been conducted on this relationship and the results regularly support the positive influence that engagement in effective educational practices has on students success (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Mladen & Kuh, 2001; Pascarella & Terenzini, 2005; Pike et al., 2009). In addition, this effect is consistent across student profiles and varied institutional categories (i.e. size, mission and selectivity). Most notable is the compensatory effect that student engagement appears to have for students from disadvantaged backgrounds (Kuh, 2009; Kuh et al., 2008; Strydom et al., 2010). By directing and encouraging these students to engage in effective educational practices, significant improvements in their performance are reported. Hence, a possible solution to the current crisis in SA HEI may lie in focused policies and practices that promote student engagement and encourage the investment of time and energy in appropriate purposive educational activities (Strydom et al., 2010).

Student engagement is recognised as the extent to which students are involved in activities and conditions that are likely to generate high-quality learning (Krause & Coates, 2008). 'Engagement' refers to various aspects of the student experience, viz. academic, non-academic and social interactions. Krause and Coates (2008) assert, "at a certain level of analysis, engagement is taken to provide a singularly sufficient means of determining if students are engaging with their study and university learning community in ways likely to promote high quality learning." (p. 2). Engagement could therefore serve as a conduit or mediator for the acquisition of graduate attributes and ultimately student success. This notion is supported by the view that engaged students are committed to their own learning and are more likely to participate actively in lifelong learning opportunities than student who are not engaged (Chalmers, 2007). Following this line of reasoning, the role of the institution as provider of 'engaged' learning opportunities is also emphasised, but the student's ability to and

responsibility for making use of these opportunities is paramount. In sum, student engagement not only reflects but also develops from the dynamic interplay between student and institutional activities and conditions (K. Krause & Coates, 2008).

The HE literature on student engagement is well documented for countries such as the United States, Australia and the United Kingdom (Coates, 2006; Coates & Mahat, 2013; Kuh et al., 2007; Pike & Kuh, 2004). Yet, research in the South African context is limited in comparison (Strydom & Mentz, 2010). SA higher education shares many of the challenges with other countries also striving to improve retention, success and graduation rates. However, the drive towards reform and wider inclusion is more pronounced in SA due to the low participation rates of previously disadvantaged groups who are in the majority. This inequality in participation fuels the urgent need to develop efficient and effective practices that support and enhance student success (Schreiber & Yu, 2016; Strydom et al., 2010). This not only presents a strong justification for the investigation of student engagement as a contributing factor to success but also highlights the need to explore innovative and creative methodologies to attain higher levels of student engagement in SA higher education (Strydom et al., 2010). One such avenue is gamification.

The topic of gamification has grown in popularity over the past decade accompanied by a dramatic increase in academic inquiry into this subject (Dichev & Dicheva, 2017; Dicheva, Dichev, Gennady, & Angelova, 2015; Hamari, Koivisto, & Sarsa, 2014; Paisley, 2013). Gamification has been punted as a powerful motivational tool that draws on the engaging elements found within games, and has found application in various fields including education, service marketing and business (Hamari et al., 2014). The goal of this application is to motivate and support user engagement by drawing on the motivational power of games and creating a 'fun' user experience (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification can simply be defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p.2). Moreover, it is the integration of "positive, intrinsically motivating, 'gameful' experiences brought about by game/motivational affordances" (Hamari et al., 2014, p. 1) that results in a variety of positive psychological and behavioural outcomes. The potential gamification holds as a motivational tool to foster user engagement has led to its meteoric uptake in recent years (Dicheva et al., 2015).

The application of games or game elements to learning contexts has received considerable attention, especially in tertiary education contexts (De Sousa Borges, Durelli, Reis, & Isotani,

2014a; Dicheva et al., 2015; Lee & Hammer, 2011). Educational gamification is the use of game elements in the design of learning processes that support scholastic development in formal and informal educational settings (Seaborn & Fels, 2014). It is argued to be distinct from game-based learning, simulation or serious games. While the latter are focused on the creation of games that impart an educational benefit, educational gamification is the addition of game-like concepts to a learning experience (Glover, 2013). Lee and Hammer (2011) propose that educational gamification may motivate students to learn better and to care more about their educational institution. According to Kapp (2012), educators have the opportunity to potentially nurture rich experiences and motivate learners through the application of gamification to educational environments, thereby fostering engagement. Educational gamification thus holds many affordances for designing authentic learning experiences that facilitate student learning and success through the application of game elements.

The key components in the application of educational gamification are the game elements employed. Game elements include, but are not limited to points badges, leader boards, levels, clear goals, feedback, rewards, progress and challenge (Hamari et al., 2014). Each game element is proposed to hold a motivational pull and therefore fulfils a specific function, also referred to as its motivational affordance (Sailer, Hense, Mandl, & Klevers, 2013; Zhang, 2008). An object's motivational affordance is characterised by the extent to which its properties can and do maintain a particular level of motivation (Zhang, 2008). Fitz-Walter, Tjondronegoro, and Wyeth (2012) propose that game elements provide incentives or external goals that serve to engage the user. Game elements thus trigger motivational mechanisms that may enhance the learners experience and encourage particular behaviours that could increase student engagement and ultimately student success.

The potential educational gamification holds for improved learning as an outcome of student engagement has been argued by a number of authors (Dicheva et al., 2015; Sailer et al., 2013; Surendeleg, Murwa, Yun, & Kim, 2014). Even though many cases of gamification implementation have been identified, there is still a need for theoretical and empirical investigation into the effects or benefits of educational gamification given that research on the effect of educational gamification on student engagement has yielded mixed results (Aldemir, Celik, & Kaplan, 2018; Berkling & Thomas, 2013; Sailer et al., 2013). Moreover, qualitative evaluations of student perceptions of gamification application are sparse (Aldemir et al., 2018; Çakıroğlu, Başıbüyük, Güler, Atabay, & Yılmaz Memiş, 2017; Cheong, Filippou, & Cheong,

2014), with even fewer studies being reported in the field of teaching in psychology (Stansbury & Earnest, 2017). The status quo in this area of study justifies further investigation of educational gamification as a tool to facilitate student engagement.

This study aimed to design an educational gamification framework for increased student engagement and was underpinned by the overarching research question: *What are the characteristics of an educational gamification design framework that facilitates student engagement in a first-year Industrial Psychology module?*

In order to design a framework for the development of a gamification application for student engagement the following literature-related objectives were set:

- to identify the nomonological network of variables affects student success in higher education;
- to delineate the underlying theoretical structure of student engagement; and
- to identify the current approaches to the application of gamification in educational contexts

The objectives that were set to guide the development of the educational gamification design framework are as follows:

- to propose and refine educational gamification design principles for student engagement within the HE context, based on literature;
- to apply a framework of educational gamification design principles within an online setting for student engagement within the HE context;
- to explore and describe the outcome of applying an educational gamification design principles framework for student engagement within an online learning management system; and
- to propose a revised design framework of educational gamification design principles that can be applied and used feasibly to support and facilitate student engagement within an HE context.

Given the need for innovative pedagogical approaches in the present SA educational climate, this study attempted to propose a practical yet systematic approach to facilitating student

engagement through the application of educational gamification principles and game elements. The scope and presentation of the dissertation are outlined and described in the next section.

1.2 SCOPE AND PRESENTATION OF THE DISSERTATION

Chapter 1 outlined the background and status quo of higher education in South Africa; thus, established the rationale and relevance of the present study. The examination of the research problem culminated in the research question and the objectives set for this study.

Chapter 2 begins with an in-depth discussion of the structure, role and challenges faced by higher education in South Africa. The literature review of student success and student engagement provides an overview of the theoretical perspectives and definitions of these constructs and lays the foundation for the subsequent chapter.

In Chapter 3, a review of various works on gamification in education is presented. Through a systematic review of the literature, a set of design principles to facilitate student engagement through educational gamification is proposed and underpinned the construction of a gamification intervention for student engagement.

Chapter 4 provides a detailed description and justification of the guiding research paradigm, methodological approach and specific methods employed for data collection and analysis. The study was guided by a design based research approach which consisted of iterative micro-cycles of research supported by qualitative and quantitative data collection methods.

The empirical investigation is reported and discussed in Chapter 5. A case study methodology was employed to report the findings which are presented as three instrumental cases explicating the outcomes of the micro cycles carried out in each case.

The sixth and final chapter outlines the practical implications of the research and the conclusions reached in this study. The discussion of the findings is presented through the lens of the three student engagement dimensions (behavioural engagement, emotional engagement and cognitive engagement). Furthermore, limitations of the study and recommendations for future research and concluding remarks are highlighted.

1.3 SUMMARY: CHAPTER 1

This chapter encapsulated the introductory arguments and motivation for the study. The research question and objectives, both literature-specific and empirical, were formulated and stated. An overview of the research methodological approach was defined and described followed by a brief delimitation of the study. The next chapter is the first of two literature review chapters starting with an examination of the student success and student engagement literature.

CHAPTER 2

STUDENT SUCCESS AND STUDENT ENGAGEMENT

2.1 INTRODUCTION

This chapter will provide an extensive review of the literature in the field of higher education with particular focus on student engagement and its role in student success in the domain of higher education. The discussion will then turn to gamification and the development of a gamified intervention in Chapter 3. To guide the review of the literature the following literature-related objectives were set for Chapters 2 and 3:

- to identify the nomonological network of variables that impact on student success in higher education;
- to delineate the underlying theoretical structure of student engagement; and
- to identify the current approaches to the application of gamification in educational contexts.

To provide further context, the chapter begins with a very brief overview of the South African higher education environment (following the context already provided in Chapter 1) and then turns to a broad discussion of student success and its associated predictors (cognitive, psychological and psycho-social factors).

2.2 HIGHER EDUCATION IN SOUTH AFRICA

The drive for national development hinges upon the development of a knowledge economy, especially in the globalised context South Africa finds itself (Scott, Yeld, & Hendry, 2007). South Africa's higher education system is a vital pipeline of knowledge and talent that is required to drive economic growth, social transformation, cohesion and multiculturalism (DHET, 2016; Ministry of Education, 2001). As such, higher education institutions are tasked with educating and generating skilled graduates that will contribute to the required social change and economic development. Simultaneously, there is the socio-political requirement for equity and diversity within an education system that is still working through the growing pains of a restructured landscape (CHE, 2010; Ministry of Education, 2001; Ndebele et al., 2013).

The higher education system underwent a process of restructuring of higher education institutions in South Africa. The DHET currently oversees "26 public Higher Education Institutions, 123 registered private Higher Education Institutions 50 Technical and Vocational Education and Training (TVET), 279 registered private colleges and 9 Community Education and Training (CET) colleges" (DHET, 2018, p. 2). The merging and incorporation of the original 21 universities and 15 technikons now include 11 traditional universities (offering theoretical oriented degrees), six universities of technology (offering vocational diplomas and degrees) and six comprehensive universities (offer a combination of vocational and theoretical degrees) (CHE, 2010). The restructuring of the system was motivated by the need to transform and more specifically for the "rationalization of programmes, to encourage collaboration between institutions, to enhance responsiveness, to build capacity and to refocus institutions with new institutional identities" (CHE, 2009, p. 8).

The National Plan for Higher Education, announced in 2001, articulated the role of higher education as a threefold contribution. It encompasses the development of human resources, the provision of high level skills training, as well as the production, procurement and utilization of new knowledge (Ministry of Education, 2001). Moreover, the creation of new knowledge is driven by the delivery of graduates and research. At a micro level, the higher education system provides individuals an opportunity to fulfil their aspirations of self-development by developing and enhancing their capabilities. The education provided at higher education institutions is meant to develop broad investigative, integrative and innovative capabilities (Altbeker & Storme, 2013). This is critical for the propagation of new knowledge through research and innovation that is of social and economic benefit. At a macro level, the country is particularly reliant on the higher education system to yield trained graduates to not only resolve skills shortages but also develop citizens that are critical thinkers and drivers of social reform.

Statistics South Africa reports that youth unemployment currently stands at 38.2% for 15-34 year olds (Statistics South Africa [Stats SA], 2018). However, in the same group university graduate unemployment is only 6.6% compared to 31.2% for those who have not completed Grade 12. Nevertheless, evaluations of the graduate contribution to the labour market point to an incongruence between the needs of the labour market (demand) and the output of the sector (supply) (Fisher & Scott, 2011; Reddy et al., 2016). While some authors argue that there are high incidences of graduate unemployment (Scott et al., 2007) others refute this claim as an exaggerated concern (Altbeker & Storme, 2013; Van Broekhuizen, 2016; Van der Berg & Van

Broekhuizen, 2012). In a study conducted in 2011, it was reported that the unemployment rate for individuals with non-degree tertiary education was 16 %, for matriculants the rate was 29% and for those with less than 12 years of schooling the unemployment rate was as high as 42% (Altbeker & Storme, 2013, p. 1). In comparison, the unemployment rate among university graduates was below 5% (Van Broekhuizen, 2015). The implication is that degreed graduates have a 20% to 25% higher likelihood of finding employment than their matriculated counterparts. Even though the value of a tertiary qualification is evident when comparing the rate of unemployment across the educational scale, the rising number of graduates has yet to meet the needs of the labour market (Reddy et al., 2016; Scott et al., 2007).

Between 1995 and 2011 the number of graduates entering the country's workforce has seen an increase of 5.6% per annum (Altbeker & Storme, 2013, p. 8). Nevertheless, the demand for high-level skills remains present and continues to be highlighted in the media, progress reports and the literature on the higher education sector. The extent to which the sector is meeting the demand for skills is also unclear due to contradicting views and research findings on the supply of skills available. The CHE allude to the fact that skills shortages may be more pronounced in rural areas and the movement of professionals out of the country or into others sectors may be responsible for depleting the supply of professionals with high level skills (CHE, 2009). The inability of higher education to meet the needs of the market could also lie in the low participation rates of young adults.

According to a 2016 report, the participation rate[4] stands at approximately 18% which is considered low compared to countries of a similar development standing (e.g. Brazil) (CHE, 2016). With the NDP goal for participation set at 30% by 2030, there is a need to significantly increase participation and student success in higher education, but also to address the racial disparities that are still prevalent (CHE, 2016; Lewin & Mawoyo, 2014; NPC, 2011). Even though access has increased, progression or throughput still remains a challenge along with a number of obstacles that plague the higher education landscape (Reddy et al., 2016). These will be clarified next.

South Africa's higher education system operates in a socio-political context that remains inextricably connected to historical injustices, segregation and inequality. In the past, educational provision was racialised and differentiated in terms of the quality of instruction and

[4] Participation rate is the "total headcount enrolment over the national population of 20-24 years old, calculated as a percentage" (CHE, 2018, p. iv).

the opportunities provided (Lewin & Mawoyo, 2014). With the advent of democracy, the higher education system has seen a considerable increase in the number of students enrolled in tertiary education programmes, primarily due to affirmative admission policies and massification of education (Duthie & Freeman, 2015). The reported increases in enrolment have ensured a change in the demographic profile at HEIs with steady increases in the numbers of women and black students participating (CHE, 2018; DHET, 2016). The numbers of African students, in particular, doubled between 2000 and 2015 (Motsabi & Van Zyl, 2017). However, poor throughput and high attrition persist and African, Coloured and Indians students are still, on average, the most likely to dropout, suffer poor grades and take longer to complete their degrees (Duthie & Freeman, 2015). It is evident that even though participation rates of previous disadvantaged groups have increased it has not translated into the racial redress or transformation required at higher education institutions (Fisher & Scott, 2011). Moreover, efforts to boost enrolments have not been adequately supported by measures to ensure success (DHET, 2016; Duthie & Freeman, 2015).

A number of challenges within the secondary and higher education system may explain why the issue of poor throughput and attrition persists. To illustrate, even though schooling has become universally accessible the quality thereof is still wide-ranging and has done little to address educational inequality (DBE, 2018; Duthie & Freeman, 2015). This state of affairs also influences the impact that massification has on higher education institutions and increases the number of underprepared students that enrol. Students come from varied educational backgrounds which suggests that the issue of underpreparedness may not only be limited to previously disadvantaged groups (Duthie & Freeman, 2015). Additional obstacles that students may experience include poor study choices, financial constraints, lack of funding, language, racism, discrimination, complicated academic curricula and trouble adapting to new institutional environments or cultures, to name but a few (DHET, 2016; Motsabi & Van Zyl, 2017). In addition, the growth in enrolments have exceeded the staff compliment at many academic institutions, thus influencing the burden and workload placed on academic staff (CHE, 2016). In spite of the challenges faced by students and the higher education sector student success in higher education remains imperative for individual enrichment, national development, and the realisation of the NDP goals.

2.3 STUDENT SUCCESS

The body of literature on the topic of student success is expansive (Cuseo, 2012; Mullin, 2012; Robbins et al., 2004; Usinger & Boyer, 2012). Despite the prevalence of the term student success, its definition or conceptualisation is often fragmented. Robbins et al. (2004) ascribe these discrepancies in conceptualisation to the lack of clarity or inconsistency in the definition of "college outcomes" (p. 262). At its core, student success can be defined as "a favourable or desirable student outcome" which may differ from one institution to the next (Cuseo, 2012, p. 1). However, Cuseo (2012) proposes that the most frequently researched themes or indicators in higher education literature may offer some insight into the meaning of a *desirable* or *favourable* student outcome. These include student retention, educational attainment, academic attainment, student advancement and holistic development (Cuseo, 2012). Each desired outcome of student success is alluded to in the following paragraphs.

Student retention or persistence, as an outcome of student success, emphasises the enrolment of a student and the extent to which he/she will re-enrol and endure through their undergraduate education. Factors such as dropout, integration and involvement are also covered in the literature on student retention. Closely linked to retention is *educational attainment* that focuses on the actual completion or attainment of a qualification (e.g. a degree) or goal. In order for a student to attain a qualification, he/she would be required to produce an acceptable or higher degree of proficiency, which is *academic attainment*. The terms academic performance and academic achievement are also used synonymously with academic attainment.

Traditional measures of student success often rely on academic performance indicators and may include metrics associated with grades, graduate enrolment and completion rates (Lewin & Mawoyo, 2014), performance in university entrance examinations as well as discipline-specific examinations (Kuh et al., 2007). Although useful in their own regard, these measures only serve as a proxy for actual throughput and do not adequately account for elements of the student experience or institutional quality that may contribute to student retention and throughput. Another measure is *student advancement* that relates to the educational and job-related undertakings that academic programmes prepare students for and the extent to which students will perform adequately when in these roles.

A commonality amongst the aforementioned outcomes is an emphasis on purely academic factors. A student's ability to meet, acquire and demonstrate the necessary skills and attributes

related to the above-mentioned outcomes has repeatedly been shown to hinge upon more than academic ability (Abraham, Richardson, & Bond, 2012; Fong et al., 2017; Robbins et al., 2004). Hence, Smith (2003, cited in Cuseo, 2012) suggests that an over emphasis on academic factors is not sufficient to ensure student retention without equal consideration of non-academic elements of student life.

An alternative conceptualisation of academic success is an individual's ability to effectively adjust and navigate through the academic experience and institutional environment. This approach thus shifts from an emphasis on the individual level determinants of student success to student success as a cumulative outcome that denotes a *holistic* interpretation of the student experience (Cuseo, 2012). It represents more than just the achievement of a degree but rather the assessment of the effectiveness of the entire educational experience at an individual and institutional level. This notion is supported by Lewin and Mawoyo's (2014) opinion that success should encapsulate the quality and delivery of programme offerings, as well as the nature of skills and attributes that prepare graduates for the labour market, which includes their preparedness and employability once they graduate. This view also serves to improve on the inadequacies of the traditional (only quantitative) measures of student success (Kuh, 2007; Van der Zanden, Denessen, Cillessen, & Meijer, 2018).

Holistic development pertains to the influence that the tertiary educational experience has on the development of the student as a "whole person" (Cuseo, 2012, p. 2). Moreover, Cuseo (2012) lists the following dimensions as part of this outcome:

- *"Intellectual* development: developing skills for acquiring and communicating knowledge, learning how to learn, and how to think deeply.
- *Emotional* development: developing skills for understanding, controlling, and expressing emotions.
- *Social* development: enhancing the quality and depth of interpersonal relationships, leadership skills, and civic engagement.
- *Ethical* development: formulating a clear value system that guides life choices and demonstrates personal character.
- *Physical* development: acquiring and applying knowledge about the human body to prevent disease, maintain wellness, and promote peak performance.

- *Spiritual* development: appreciating the search for personal meaning, the purpose of human existence, and questions that transcend the material or physical world."

Holistic development is akin to many institutional outcomes, such as developing enquiring minds or students that are engaged citizens. These are not directly indicative of academic achievement but are expressed in the mission statements, goals or graduate attributes of the tertiary institution (Cuseo, 2012). Student success is, therefore, tantamount to a number of student-focused outcomes that are set and defined by the institution and its stakeholders.

The outcomes presented above offer insight into various elements required to ensure student success, but none is more pertinent than holistic development. From a holistic perspective student success can be conceptualised as an outcome that is preceded by a multitude of determinants (i.e. cognitive, psychological and situational). These determinants influence a student's ability to perform academically, integrate, and adjust successfully into their social environment and ultimately persist and persevere through their tertiary education to become proficient employees and productive members of society. This is evident in the student retention literature where numerous academic and non-academic factors besides poor academic performance, have been repeatedly proven to influence dropout or withdrawal from the institution (Abraham et al., 2012; Letseka & Maile, 2008; Van Zyl, 2016). By defining the student success phenomenon holistically, one not only acknowledges but also encapsulates the multiplicity of personal development and the various aims of tertiary education (Cuseo, 2012).

Kuh et al.'s (2007) description of student success succinctly encapsulates the outcome of the interaction between the student and the institution. Student success is described as the outcome of all activities and practices that promote "academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational objectives, and post-college performance" (p. 10). This definition draws on prior research that has examined student success as a function of specific personal and environmental antecedents or indicators that include student satisfaction, integration and involvement (Astin, 1984; Tinto, 1988, 1993).

The promotion of student success requires not only a holistic definition of the construct but also scientifically informed guiding principles or features of the learning experience that can be applied in order to meet the desired outcomes. Kuh et al. (2007) based their model of student

success on Chickering and Gameson's (1987) *Seven principles for good practice in undergraduate education*, namely:

- encouraging interaction between students and faculty;
- developing exchange and collaboration among students;
- encouraging active learning;
- providing feedback punctually;
- impressing the importance of time on task;
- conveying high expectations; and
- respecting diverse aptitudes and approaches to learning.

These principles serve as guidelines for effective teaching and learning and were intended for all stakeholders in undergraduate education (e.g. lecturers, students, administrators etc.). Thus, in order to achieve desired student success outcomes requires an institutional level drive to create an environment that supports and facilitates student success, as conveyed in Chickering and Gameson's (1987) principles and Kuh et al.'s (2007) model. However, this alone is not sufficient to ensure student success: that is, the targets or receivers of the products of effective practices (i.e. students) should also be considered. This requires a focus on personal or individual-level determinants or factors that enable a student to effectively engage with the environment. For instance, Wankowski (1991) asserted that academic success is determined by; "1) personal confidence and a feeling of competence in learning; 2) hopeful but realistic projection into the future occupational roles and social roles; 3) emotional stability; 4) temperamental tendency towards introversion; 5) relative independence from teachers; 5) a tacit acceptance of the curricular and work demands arising within the structure of tuition" (p. 61). Similarly, Cuseo (2012) proposed *seven central principles of student success* namely:

- personal validation;
- self-efficacy;
- sense of purpose;
- active involvement;
- reflective thinking;
- social integration; and
- self-awareness.

Cuseo (2012) referred to these as "success-promoting principles" and argued that these principles support and promote "(a) student retention (persistence), (b) student learning (academic achievement), and (c) personal development (holistic outcomes)" simultaneously (Cuseo, 2012, p. 3).

The factors and principles proposed by both Cuseo (2012) and Wankowsi (1991) provide clear outcomes or rather ideals to strive towards but are also indicative of the broad network of cognitive, psychological and social processes that need to be considered when attempting to promote student success. What will follow is a review of the student success literature that will serve to unpack the complex array of variables that play a role in the higher education student's learning experience and path towards success. This will serve as an informative foundation for the present study in order to uncover the factors and elements that are not only malleable and controllable but that may be further cultivated through effective teaching and learning practices. This discussion will focus specifically on cognitive, psychological and psychosocial factors.

It is, however, important to note before continuing, that the categorisation of non-cognitive determinants of academic performance is not always clearly defined (Robbins et al., 2004). For example, in the education literature, non-cognitive predictors are identified as "anything but standardised academic achievement and aptitude tests and school-based academic performance (e.g., grade point average [GPA] and class rank)" (Robbins et al., 2004, p. 261). In contrast, the school of cognitive psychology also defines constructs such as self-efficacy beliefs and outcome expectancies, meta-cognitive awareness, and achievement and performance goals as being cognitive in nature (Eccles & Wigfield, 2002; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). Nevertheless, the former definition is supported for cognitive variables. Non-cognitive variables are referred to as psychological variables.

2.3.1 Predictors of student success

As alluded to above, student success has been conceptualised and theoretically examined from various outcome perspectives (i.e. student retention, educational attainment, academic attainment and holistic development). This review will report on the most pertinent variables highlighted in the literature as significant contributors to, and predictors of student success.

2.3.1.1 Cognitive variables

The terms general ability, intellectual ability, scholastic aptitude and intelligence are generally used interchangeably when referring to the cognitive variables or predictors of performance. The relationship between intelligence and academic performance has been an enduring focal point in the education literature, specifically as a predictor of academic success (Robbins et al., 2004). Moreover, cognitive predictors of academic success have a long history of investigation within the academic performance arena. The prediction of academic performance has led to the development of tests of general cognitive ability including intelligence tests and cognitive ability tests (Cronbach, 1949; Kline, 2015; Van Iddekinge, Aguinis, Mackey, & Deortentiis, 2014). These tests are generally measures of cognitive capacity or an assessment of an individual's ability (Abraham et al., 2012). Even though the degree of predictive power of intelligence is well documented, the results are varied. Earlier studies reported significant correlations between intellectual ability and academic success (see Busato, Prins, Elshout, & Hamaker, 2000) but more recent reviews have gone so far as to assert that at a post-secondary education level, intelligence is a poor predictor of academic performance and that it becomes even less relevant as a student progresses to higher levels of education (O'Connor & Paunonen, 2007).

An additional concept in the realm of cognitive ability is that of learning potential. Learning potential is conceptualised as the combined influence that *Abstract reasoning capacity*, *Information processing capacity* (speed, accuracy, and flexibility), *Transfer of knowledge* and *Automatisation* have on an individual's ability to learning (Taylor, 1994; 1997). This body of work expresses the afore-mentioned factors as learning competencies that inform *Classroom learning performance* and *Learning performance during evaluation* (Mahembe, 2013). Earlier work in the arena centred on the formulation of dynamic assessment theories that explain learning potential and the complex processes unpinning the transfer of knowledge (Budoff, 1968; Campione & Brown, 1987; Carlson & Weidl, 1978; Guthke, 1992, 1993; Guthke & Stein, 1996) that informed skills training. More contemporary investigations have sought to identify learning competencies that influence whether students are successful or not (Burger, 2012; De Goede, 2007; Mahembe, 2013; Taylor, 1994; 1997). The studies make a valuable contribution to affirmative development and the role that both cognitive and non-cognitive factors play in learning, which is particularly pertinent in the South African education context where students come from diverse backgrounds that influence their ability to succeed.

Subsequently, the last two decades has seen a proliferation in studies examining the role of non-cognitive predictors of academic performance and student success (Abraham et al., 2012; Eccles & Wigfield, 2002). O'Connor and Paunonen (2007) advocate the use of predictors other than intelligence to predict academic performance, such as measures of personality, motivation, and study habits. The constructs that are operationalised in these measures speak to implicit psychological factors that influence the extent to which a student will be successful, even if general cognitive ability or intelligence is at an adequate level. The following section will highlight the most pertinent psychological variables in the student success literature.

2.3.1.2 Psychological variables

A vast number of psychological variables that reflect the individual differences in student success are acknowledged. There are however, a number of variables that have been extensively researched, namely personality, motivation, self-regulatory learning strategies, and emotional intelligence. These variables have received significant support as predictors of academic performance and will be discussed in the subsequent sections.

2.3.1.2.1 Personality

Personality has been extensively investigated as a predictor of academic performance and has been found to account for additional variance over and above intelligence, especially at higher levels of formal education (Furnham, Chamorro-Premuzic, & McDougall, 2002; Kappe & Van der Flier, 2012; Poropat, 2009; Vedel, 2014). Personality is generally conceptualised and assessed according to the five-factor model, which represents an orthogonal interpretation of five personality dimensions (i.e. conscientiousness, extraversion, neuroticism, openness, and agreeableness) (Abraham et al., 2012; Costa & McCrae, 1992; Furnham et al., 2002). The description of the five factors is widely agreed upon and have all shown to predict academic performance to a certain degree, especially conscientiousness (Busato et al., 2000; Poropat, 2009; Vedel, 2014).

Conscientiousness is characterised by an achievement orientation underpinned by self-discipline, tenacity, organisation and dependability (Abraham et al., 2012; Busato et al., 2000; Trapmann, Hell, Hirn, & Schuler, 2007). When applied to academic attainment, students who display high levels of conscientiousness are more likely to remain motivated and persist when dealing with challenging course content (Mount & Barrick, 1995). In contrast, students who are low in conscientiousness are less likely to achieve because of a lack of persistence. This self-

regulatory limitation is likened to the concept of *procrastination,* which is defined as "a behavioural tendency to postpone tasks or decision making" (Milgram, Mey-Tal & Levison, 1998; Van Eerde, 2003, both cited in Abraham et al., 2012, p. 9).

Extraversion denotes the degree to which people are inclined towards sociability and high activity (Busato et al., 2000). Moreover, it involves the "quantity and intensity of interpersonal interaction, encompassing traits such as assertiveness, sociability, activity, cheerfulness, and gregariousness" (Trapmann et al., 2007, p. 133). Rolfhus and Ackerman (1999) argue that students with extravert propensities are more sociable, leading to lower achievement because of the distraction social behavioural tendencies might cause. On the other hand, students with introvert propensities may devote more time towards their learning and knowledge consolidation.

Agreeableness is a dispositional inclination toward nurturance, cooperation, flexibility, trust, tolerance and the kind and fair treatment of others (Busato et al., 2000; Trapmann et al., 2007). Costa and McCrae (1992) include trust, straightforwardness, altruism, compliance, modesty, and tender-mindedness as traits of agreeableness. It is proposed that high Agreeableness impacts performance due to the student's willingness to cooperate with the learning process and comply with instructions (Poropat, 2009). However, contemporary work suggests that agreeableness may not transfer to success in the work place (Solomon, Campbell, & Hall, 2018)

On the other hand, *neuroticism* or emotional stability implies an inclination towards experiencing negative emotions and higher levels of anxiety or a measure of emotional stability vs. instability (Abraham et al., 2012; Busato et al., 2000). This manifests as anxiety, angry hostility, depression, self-consciousness, impulsivity, and vulnerability (Costa & McCrae, 1992). High neuroticism would influence how students respond to stress and time pressures as well as their ability to adjust or adapt to unfamiliar situations or unexpected changes (Goldberg, 2001, cited in Trapmann et al., 2007) and has also been linked to test anxiety and absenteeism (Abraham et al., 2012; Furnham et al., 2002).

Lastly, *openness to experience* (also called intellect) is characterised by receptiveness to new ideas, creativity, curiosity, originality, and intellectuality (Abraham et al., 2012; Trapmann et al., 2007). The characteristics of this trait would positively influence the students processing and management of new learning by facilitating the process of learning (Lounsbury, Steel, Loveland, & Gibson, 2004; Vermetten, Lodewijks, & Vermunt, 2001).

As such, personality has received considerable support as a predictor of academic performance. For example, Furnham et al. (2002) found that personality traits were better predictors of academic performance than cognitive ability and beliefs about intelligence. This is supported by Vedel's (2014) systematic review and meta-analysis in which significant correlations were reported between academic performance and agreeableness, conscientiousness and openness, with conscientiousness as the strongest predictor of a student's grade point average (GPA). Taking a different approach, Kappe and Van der Flier (2012) used undergraduate human resource management (HRM) students to examine the combined predictive validity of personality, intelligence and motivation on academic performance. They reported that in combination these predictors accounted for 33% of variance in academic achievement. These studies highlight the predictive strength of personality but should not detract from the role of other factors (e.g. motivation) in explaining academic performance and student success.

2.3.1.2.2 Motivation

Motivation is described as the drive underlying all intentions to act but also subsumes the energy, direction and persistence required to start and sustain this effort (Ryan & Deci, 2002; Schunk, Meece, & Pintrich, 2014). It is thus an investment of energy that directs an individual to act or behave in a particular manner. Within the education literature, motivation is conceptualised in various forms and ascribed to both the input and outcome of the learning process. Brophy (1983) hypothesised that the motivation to learn is both state and trait like in nature. State motivation is defined as the momentary and contextual properties that would rouse and direct a student to action. Conversely, trait motivation is relatively stable and accounts for learning that is self-directed and takes place outside of the classroom context. Similar to trait motivation, learning motivation refers to the sustained participation in and commitment to learning that is driven by an aspiration that energises and guides goal-oriented behaviour (Ames & Archer, 1988). More recently, motivation has been restated as achievement motivation, which is defined as the propensity to strive for success and positive consequences that accompany it and the efforts to circumvent failure and the negative consequences thereof (Busato et al., 2000; Linnenbrink-Garcia & Patall, 2016). This form of motivation implies that the student requires both the cognitive ability and motivational drive to excel in a learning context (Schunk et al., 2014).

Several motivational theories exist that provide explanations for factors that may influence a student's performance in a given task. The focus of these theories is primarily based on the

individual's beliefs of competence, expectancy and control (Eccles & Wigfield, 2002). Earlier research on motivation made a distinction between cognitive and motivational factors but over the last few decades these lines of research have amalgamated (Linnenbrink & Pintrich, 2002; Linnenbrink-Garcia et al., 2018). This shift has also facilitated a more pronounced emphasis on the social-cognitive models of motivation, which are based on three assumptions. Firstly, a social cognitive approach views motivation as a dynamic, manifold phenomenon and thus assumes numerous ways in which students can be motivated. Secondly, motivation is not assumed to be a stable trait but rather context and domain-specific, implying that motivation is changeable and that the environment/context can be altered to increase motivation. Thirdly, a student's self-regulation mediates the interactions between the individual, context and subsequent achievement (Linnenbrink & Pintrich, 2002). Linnenbrink-Garcia et al. (2018) emphasise the importance and value of acknowledging the myriad of motivational facets (e.g. competency beliefs, task value and achievement goals) and advocate for the examination of integrative profiles that combine various theories of motivation to minimise unnecessary construct overlap.

In order to highlight the most pertinent constructs involved in motivation, the discussion will be constructed around the four primary motivational beliefs associated with student achievement and learning, namely attributions, self-efficacy, intrinsic and extrinsic motivation and goal orientation (Eccles & Wigfield, 2002; Linnenbrink & Pintrich, 2002; Schunk et al., 2014).

Attributions: Attribution theory postulates that an individual interprets events in terms of causality in order to determine explanations and expectations of future actions, thereby perceiving particular causes for success or failure (Linnenbrink-Garcia, Patall, & Pekrun, 2016; Weiner, 1985, 2000). These causes are either attributed to personal factors (e.g. effort or ability) or environmental factors (e.g. a strict or biased lecturer) and can be categorised according to three particular orientations or causal dimensions: "stability (how stable the perceived cause is), locus (whether the cause is internal or external) and controllability (whether or not the perceived cause be can controlled)" (Linnenbrink & Pintrich, 2002, p. 317). Attribution theory also claims that the emphasis placed on explaining why successes or failures have occurred, can explain other psychological outcomes such as affect, efficacy and outcome expectations (Weiner, 2000), which in turn are associated with behavioural outcomes such as engagement and performance (Linnenbrink & Pintrich, 2002).

Attributions associated with one's control over and expectations of success or failure are also related to locus of control (LOC) beliefs. Successes and failures are thus attributed to either internal, personal factors or external, environmental factors (Linnenbrink-Garcia et al., 2016; Rotter, 1966). The interaction between LOC beliefs and academic achievement and socialisation is complex. In this context, students with an internal locus of control are likely to attribute their successes to internal factors (e.g. ability, class attendance or studying) and therefore expect future successes. However, if these students interpret failure as a consequence of their internal shortcomings they may also expect failure in the future, unless they believe that they have the ability to address and change these factors (Cassidy & Eachus, 2000). In contrast, students with an external locus of control attribute their successes and failures to external factors (e.g. poor quality teaching, poor support) and may therefore lack motivation to engage in the educational experience because the outcome is based on unpredictable or uncontrollable factors (Bean & Eaton, 2002; Cassidy & Eachus, 2000). Moreover, Bean and Eaton (2002) posited that students with an internal locus of control were more likely to study hard and socialise and that these efforts would result in adaptive academic and social integration.

In sum, the hypothesised interactions between achievement motivation and attributions (i.e. locus, controllability and stability) are well supported in the literature (Linnenbrink-Garcia & Patall, 2016; Linnenbrink-Garcia et al., 2016).

Self-efficacy: The influence of competency beliefs and expectancies on academic achievement is well documented, particularly self-efficacy (Linnenbrink & Pintrich, 2002; Linnenbrink-Garcia et al., 2016). The seminal work of Bandura (1977) described self-efficacy as an expectation of success or an individual's confidence in or beliefs about his or her ability to perform a task or activity. In addition, self-efficacy is multidimensional in nature due to the variation in strength, generality, and level (or difficulty) that is present across different contexts or tasks (Eccles & Wigfield, 2002; Linnenbrink & Pintrich, 2002). Self-efficacy may, therefore, manifest as high or low for specific tasks, depending on their difficulty and contexts.

Academic self-efficacy is conceptualised as a student's expectations and beliefs regarding their aptitude to study content, develop skills, or master certain activities (Linnenbrink-Garcia et al., 2016). Bandura (1977) distinguished two types of self-efficacy expectancy beliefs namely outcome expectancies and efficacy expectancies. *Outcome expectancies* refer to the perceived linkage between behaviour and an outcome (e.g. "if I study hard I will pass my test") that may result in optimistic or negative attributions (Abraham et al., 2012). In contrast, *efficacy*

expectancies are beliefs about personal capabilities to perform (Bandura, 1977). A student may therefore believe that putting in the time and effort to study will lead to success in a particular course but they may not believe that they are able to mobilise this effort. On the other hand, a student may believe they have the ability but may not be convinced that it will lead to success (Abraham et al., 2012; Eccles & Wigfield, 2002).

Efficacy expectations are also formulated in relation to experiences of performance that is termed *performance self-efficacy*. A student may, therefore, have preconceived expectations of their ability to perform in specific activities or contexts. Conversely, students are confronted with certain challenges they may lack experience in, their expectations may then be based on more generalised perceptions of their personal capacity to perform. Academic self-efficacy has been proven to support achievement and learning as well as adaptive outcomes, such as effort and persistence when faced with difficult tasks (Bandura, 1977; Banfield & Wilkerson, 2014; Pintrich, 2003; Zimmerman, Bandura, & Martinez-Pons, 1992). Students who believe that they have the skills and abilities to succeed at academic tasks are more likely to mobilise the effort to persist and perform better than those with lower self-efficacy beliefs. Self-efficacy beliefs have also been found to positively influence student cognitive engagement and the extent to which they employ effective self-regulatory strategies (Linnenbrink & Pintrich, 2002). Bean and Eaton (2002) also highlight the role of self-efficacy in a student's ability to deal with academic and social challenges.

Academic self-efficacy should also be distinguished from *academic self-esteem*. Where the former refers to beliefs of performance competencies, the latter is concerned with an individual's *self-worth* in relation to academic ability. In the academic environment both competence and achievement are valued, therefore the grades that individuals receive are seen as a measure of their worth as students (Covington, 2000). Academic ability is therefore a key facet of self-worth that an individual would be motivated to sustain. In addition, self-worth is also governed by how an individual defines success, for instance success-oriented or failure-avoidant. Success oriented students strive towards personally meaningful goals in order to be the best that they can be whereas a failure avoidant orientation defines success in relation to how well the individual does in comparison to others (Covington, 2000). The latter is driven by a fear of failure and the student may employ failure avoiding tactics or attributions in order to protect their self-worth. They are also more likely to strive towards performance goals rather than learning goals.

Goal orientation: The research on goals and goal orientation has proliferated and resulted in a diverse categorisation of these constructs (Elliot & Church, 1997; Linnenbrink-Garcia & Patall, 2016; Pintrich, 2000). Goals that are focused on the motivation and behaviour required for achievement are referred to as achievement goals (Elliot & Church, 1997). According to Pintrich (2000) achievement goals have primarily been approached from three perspectives that are distinguished by varying levels of analysis.

The first level is characterised by task-specific goals, such as target goals, that are established in response to a specific task or problem (Locke & Latham, 2002, 2006). Task-specific goals have explicit standards or criteria built into them that enable evaluation of one's performance (e.g. achieving a grade of 60% or more for a particular course".

At the second level of analysis the content of the goal is emphasised: that is, the target as well as the reason for the goal. These goals are more generalised and refer to the potential array of goals that motivate particular behaviours, for example goals of belonging, understanding, mastery and creativity amongst others (Ford, 1992, cited in Pintrich, 2000). General goals differ from target goals as they do not explicitly outline the standards or criteria for evaluation. The third level of analysis refers to achievement goals which "reflects an intermediate level between the very specific target goals and the more global goal content approach" and denote the underlying drive an individual has for pursuing an achievement tasks such as academic learning tasks (Pintrich, 2000, p. 93). Hence, achievement goals are a cohesive and organised combination of beliefs encompassing the reason or purpose (e.g. mastery) and targets of performance that drive motivated achievement behaviour. When goals are focussed on related beliefs about a task this general orientation is referred to as goal orientation.

The terminology related to goal orientations varies. For instance, goals that speak to the mastery of a task or learning have been associated with terms such as learning-, task- or mastery goals. Goals that are directed towards aptitude or performance in comparison to others are described as performance- or ego-involved goals. From a motivation perspective, goals that address the betterment of the individual or individual achievement are thought to be intrinsically-motivated, in contrast to those directed towards demonstrating competence or competing with others that are deemed to be extrinsically motivated (Abraham et al., 2012; Covington, 2000; Ryan & Deci, 2002). Consequently, learning or mastery goals are generally considered to produce more adaptive outcomes than performance goals (Abraham et al., 2012; Linnenbrink-Garcia & Patall, 2016; Pintrich, 2000).However, more recent developments in the conceptualisation of

performance goals suggest that they may not necessarily be less adaptive than learning goals and may have divergent effects on performance depending on the goal-outcome linkages that are made by the individual (Linnenbrink-Garcia & Patall, 2016; Wormington & Linnenbrink-Garcia, 2017). Performance goals thus include approach and avoidance goals. Performance approach goals are underpinned by positive expectations of achievement and may serve to develop academic motivation and appraisal of academic capability (Harackiewicz et al., 2002). On the other hand, performance avoidance goals are formulated to avoid anticipated disappointment or negative appraisal and may lead to diminished motivation and accomplishment (Elliot & Church, 1997). Despite the varying goal theories that have been proposed, it can be postulated that academic attainment is influenced not only by the type of goal that is pursued, but also the source and degree of motivation that is mustered toward goal attainment.

Intrinsic and extrinsic motivation: Intrinsic and extrinsic theories of motivation provide much insight into the reasons that individuals have for undertaking particular tasks, for example one may engage in an activity for its own sake (intrinsic motivation) or as a means to an end (extrinsic motivation) (Schunk et al., 2014). These theories therefore explain how personal factors influence engagement in achievement tasks. In contrast, self-determination theory (SDT) describes the conditions that produce and sustain, versus reduce and lessen, an individual's innate propensity towards self-regulation or intrinsic motivation (Eccles & Wigfield, 2002; Ryan & Deci, 2000).

The theory posits that motivation is driven by three innate psychological needs (i.e. the need for autonomy, competence, and relatedness), the satisfaction of which leads to enhanced self-motivation and psychological wellbeing (Ryan & Deci, 2000). The pursuit of tasks for their own sake or that are inherently satisfying to the individual (intrinsically motivating) influence feelings of autonomy and competence and result in optimal self-regulation. On the other hand, tasks that are pursued with the intention of accessing a desired end state or avoidance of an aversive consequence, are extrinsically motivated. In a learning context, intrinsic motivation is believed to be more conducive to learning than extrinsic motivation. Where the former supports optimal learning the latter may stifle motivation and performance (Abraham et al., 2012).

SDT contends that intrinsic motivation is realised and sustained through stimulating and challenging engagement with an activity in which the student is able to develop competence in an autonomous manner (Ryan & Deci, 2000). Similarly, extrinsically motivated behaviour

stems from a need for competence or self-determination. A behaviour or a goal may, therefore, be extrinsically motivated but still able to serve an individual's needs. As such, the principles of SDT have been widely used in the development of classroom interventions and activities and have been found to promote engagement amongst students (Stansbury & Earnest, 2017; Zepke, Leach, & Butler, 2013).

2.3.1.2.3 Self-regulated learning strategies

Self-regulated learning includes the thoughts, feelings, and actions that a student may employ in order to achieve academic goals (Zimmerman & Schunk, 1989). Pintrich (2004) proposed that achievement and learning is the function of the interplay between a number of dispositional and environmental factors, which are mediated by "the individuals' self-regulation of their cognition, motivation, and behaviour" (p. 388). The three most prominent self-regulated learning strategies or approaches that have been identified include the deep, surface and strategic approaches (Cassidy & Eachus, 2000; Entwistle, 1991; Entwistle & Waterston, 1988). The deep approach refers to learning directed at personal development or purely for the sake of learning and is, therefore, linked to intrinsic motivation. A surface approach is associated with extrinsic motivation due to the emphasis placed on the outcome of learning (e.g. obtaining a qualification). Lastly, a strategic approach aims to maximise the output with the least effort.

The most expansive explanation of learning strategies is Pintrich's (2004) model of self-regulated learning. Pintrich (2004) proposes four phases of self- regulated learning namely planning (goal setting), monitoring (metacognition), control (regulation), and reaction (reflection) directed at the self, the task and/or the environment. The model provides a framework through which learning could be conceptualised and argues that phases are dynamic and not necessarily hierarchical as changes in one phase may influence the other and are applicable to the various domains that are regulated during learning: that is, cognition, motivation, behaviour and context domains.

The consequent learning strategies are operationalised in the Motivated Learning Strategies Questionnaire (MLSQ), namely:

- rehearsal (learning through repetition);
- organisation (e.g., note taking and organising points meaningfully);
- elaboration (e.g., summarising material using one's own words);
- critical thinking (e.g., questioning the validity of key texts and materials);

- meta cognition (e.g. self-regulatory techniques including planning, self-monitoring and flexibility);
- effort regulation (e.g. self-management of motivation or persistence when challenged by difficult work);
- concentration (e.g. ability to direct and maintain attention during academic study);
- help seeking, peer learning; and
- time/study management.

Abraham et al. (2012) tested these self-regulatory learning strategies as correlates of academic performance and found small but significant, positive correlations with meta-cognition, critical thinking, elaboration and concentration.

2.3.1.2.4 Emotional intelligence

The development of the emotional intelligence construct encapsulated the relationship between cognition and affect. Salovey, Brackett, and Mayer (2004) defined emotional intelligence as "the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" (p. 189). Other definitions view emotional intelligence as an adaptive capacity or ability to manage ones emotions in order to effectively interact with others and deal with environmental demands (Bar-On, 2004; Newsome, Day, & Catano, 2000; Parker, Taylor, & Bagby, 2001). Palmer and Stough (2001) describe the construct as "the capacity to effectively perceive, express, understand, and manage emotions in a professional and effective manner at work" (p. 1). Görgens-Ekermans, Delport, and Du Preez (2015) contend that this definition could also be applied to the academic context when studying is conceptualised as a student's 'work'. The authors conducted a study on first year university students at a South African university and based on their findings argued that emotional intelligence facilitates student success through the regulation of positive and negative emotions that influence the attainment and maintenance of necessary psychological resources, such as self-efficacy and stress-coping skills. Furthermore, in Abraham et al.'s (2012) meta-analysis of psychological correlates of academic performance, they reasoned that the maintenance of positive emotional states and effective interpretation of emotions have the potential to facilitate learning and academic performance.

Research on the relationship between emotional intelligence and academic achievement has yielded mixed results. Newsome et al. (2000) investigated the incremental validity of emotional

intelligence in predicting academic performance using the *Emotional Quotient Inventory* (EQ-I) and found no significant relationship between the EQ-I and academic achievement. In contrast, Parker, Summerfeldt, Hogan, and Majeski (2004) reported that total scores on the EQ-I were poor predictors of academic achievement but specific subscales of the measure namely intrapersonal (e.g. recognising and understanding one's feelings), stress management (e.g. resisting or delaying an impulse), and adaptability (e.g. adjusting emotions and behaviours to changing situations and conditions) explained between 8 and 10% of variance as predictors of academic success.

Emotional intelligence emanates from the positive psychology school of thought along with a number of other constructs that may be better suited to explaining academic success. Some examples are:

- Grit ("perseverance and passion for long term goals") (Duckworth, Peterson, Matthews, & Kelly, 2007, p. 166);
- character strengths (a classification of various traits linked to the realisation and accomplishment of anticipated goals and positive outcomes) (Lounsbury, Fisher, Levy, & Welsh, 2009); and
- psychological capital (an individual's positive psychological state of development characterised by self-efficacy, optimism, hope and resilience) (Luthans & Youssef, 2007), to name a few.

In conclusion, the cognitive and psychological factors examined in this review are important factors to consider in the examination of student success. Nevertheless, these factors provide but a few pieces of the student success puzzle. It is well established that the environment also has an important role to play in human development. As human beings, students are shaped by their environments and experiences which influence the extent to which their cognitive and psychological characteristics develop even before they enter tertiary education. In order to create a holistic picture of student success, the environment and the complex influences and interactions that inform a student's experience must be examined. For this reason, the psycho social factors that influence student success will be discussed next.

2.3.1.3 Psycho-social factors

A plethora of psychological and environmental factors is proposed to influence and explain student success. The two most prominent psycho-social models that could affect student achievement and retention in the student retention literature will be discussed. Psycho-social factors refer to the intersection of the psychological and the social environment. Two models that are often cited are: Bean and Eaton's (2002) Model of Psychological Processes and Tinto's (1993) Interactionist Model of Student Departure. Both models emphasise the role that background factors play in effective social and academic integration into a new institution and the influence that these psycho-social factors have on student persistence (Robbins et al., 2004).

Bean and Eaton's (2002) Model of Psychological Processes contributes to the psychological understanding of student retention. They explain the psychological factors that influence student retention by drawing on theoretical perspectives from attitude-behaviour theory, coping behavioural (approach-avoidance) theory, self-efficacy theory, and attribution (locus of control) theory (see Figure 2.1). Their model was based on Bean's (1980) original Causal Model of Student Attrition that emphasised the role of individual psychological processes and background factors that determine the interaction with the environment and thus student retention. Bean (1980) hypothesised that academic and social integration is the result of attitudes and behaviours that influence the level of satisfaction the student has with the institution and thus the degree of commitment towards the institution. He further stated that a student's background characteristics should be considered when examining their interaction with the institutional environment. These included previous performance, socio-economic status, place of residence, distance from home and size of the community of origin. Other characteristics included those of the organisation (e.g. institutional quality, relationships with faculty, integration, communication of rules and requirements etc.) and intervening variables (e.g. satisfaction and institutional commitment) that ultimately determined the likelihood of completing the degree or dropping out (Bean, 1980). Bean and Metzner (1985) also applied this model to non-traditional students (i.e. older, part-time, and commuter student) and proposed that this group were more susceptible to the effects of the external environment (e.g. finances, family responsibilities etc.), whereas traditional student attrition was more a result of social integration variables.

More recently, Johnson, Wasserman, Yildirim, and Yonai (2014) applied a modified form of the model to examine persistence decisions amongst students over a two-year period. Notably,

for students of colour their persistence decisions were influenced directly and indirectly by a combination of academic, social and financial entry characteristics as well as stress created by the academic environment. The factors that influenced white students included feelings of preparedness for the demands of the social and institutional environment, opportunities for diverse peer interactions and social difficulty stress. These studies serve to highlight the unique experiences of different demographics groups, particularly how the environment and psychological factors interact to influence experiences and persistence decisions.

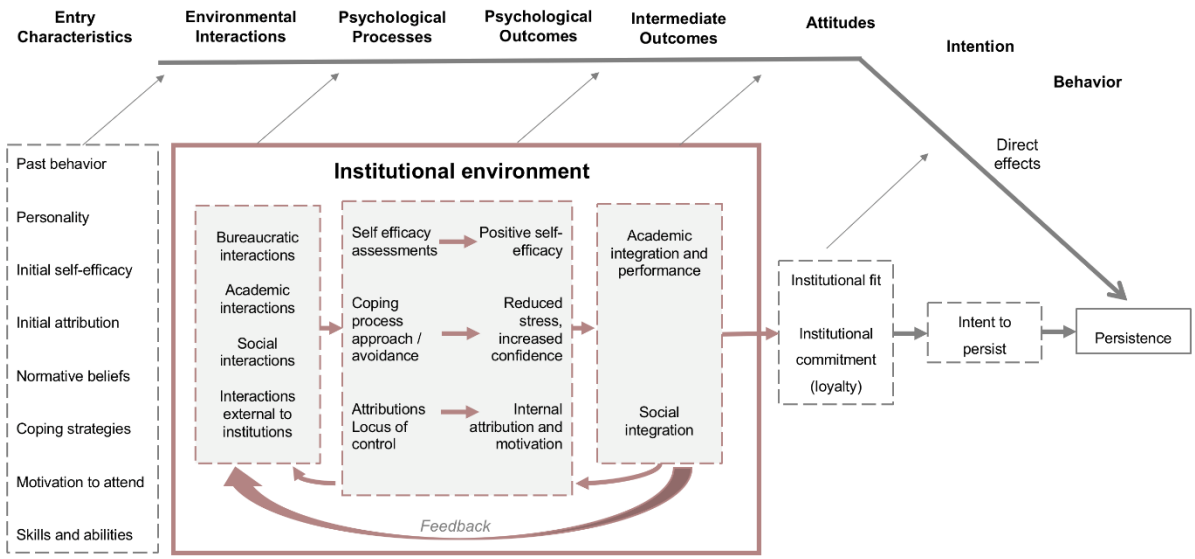

Figure 2.1. A psychological model of college student retention. Adapted from "The Psychology Underlying Successful Retention Practices" by J. Bean & S.B. Eaton, 2002, *Journal of College Student Retention, 3(1)*, p. 76. Copyright 2001 SAGE Publications. Adapted with permission.

Tinto's (1993) interactionist theory of student departure is one of the most cited works within the student retention/persistence literature. His theory emphasises the process of student adjustment and the adaption that takes place in order to integrate into the institutional system, specifically the academic and social integration. A student's integration is characterised by their ability to effectively work through the stages of integration that Tinto (1993) termed separation, transition and incorporation (Milem & Berger, 1997). Separation involves a process of disassociation from the norms of familial or social groups with which the student may have been associated. This stage is followed by a period of transition where students have separated themselves from their past communities and are interacting with the new group, but have not yet assimilated the norms and behaviours of the new community. Incorporation takes place when the student accepts and incorporates the normative values and behaviour patterns of the

new community. The successful navigation of these stages leads to integration. However, this navigation of stages does not guarantee that the student will persist (Kuh et al., 2007; Milem & Berger, 1997; Tinto, 1993). Effective integration is presumed to involve the dynamic interplay between both academic and social integration (Kuh et al., 2007).

Tinto (1975) first described academic integration as *course-content mastery* that is characterised by the compliance with academic requirements and *intellectual development*, which refers to adherence to the normative values, entrenched in the institution's academic system. Social integration represents the student's *affiliations* with their peers and the extent to which they interact with faculty members, as well as the *congruency of values* between the student and their new community. A student's degree of social integration is, therefore, influenced by their self-esteem and the quality of relationships they establish with their peers and lecturers. A student's inability to integrate successfully may manifest as academic difficulties, poor fit with the academic and social culture of the institution and a lower level of commitment to the institution – all considered as key predictors of attrition. The model thus combines "pre-entry characteristics of students, institutional characteristics, and the academic and social integration of students" (Fong et al., 2017, p. 396). Tinto's theory has since evolved and developed to include the influence of factors such as adjustment, difficulty, incongruence, isolation, finances, learning and external obligations or commitments of the students in the university (Tinto, 1993, p. 45; Tinto, 2015).

In sum, Bean and Eaton (2002) and Tinto's (1993) models share several commonalities. Robbins et al. (2004) summarised and categorised these similarities under the broad psycho-social themes: contextual influences (environmental characteristics of the institutional environment such as financial support, size of institution, institutional selectivity), social influences (represented by perceived social support), social engagement (social involvement, integration and belonging) and academic engagement (commitment to degree and commitment to institution).

Even though Tinto's (1993) theory is only modestly supported by empirical evidence (Fong et al., 2017; Kuh et al., 2007) it has potentially significant relevance to the experience of the South African student. A large number of university students come from poor communities, under-resourced schools or vastly different backgrounds than their peers. These students may find the process of academic and social integration into a new community that is unfamiliar and incongruent with their established value systems and behaviour patterns, exceptionally difficult.

Their inability or struggle to successfully integrate and fit in could account for the high levels of attrition (refer to the previous discussion in section 2.3).

Various theorists and researchers have supported and added to the psychosocial factors proposed by Bean, Eaton and Tinto (e.g. Harris & Wood, 2016; Harris, Wood, & Newman, 2015), that emanate directly from the institutional environment. South African studies have highlighted the financial burden, difficulty of the degree/course, differing needs of diverse student groups and the classroom experience as factors that influence students' academic progression (Jama, Mapesela, & Beylefeld, 2008; Van Breda, 2017). The effect of these factors are directly or indirectly compounded by pre-entry attributes such as family background, academic ability, race, gender and prior schooling (Fong et al., 2017; Harris & Wood, 2016; Milem & Berger, 1997). Common variables across local and international studies include factors such as age, socioeconomic status, language, employment responsibilities, social support, stress, psychological health, career orientation and student workload, which can also be added to this list (Abraham et al., 2012; Harris et al., 2015; Jama et al., 2008, Van Breda, 2017). This plethora of psychosocial factors influence each member of the student population to varying degrees. When combined with the socio-political and institutional environment, which has its own challenges and systemic contextual problems (Kilfoil, 2015), the business of fostering student success becomes a complex endeavour and warrants context specific investigations to understand the nomonological variables at play in each unique environment. To this end, Kuh et al. (2007) proposed a framework explicating the combined influence of the most pertinent psycho-social variables into a guiding framework for student success. In the absence of local frameworks that explain student success in the South African context this framework was chosen to guide the present study as its cross cultural applicability is well established (Strydom & Mentz, 2010; Strydom et al., 2010). In the subsequent section, Kuh et al.'s (2007) framework and the central role that student engagement plays in student success will be discussed.

2.3.2 Student success and student engagement

Over the last two decades the student success literature has been dominated by the work of George Kuh and his colleagues. In turn, the proliferation of their work on student success is widely recognised to contribute to the understanding and conceptualisation of student engagement.

Figure 2.2, summarises the various factors that influence student success including, individual, institutional, non-institutional and broader contextual factors (Kuh et al., 2007, p. 11). The authors depict the path of educational attainment or success as a wide path with various avenues and that a student may encounter. The student's path is initially influenced by experiences they encounter before they enter higher education, such as their background and the support they receive from their family, their academic preparedness, enrolment choices, and financial aid. In the South African context, these factors have a significant impact on the number of students that qualify and eventually gain access to the institution (Donohue & Bornman, 2014; Leibowitz & Bozalek, 2014; Van Zyl, 2016; Wawrzynski, Heck, & Remley, 2012). Kuh et al. (2007) also include mediating factors that may also influence a student's transition into the institution. For example, remediation courses in which the student acquires academic skills, campus and financial aid policies. In South Africa, especially, many students rely on funding from state-regulated financial aid such as the National student Financial Aid Scheme (NSFAS) or bank loans. These hurdles may temporarily, or permanently, hinder many students from entering higher education institutions (Kuh et al., 2007; Van Zyl, 2016, 2017). Institutions are also influenced by external factors such as the economy, government regulations and policies and demographic considerations.

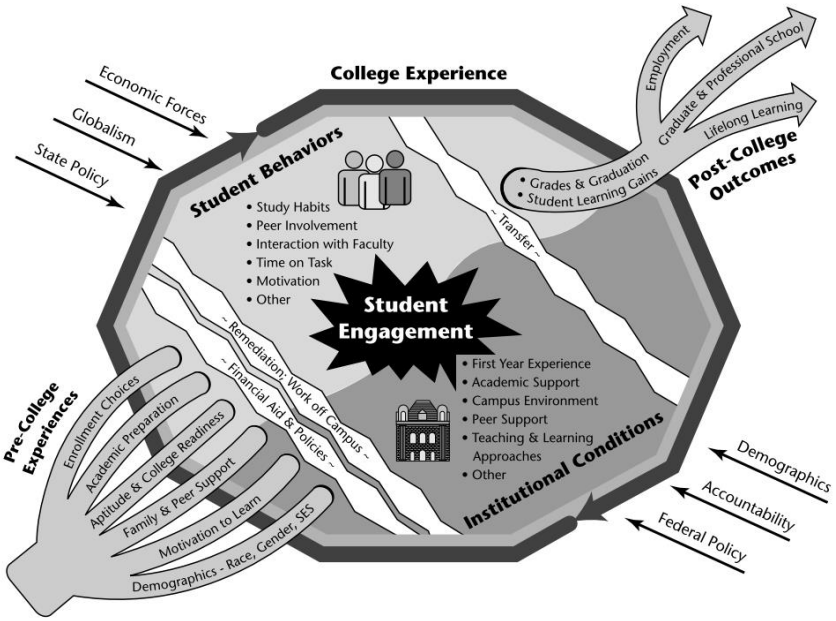

Figure 2.2. Guiding framework for the role of student engagement in student success. Reprinted from *Conducting Educational Design Research* (p. 11) by G. Kuh, K. Kinzie, J. Buckley, B.K. Bridges & J.C. Hayek 2007. San Francisco, CA: Jossey-Bass. Copyright 2007 John Wiley and Sons Limited. Reprinted with permission.

Once a student has successfully gained access to the institution the actual "college experience" begins. The two dimensions of this experience are influenced by the student's behaviours (e.g. motivation, peer and faculty interaction, study habits, time on task etc.) and the institutional conditions (teaching and learning methods, educational policies, academic and peer support etc.) (Kuh et al., 2007). Within this conceptualisation, student engagement is viewed as a representation of student behaviours and institutional factors that the university has some degree of influence over. This may manifest as meaningful student-faculty interactions and active and collaborative learning within an institutional environment that is perceived as supportive and inclusive (Kuh et al., 2007). These practices ultimately result in "student satisfaction, persistence, educational attainment, and learning and development" (p. 12) as supported by Astin (1984), Chickering and Gameson (1987), Pascarella and Terenzini (2005) and others.

This framework succinctly outlines the central role of student engagement in the attainment of student success from a systemic institutional perspective and provides a glimpse into the conceptualisation of this construct. Nevertheless, this is only one view of the student engagement construct. The following section will serve to elaborate on the phenomenon of student engagement and highlight the various dimensions and schools of thought related to this construct.

2.4 STUDENT ENGAGEMENT

The development of the student engagement construct has taken place over a period of approximately seventy years (Astin, 1996; Kuh, 2009; Pascarella & Terenzini, 2005). The term is underpinned by literature centred on the student experience and research-led teaching and has culminated in a large body of work focused on the enhancement of teaching and learning in higher education (Buckley, Bridges, & Hayek, 2006; Harper & Quaye, 2011; Kuh & Schneider, 2008; Trowler, 2010). The earliest conceptualisation of the term emerged from the investigations of the positive outcomes derived from time on task learning (Merwin, 1969 cited in Kuh et al. 2007) and later *quality of effort* (Pace, 1984). These studies demonstrated the value students derived from increased participation in tasks and activities that were deemed educationally purposeful (Kuh, 2009). Astin's (1984) theory of *student involvement* extended this notion and presented five postulates of the involvement concept. Involvement thus refers to (a) the investment of physical and psychological energy in different "objects" that range from very general to very specific; (b) occurs along a continuum, different students will vary in the

amount of energy they invest in various objects at various times; (c) it includes quantitative and qualitative components; (d) the quality and extent of involvement determines the amount of student learning and personal development that takes place; and (e) the evaluation of the effectiveness of educational practices is determined by their ability to increase involvement (Astin, 1984).

The expansive work of Pascarella and Terenzini (2005) and Tinto (1993) has amalgamated and developed the concepts of student involvement, time on task and quality of effort, as well as establishing their connection to a number of desired institutional outcomes, particularly student engagement (Kuh, 2009).

Engagement is believed to be a key factor in addressing issues of poor academic performance, boredom, alienation and dropout as well as serving as an indicator of institutional excellence and student success (Axelson & Flick, 2011; Fredricks, Blumenfeld, & Paris, 2004). Student engagement is also positioned as an outcome of factors such as student motivation, teaching and teachers, teacher-student interactions and interactions between learners. In addition, it is also influenced by institutional policies and non-institutional factors such as family, friends, health and employment (Kuh et al., 2007; Zepke & Leach, 2010; Zepke, Leach, & Butler, 2013).

These views overlap significantly with the theoretical perspectives in the student success literature, which were discussed earlier. Despite the recognition of the role and importance of student engagement, there are diverse definitions of the term.

2.4.1 Defining student engagement

Student engagement originates from the term “engagement” which is used in a number of contexts, from school and higher education literature to business and psychology literature, with each ascribing unique meaning to the term. A consequence of the lack of consensus across fields, and even amongst researchers in this arena, is that various definitions and conceptualisations exist for student engagement (Garrett, 2011).

Within the education literature, the concept of engagement subsumes an individual’s level of behavioural and emotional intensity when actively involved in a task (Reeve, Jang, Carrell, Jeon, & Barch, 2004). Moreover, it incorporates various elements of motivation such as intrinsic motivation, self-determination, goal orientation and mastery (Reeve et al., 2004). In a

review of the literature to establish a working definition of the term student engagement, Garrett (2011) noted that phrases such as *active involvement*, *active participation*, *fully immersed in the topic*, *thinking critically and creatively* and *sharing ideas and enthusiasm* were often emphasised. These conceptions of the term are echoed, to some degree, in other definitions. For example, Fletcher (2014) defined student engagement as "students' willingness, need, desire and compulsion to participate in and be successful in the learning process" (p. 1). Student engagement is also described as the level of involvement or interest students have in their own learning, as well the connection they feel towards their peers, their classes and the institution (Axelson & Flick, 2011). It is further seen as the inclinations students may have to partake in routine activities that constitute their academic tuition, for example class attendance, homework or assignment completion, test preparation (Chapman, 2003) or simply "students devoting their time to educationally purposeful activities" (Strydom et al., 2010, p. 261). Moreover, Harper and Quaye, (2011) argue that it is possible for students to be involved or participate but not be engaged. Engagement therefore requires investment of time and effort in addition to being involved. It is clear that the varied attempts to define student engagement stem from differentiated foci. Therefore, in order to develop a holistic understanding of the construct requires examination of the various perspectives or approaches that the various definitions reflect (Kahu, 2013).

In Kahu's (2013) review of the engagement literature, she identified four perspectives (i.e. behavioural-, psychological-, socio-cultural- and holistic perspectives) that inform the understanding of engagement. She reported that the most widely recognised conceptualisation of student engagement forefronts the role of student behaviour and teaching practices in student engagement (Kahu, 2013). From the *behavioural perspective* student engagement is defined in terms of the "time and effort students devote to educationally purposeful activities" which may convey a rather simplistic application of the construct (Kuh et al., 2007, p. 10). When examining the construct from a *psychological perspective* engagement is viewed as "an internal psycho-social process that evolves over time and varies in intensity" which emphasises the complex process behind its behavioural manifestation (Kahu, 2013, p. 761). From this perspective, student engagement is viewed as a complex phenomenon that is multi-dimensional in nature. Some authors conceptualise this dimensionality as a combination of behavioural, emotional and cognitive engagement (Fredricks et al., 2004; Fredricks & McColskey, 2012). The *socio-cultural perspective* on student engagement highlights the social context of the student experience (Kahu, 2013) and addresses some of the cultural hurdles students face as a result of

the inherent social and cultural biases that emanate from historically dominant groups and their traditions (i.e. institutional habitus) (Thomas, 2002). Moreover pertinent arguments for the role that social and political contexts play as well as why students become engaged or alienated are put forth (Kahu, 2013). Lastly, the *holistic perspective* seeks to combine elements of the behavioural, psychological and socio-cultural approaches and have included the environmental dimensions that may also play a role in student engagement. Kahu (2013) proposes a conceptual framework based on Fredricks et al. (2004) conceptualisation of student engagement, but also includes the role of the student, the organisation and the entrenched sociocultural context that may contribute to student engagement (See Figure 2.2). This view therefore denotes the "lived reality of the individual" (as a holistic perspective) when examining student engagement rather than only the internal state or displayed behaviours (Kahu, 2013, p. 766).

Student engagement is also defined from an antithetic standpoint by contrasting engagement in terms of what it is not. Disengagement is indicated by negative behaviours, displayed by the student, that manifest as a lack of interest, involvement, or commitment to educationally purposefully activities (Garrett, 2011; Hu & Kuh, 2003). McInnis (2001) argued that disengagement denotes a deficiency in student's value systems or attitudes, which not only diminishes their experience, but also leads to deficient interventions in response to this problem. Engagement has also been contrasted with alienation or "inertia, apathy, disillusionment or engagement in other pursuits" (Krause, 2005, p. 4) which denotes a lack of activity (passiveness) rather than conscious (active) withdrawal from or rejection of opportunities to learn. Despite this student-driven interpretation of the term, McInnis (2001) argued that the role of the university as well as social and political factors should also be acknowledged. Notwithstanding the popularity of student engagement, the antithesis thereof, disengagement or alienation, is still relatively under researched. This is echoed by Hu and Kuh (2003) who assert that "a lacuna exists in our understanding of what is associated with disengagement" (p. 556).

The preceding discussion highlights the complexity of the student engagement construct and the various conceptualisations thereof. An amalgamated definition of student engagement is concisely encapsulated in Trowler's (2010) review and best serves to highlight the overarching tenets of student engagement:

> "Student engagement is concerned with the interaction between the time, effort and other relevant resources invested by both students and their institutions intended to

> optimise the student experience and enhance the learning outcomes and development of students and the performance, and reputation of the institution" (p. 3).

The various conceptualisations and definitions of student engagement give credence to the multi-dimensional nature of the construct. The current study, in support of the view that student engagement is a multi-dimensional construct, aligned with the psychological perspective proposed by Kahu (2013) which states that student engagement is an "internal psycho-social process that evolves over time and varies in intensity" (p. 761). The discussion will now turn to a description of the dimensionality of student engagement.

2.4.2 Dimensions of student engagement

The psychological perspective on student engagement endorses a multidimensional conception of the construct. Engagement is therefore conceptualised as a combination of behavioural, emotional and cognitive engagement (Fredricks et al., 2004; Fredricks & McColskey, 2012). Trowler (2010) contends that each dimension is bipolar, reflecting either a positive or negative level of the specific type of engagement. Moreover, positive or negative engagement is a reflection of the extent to which behaviours in each dimension are productive (i.e. expectations have been internalised and approved) or counterproductive (i.e. behaviour that challenges, confronts or rejects) (Trowler, 2010). This implies that students can, therefore, engage positively or negatively within each of the behavioural, emotional or cognitive dimensions. This section will provide an overview of the conceptualisation of the three prominent dimensions of student engagement, namely behavioural, emotional and cognitive engagement.

2.4.2.1 Behavioural engagement

Behavioural engagement refers to the actual participation or involvement in a task or activity (Fredricks et al., 2004). These activities may be academic, social or extracurricular and are a necessary requirement to the attainment of positive academic outcomes. Appleton, Christenson, Kim, and Reschly (2006) made a distinction between academic and behavioural engagement. Academic engagement is characterised by the time spent on a task, the credits earned toward graduation, and homework completion whereas behavioural engagement encompasses factors such as attendance, voluntary classroom participation, and extra-curricular participation.

Reading (2008) proposed that positive conduct (e.g. attendance, not engaging in disruptive behaviour), immersion in learning activities (e.g. determination, perseverance) and partaking

in institution-related activities (e.g. sport, leadership roles) reflected behavioural engagement. For example, in a South African study, Gerber, Mans-Kemp, and Schlechter (2013) measured behavioural and academic engagement amongst third year business management students using class attendance and results from the completion of a homework assignment. The study found that the semester marks and the final examination mark were significantly moderated by the two forms of engagement.

Horstmanshof and Zimitat (2007) referred to behavioural engagement as a measure of academic conscientiousness which encompassed the time, consistency and approach adopted when studying. Their study was conducted on a sample of first-year undergraduate students an Australian university and argued that engagement is demonstrated through the implementation of a deep approach to learning, which denotes a focus on mastery, and an in-depth understanding of learning content rather than a superficial processing or memorisation of new work. In the present study, behavioural engagement is conceptualised as an amalgamation of the examples expressed above. Thus, behavioural engagement is regarded as task/activity completion, class attendance, and online engagement with the learning management system.

2.4.2.2 Emotional engagement

Emotional engagement emphasises the presence and role of emotion in the learning experience (Kahu, 2013). It includes the affective reactions (i.e. positive and negative feelings) the student has toward with his/her peers, lecturers or the institution. Affective reactions are also associated with immediate emotions (e.g. interest, happiness and enjoyment) or emotional reactions towards particular individuals or entities (e.g. respecting the lecturer, feeling a sense of belonging) (Fredricks et al., 2004; Reading, 2008). Emotional engagement is often expressed as the identification the student has with the institution and is composed of a sense of attachment or belonging and value or appreciation of the institution (Finn, 1989). However, in the taxonomy of engagement by Appleton et al. (2006) the authors categorised feelings of belonging, and relationships with teachers and peers as ‘psychological engagement’ rather than emotional engagement.

Emotional engagement is also synonymous with a number of constructs used in motivational research, particularly intrinsic motivation, which is underpinned by a desire to learn based on the pleasurable association and interest in the learning (Fredricks et al., 2004; Kahu, 2013; Reading, 2008). In Kahu’s (2013) review of the engagement literature she also refers to the

concept of conation that some authors propose as an additional dimension of engagement. Conation is defined as the drive to succeed and is composed of six qualities: belief, courage, energy, commitment, conviction and change (Riggs & Gholar, 2009, cited in Kahu, 2013). Despite this proposition, the three-dimensional model of engagement and the model's account of the psychological perspective of engagement including a combination of behavioural, emotional and cognitive engagement is generally accepted (Fredricks et al., 2004; Fredricks & McColskey, 2012; Kahu, 2013).

2.4.2.3 Cognitive engagement

Cognitive engagement is characterised by the extent to which the student is invested in his/her learning. It also refers to the psychological thought processes and effort required to comprehend or master challenging ideas or skills (Fredricks et al., 2004). It involves not only an inner psychological investment but also a degree of self-regulation or meta-cognitive evaluation of learning (Reading, 2008). Rotgans and Schmidt (2011, p. 465) defined cognitive engagement as "a psychological state in which students put in a lot of effort to truly understand a topic and in which students persist studying over a long period of time" (p. 465). This definition highlights the role of willingness, effort and persistence in the learning process. Reading's (2008) description of cognitive engagement emphasises the expression of the internal desire to overcome challenges, learn and master knowledge or skills. Appleton et al. (2006) also included cognitive engagement in their taxonomy and described it as an internal indicator of self-regulation, applicability of learning content to future undertakings, value of learning, and personal goals and autonomy. This is also akin to Horstmanshof and Zimitat's (2007) description of academic orientation, which expresses the psychological value students place on academic endeavour and learning.

Cognitive engagement is further linked to the use of deep learning strategies but also integrates aspects of motivation, self-efficacy and expectations (Fredricks et al., 2004; Jimerson, Campos, & Greif, 2003; Kahu, 2013). As highlighted in the previous discussion of motivation, self-efficacy and expectations, these factors have a significant bearing on a student's performance and depth of learning and understanding. Moreover, these constructs are generally context-specific and task-dependant. Correspondingly, Rotgans and Schmidt (2011) argued that cognitive engagement is also influenced by the task at hand, but is dependent on the inherent degree of autonomy the task or activity affords the student. Based on this assumption, an activity such as attending a lecture would be less cognitively engaging than completing an

assignment that requires group interaction or information gathering. In studies conducted with high school learners and university students cognitive engagement has also been found to be positively related to personal goal orientation, investment in learning and academic performance (Greene & Miller, 1996; Greene, Miller, Crowson, Duke, & Akey, 2004).

2.4.3 Typologies of engagement

Various typologies have been proposed in order to categorise differences in institutional efforts (Pike & Kuh, 2005), student-faculty interaction (Cox & Orehovec, 2007) and task characteristics (Mitchell & Carbone, 2011) to account for the varying degrees of student engagement in different tertiary education contexts.

As the current study focused primarily on interventions created for a learning management system (LMS), Coates's (2007) *typological model of student engagement styles* is most relevant. This typology acknowledges both the online environment (i.e. the learning management system (LMS) and the university context (i.e. general engagement). Coates (2007) conducted cluster analysis on 1051 responses to the Student Engagement Questionnaire. The sample only included full-time, campus-based, early-year undergraduate students at Australian universities that had used an online LMS. He identified four styles or states of student engagement that categorised engagement as intense, collaborative, independent or passive. The model provides an experiential account of engagement but also acknowledges the transient nature of the proposed styles (Figure 2.3). Coates (2007), therefore, asserted that the styles of engagement do not represent enduring traits and are therefore likely to change in various contexts.

The model is based on the proposition that engagement has an academic and a social dimension. An *intense engagement style* is characterised by a high rate of academic and social involvement in which the student engages with, for example the LMS regularly and uses it to "enhance and contextualise their study, to communicate and collaborate with other students, to manage and conduct their learning and to contact staff" (Coates, 2007, p. 132-133). They see value in the use of the LMS and how it can be used to enhance their learning. They also view themselves as active, imaginative and motivated learners that learn through collaboration and participation in various classroom and campus activities. The *independent engagement style* typifies a student that is academically but less socially inclined. The LMS is viewed as an integral part of their education that facilitates their development through knowledge construction activities and the

provision of support but not as a tool for collaboration or interaction with other students or staff. Students that embody this style are likely to pursue challenging learning experiences, value feedback that is formative and applicable to their learning and reflect on their learning.

In contrast, the *collaborative* and *passive engagement styles* are described as the inverse of the independent and intense styles. A student with a collaborative engagement style is drawn by the opportunity to connect and communicate with their peers thus emphasising a social rather than academic focus. Lastly, a passive style of engagement would be characteristic of infrequent interaction or use of enriching learning opportunities both online or in the general university context.

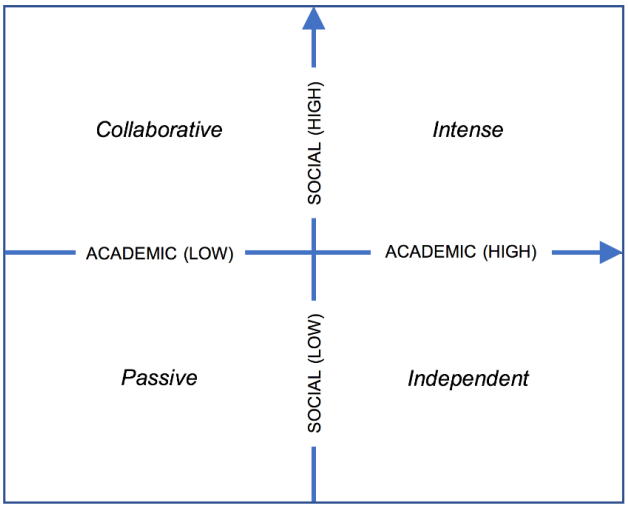

Figure 2.3. Typological model of student engagement styles. Adapted from "A model of online and general campus-based student engagement" by H. Coates, 2007, *Assessment & Evaluation in Higher Education, 32(2)*, p. 133. Copyright 2007 Taylor & Francis. Adapted with permission.

Although Coates' (2007) typology offers insight into the types and styles of engagement, it is also important to acknowledge the myriad of personal and contextual factors that may influence a student's propensity towards a particular style. To this end Payne (2017) proposed a force field model of student engagement that incorporated factors found to either encourage engagement (e.g. self-efficacy or positive teaching and learning experiences) or resist engagement (i.e. unappealing content or delivery) (Figure 2.4). The model was derived from questionnaires and profiles, as well as a thematic analysis of interviews and focus group transcripts, collected from a sample of students at a British university. The model recognises that the influence of some factors will vary from one student to another (indicated by dashed arrows), for example a resisting force such as group work may have a negative effect on a student's engagement but may not be detrimental to engagement. In combination the factors

determine an individual's engagement stance which is also influenced by the degree to which a student is intrinsically or extrinsically motivated and whether he/she is functionally or emotionally connected to the course. Payne (2017) thus proposes that engagement encompasses four components that determine an individual's personal orientation of engagement; namely:

- Intrinsic motivation related to the course or the subject itself.
- Extrinsic motivation, resultant from the rewards anticipated from course completion, generating a desire to succeed.
- Functional connectedness, which could in turn be considered to comprise separate elements, such as attendance, submission, catching-up online and using support opportunities.
- Emotional connectedness, including the personal effort expended to achieve mastery.

As this model or line of reasoning is still in development and has not been empirically tested yet, Payne (2017) hypothesises that the 'differently engaged' students would have low functional connectedness but stronger emotional connectedness. A poorly engaged student might still want to achieve the result of completing their degree, with high extrinsic motivation, even if other components of their engagement are low.

This model supports the multi-dimensional and multifaceted nature of student engagement and provides a framework of factors that influence engagement that can guide the support offered to individual students as well as group interventions.

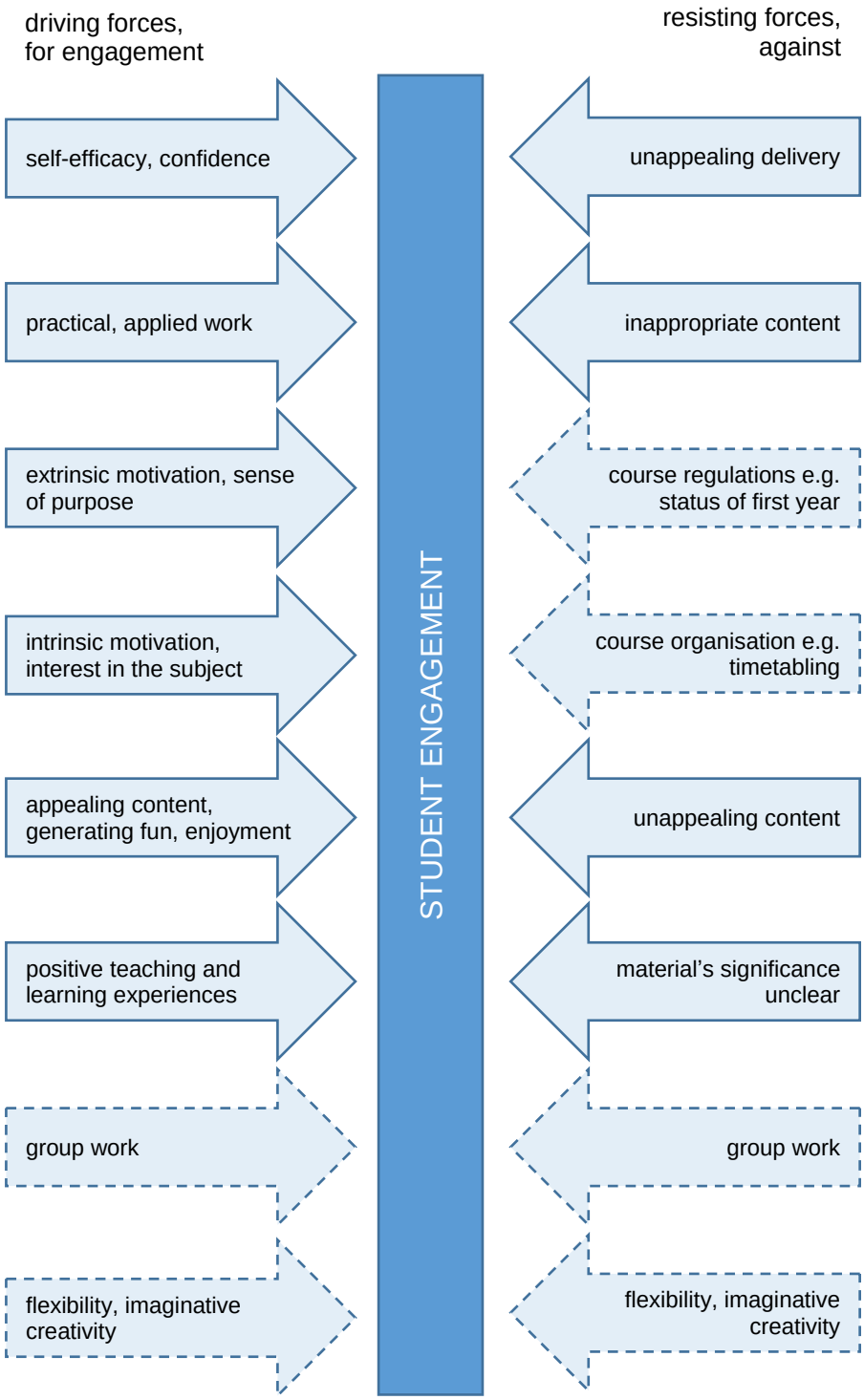

Figure 2.4. Force field model of student engagement. Adapted from "Student engagement: three models for its investigation" by L. Payne, 2017, *Journal of Further and Higher Education,* p. 8. Copyright 2017 by Taylor & Francis. Adapted with permission.

2.4.4 Student engagement and motivation

Student engagement is often used synonymously with motivation as both lead to enhanced learning outcomes. However, the two concepts are distinct and have certain differences that warrant mention (Fredricks & McColskey, 2012). Motivation involves the underlying motives of a particular behaviour and is understood as *the direction, intensity, quality, and persistence of one's energies*. Most conceptions of motivation are underpinned by individual differences and the associated psychological processes involved and try to provide answers to questions; "Can I do this task" and "Do I want to do this task and why?" (Eccles & Wigfield, 2002, p. 115). Newmann, Wehlage, and Lamborn (1992) argue that academic motivation denotes a general proclivity towards or disposition to do well in academic tasks. However, a student may have the desire to perform well but not act on this.

Conversely, engagement is generally associated with action, that is, it it is the "behavioural, emotional and cognitive manifestation of motivation" (Fredricks & McColskey, 2012, p. 765). In addition, engagement is also an outcome of an individual's interaction with the context (Fredricks et al., 2004). It is therefore malleable and receptive to environmental variations. The act of engaging in a task is therefore inseparable from the environment in which this takes place. Engagement thus draws attention to the environmental conditions that may or may not stimulate motivation or foster new motivation (Newmann et al., 1992)

It follows then that motivation is a necessary precondition for a student's engagement in learning (Linnenbrink-Garcia & Patall, 2016; Saeed & Zyngier, 2012). However, the self-system model of motivational development contends that motivation is necessary, but not sufficient for engagement (Connell & Wellborn, 1991; Deci & Ryan, 1985) and as such the model proposes that individuals have three basic motivational needs, namely autonomy (can choose how and when to complete a task), competence (activities are optimal to achieve desired outcomes), and relatedness (interacting with instructor and peers in a supportive environment). Students are, therefore, more likely to be engaged, if opportunities to fulfil these three basic needs are provided. Conversely, disengagement or disaffection is more likely if activities or the environment are perceived to be oppressive, callous and unfair (Skinner, Furrer, Marchand, & Kindermann, 2008). This implies that educational practices need to address the motivational needs of students in order to stimulate engagement. The following section will explore approaches employed in the facilitation of student engagement.

2.4.5 Facilitating student engagement

A number of authors have emphasised that the facilitation and improvement of student engagement is a shared responsibility (Kuh et al., 2007; Wawrzynski et al., 2012; Zepke et al., 2013). The onus thus lies on the institution and its educators to employ strategies that develop and promote educationally purposeful activities. However, the benefits of engagement are only attainable if students participate and actively engage in these activities (Kuh, 2003; Trowler, 2010).

The classroom setting has long been the environment in which learning activities are presented, but with the advancements in technology the capabilities of the available tools have enhanced the teaching and learning environments in which students operate and engage with their studies (Coates, 2006b). Modes of delivery now include face-to-face, a combination of online and face-to-face (blended learning) or fully online presentations. Software enabled online platforms known as learning management systems (LMS) have supported the expansion of traditional face-to-face courses to online or virtual learning environments (Cerezo, Sánchez-Santillán, Paule-Ruiz, & Núñez, 2016). The use of LMSs as an educational technology has proliferated and is now a ubiquitous feature of university courses. These systems generally support course administration and pedagogical functions to varying degrees. Some examples provided by Coates, James, and Baldwin (2005, p. 20) include the following:

- asynchronous and synchronous communication (announcement areas, e-mail, chat, list servers, instant messaging and discussion forums);
- content development and delivery (learning resources, development of learning object repositories and links to internet resources);
- formative and summative assessment (submission, multiple choice testing, collaborative work and feedback); and
- class and user management (registering, enrolling, displaying timetables, managing student activities and electronic office hours)

These platforms also enable the presentation of technologically enhanced classes that alter patterns of teaching and learning and thus introduce alternative forms of interaction with learning content (Beer, Clark, & Jones, 2010; Coates et al., 2005).

Coates (2006) proposed that student engagement is stimulated by the nuances and dynamics that shape the learning environment and thus emphasise the importance of the context. Therefore, the mode of delivery is an important consideration when examining student engagement as it delineates the setting in which a student engages with their learning (Beer et al., 2010). Moreover, it dictates the nature of interactions between the students, their instructor/lecturer and their peers. Coates et al. (2005) argued that if LMS's are influencing the structure of teaching, by implication, student study habits, learning and engagement are also affected.

Lim (2004) stated that a student's engagement in an online learning environment requires mindful, cognitive effort and attention that can potentially enhance learning and retention. However, the mere provision of learning activities does not guarantee that students will make use of these opportunities. Correspondingly, where educational technologies are employed, it is the uptake of the tool that ultimately defines its value (Coates et al., 2005). The challenge, therefore, is how to facilitate student engagement in online learning environments?

A logical starting point is an examination of established educational practices that facilitate engagement. In this regard, the National Survey of Student Engagement (NSSE) offers some ways to stimulate student engagement as the instrument is underpinned by Chickering and Gameson's (1987) *Seven principles of good practice in undergraduate education* and was developed as a measurement tool for quality assurance across higher education institutions (Kuh, 2001). The NSSE measures the "extent to which students actively engage in activities directly related to success in higher education and the conditions that institutions provide for such engagement" (National Survey of Student Engagement, 2008, cited in Strydom et al., 2010, p. 263). The NSSE is designed around a set of high-impact educational practices that could fruitfully be employed to facilitate student engagement (Harper & Quaye, 2011, p. 5):

- "Academic challenge − including higher-order learning, reflective and integrative learning, quantitative reasoning, and learning strategies
- Learning with peers − including collaborative learning and discussions with diverse others.
- Experiences with faculty − including student-faculty interaction and effective teaching practices.
- Campus environment − including quality of interactions and supportive environment.

- High-impact practices − special undergraduate opportunities such as service-learning, study abroad, research with faculty, and internships that have substantial positive effects on student learning and retention."

Similarly, Coates (2006; 2007) developed a measure of student engagement for campus-based students. The questionnaire assessed the manifestation of engagement and general learning practices in online environments informed by five facets of effective engagement practice (Coates, 2007, p. 122). These are aligned with the high impact educational practices included in the NSSE, namely:

- "active and collaborative learning;
- participation in challenging academic activities;
- formative communication with academic staff;
- involvement in enriching educational experiences; and
- feeling legitimated and supported by university learning communities."

With the emergence and growth of new media, information and communication technology Chickering and Ehrmann (1996) developed a list of practical implementation strategies specifically for online instructional environments that are still applicable today. These include; 1) encouraging contact between students and faculty to facilitate student motivation and involvement, 2) developing reciprocity and cooperation through collaborative group activities 3) making use of active learning techniques 4) providing prompt feedback 5) emphasising time on task 6) communicating high expectations and 7) respecting diverse talents and ways of learning by accommodating various learning styles. Many of the strategies that underpin effective online instruction thus embody these practices and are still useful today, implying that classroom and online learning might not be very different (Meyer, 2014). A number of these implementation strategies are discussed below.

Gaytan and McEwen (2007) conducted an investigation to identify practical strategies, valued by students and faculty alike, for preserving instructional quality in online environments. They proposed that the effective promotion of engagement in online environments requires careful consideration and selection of activities that promote active learning and accommodate the various learning style preferences. This also necessitates the use of a various online assessments , for example quizzes, portfolios, assignments, or review questions, supported by informative

and timely feedback. Meyer (2014) proposes that assignments should be active and create opportunities for students to engage in a variety of activities, such as thinking, debating, interviewing, creating, assessing, comparing etc.

In addition, the activities or assessments should also facilitate meaningful interaction between the students and their instructor but also with their peers (Dixson, 2010). Chickering and Ehrmann (1996) contend that frequent interaction between students and staff is imperative to student motivation and involvement. Correspondingly, Umbach and Wawrzynski (2005) report that campuses where more active and collaborative learning techniques and exercises were used had more engaged students who reported improvements in their individual social growth, overall learning, and practical competencies. Instructors should, therefore, leverage the available technology to create open communication channels that enable meaningful student-to-faculty and student-to-student interaction.

Collaborative and active learning are also achievable in an online setting. In online environments collaborative learning can include activities such as group discussions, group problem solving and group work (Dixson, 2010; Xu, Du, & Fan, 2015; Zheng, Niiya, & Warschauer, 2015). In addition, activities that require the sharing of ideas and debating alternatives develop thinking and deepen understanding (Chickering & Ehrmann, 1996). Active learning denotes involvement and active engagement with learning content rather that passive absorption and memorisation. In this regard, tools, resources and activities that encourage active learning (i.e. talking about, reflecting on, applying knowledge) should be harnessed and incorporated into the online environment (Chickering & Ehrmann, 1996; Lee & Hannafin, 2016; Meyer, 2014). Activities should also provide students with guidance on the effective use of time and application of energy for learning (Bart, 2012). In sum, Gaytan and McEwen (2007, p. 130) assert that

> "Instructors are challenged to develop vibrant learning communities in their online courses, to provide students with a variety of instructional and assessment strategies to meet their varied learning styles, and to make meaningful and timely feedback an important element of their courses."

One approach that may draw students to these vibrant environments is the use of gamification in the LMS. Gamification is purported to improve user engagement and motivate users (Broer & Breiter, 2015; Paisley, 2013). Gamification draws on the elements of a game that make it fun, thereby promoting playful learning by emphasising ways in which engagement and

challenge can be increased (Codish & Ravid, 2014; De Byl & Hooper, 2013). However, even though engagement is widely cited as a primary outcome of gamification very few studies have examined the influence of gamification on the dimensions of engagement, as discussed in section 2.4.2 (see Ding, Kim, & Orey, 2017). Moreover, South African studies reporting on the application of gamification in education environments are scarce (see Botha, Herselman, & Ford, 2014; O'Donovan, Gain, & Marais, 2013; Vermeulen, Gain, Marais, & O' Donovan, 2016) and even fewer have been conducted in psychology or industrial psychology modules (see Sillaots, 2014; Stansbury & Earnest, 2017). This supports the necessity of the present study and justifies the exploratory approach that was applied.

The subsequent chapter will elaborate on the concept of gamification and explore its use in the higher education context, with particular focus on how this methodology can be used to increase student engagement. Steps taken to inform this study are also discussed

2.5 SUMMARY: CHAPTER 2

In this chapter, the concept of student success and the associated variables that contribute to student success were investigated. From this discussion, student engagement emerged as a prominent contributor towards the support and attainment of student success. Notably student engagement is not only an outcome, but also a means through which students can achieve desired academic outcomes. In keeping with the psychological perspective on student engagement, the current study aligns itself with the three dimensions of student engagement, namely behavioural, emotional and cognitive engagement. Furthermore, the distinction between motivation and student engagement was established and various approaches to facilitate student engagement were provided, both in an online environment and a traditional face-to-face classroom setting. In the following chapter gamification is explicated and argued as an approach that can be harnessed to facilitate the enhancement of student engagement in a blended learning environment.

CHAPTER 3

EDUCATIONAL GAMIFICATION

The study and application of gamification have proliferated over the last decade. Gamification has been widely applied in areas such as marketing, sustainability, healthcare, business and education, to name a few (Barata, Gama, Jorge, & Gonçalves, 2013; Muntean, 2011; Pedreira, García, Brisaboa, & Piattini, 2014). The uptake of gamification in education is particularly significant with numerous educators turning to gamification to not only redesign pedagogy (Prensky, 2005, p. 62) but more importantly, enhance learner motivation and engagement (Šćepanović, Zaric, & Matijevic, 2015). In environments where students are perceived to be technologically savvy the assumption is that they expect to be engaged (Lister, 2015).

This chapter provides the theoretical foundation for the development of educational gamification design principles that facilitate student engagement. In order to contextualise the placement of the educational gamification literature, an overview of the potential of information and communication technology (ICT) use in higher education is presented. This is followed by a discussion of gamification in education (educational gamification). The discussion of educational gamification, the theoretical perspectives that inform it, as well as the game elements and mechanics discussed here stem from a systematic review of prior literature reviews conducted on the topic of gamification in education. The methodology followed for this systematic review is provided in Chapter 4. The review (of review articles) served to inform the development of design principles that guided the construction of a gamified intervention for student engagement. The chapter concludes with a brief outline of the process followed to develop and construct the gamified intervention.

3.1 INFORMATION AND COMMUNICATION TECHNOLOGIES IN HIGHER EDUCATION

The term ICT's refers to a range of technologies such as computers, tablets, software, learning management systems and others that serve as a platform for instruction delivery, but also have the potential to improve and enhance learner experiences when aligned with effective pedagogy (Barata et al., 2013). ICTs can therefore be used to alter the manner in which students can learn by supporting more competency-based curricula and learner-centred, rather than teacher-

centred, forms of instruction (Oliver, 2002). In addition, ICT's may facilitate more self-directed approaches to learning whereby students are encouraged and supported to take charge of their own learning. Hence, Meyer (2016) argues that the role of ICT in education is significant as it offers "a means of supporting a progression of learning, and is best employed in support of a value creation process in teaching and learning" (p. 4). Synonymous with ICT usage are terms such as e-learning or online learning that encompass the use of new technologies or applications to impart knowledge. This is done by supportive and enhanced teaching and learning dissemination and assessment, that goes beyond the limitations of time and place (Bagarukayo & Kalema, 2015; Czerniewicz, Ravjee, & Mlitwa, 2007). The delivery models of e-learning range from fully online presentations (no face-to-face interactions) to a combination of face-to face and online presentations (blended learning). Blended learning is viewed as a multi-modal approach that integrates classroom methods with learning activities supported by online technologies (Zhonggen, 2015). As discussed in section 2.5.2, learning management systems had been adopted to support these varied modes of delivery.

The use of e-learning in the South African higher education sector has become more commonplace over the last two decades, encouraging greater interest and uptake in the use of ICT as part of university teaching and learning (Bharuthram & Kies, 2012; Jaffer, Ng'ambi, & Czerniewicz, 2007; Ng'ambi, Brown, Bozalek, Gachago, & Wood, 2016). This trend is driven by the need to improve local and global competitiveness, but also to improve the quality of education and find innovative approaches to address the challenges within the educational system (Bagarukayo & Kalema, 2015). The notion of competitive advantage has shifted from an emphasis on capital to information and knowledge, through innovation and creativity (Mlitwa, 2006). Jaffer et al. (2007) assert that the ability of higher education institutions to compete on a global playing field hinges on the effective integration of technology with current learning environments.

Ng'ambi et al.'s (2016) "rear-view" of technology-enhanced practices in SA's HE sector provided a chronological evolution of technology use over the last 20 years (p. 843). Briefly, ICT usage has evolved from computer-assisted learning, to learning management systems and more recently student-owned tools, such as social media, instant messaging or mobile technologies. Simultaneously, there has also been a proliferation of e-learning strategies, communities of practice, establishment of university units solely dedicated to supporting ICT use in teaching and learning and in the last five years a more pronounced emphasis on

scholarship and professional development (Ng'ambi et al., 2016). The higher education sector has prioritised the use of ICTs in teaching and learning, particularly towards increasing access, closing the digital divide, meeting social transformation goals and creatively advancing the skills and knowledge required for graduates to be lifelong learners and contributing global citizens (Brown & Czerniewicz, 2010; Jaffer et al., 2007).

Despite the vast potential for ICT use, the higher education landscape is still fraught with obstacles and challenges. The primary issue being the vast disparity between institutional resources (and thereby ICT usage) and the educational background of the students entering these institutions (Bharuthram & Kies, 2012). Access to ICT's is therefore still limited and unequal (Meyer, 2016). Nevertheless, Ng'ambi et al. (2016) contend that digital devices have become more readily accessible to the average student but there are still those that have limited access to ICT's and lack basic literacy skills. The issue is compounded by the varied levels of proficiency in ICT amongst South African students entering higher education − thus creating a "digital divide" (Brown & Czerniewicz, 2010, p. 357). This divide is characterised by the differential level of knowledge and skills required for digital literacy, referred to as "digital apartheid" and is primarily due to the large difference in opportunity and access to ICT's between digital natives (individuals brought up in digitally rich environment) and digital immigrants (individuals that learn and adapt to using technology) (Brown & Czerniewicz, 2010, p. 357).

Closing the digital divide has evolved into an urgent education imperative as the promotion, use and provision of access to ICT is essential in an increasingly technology-driven global society (Czerniewicz et al., 2007). Moreover, Moll, Adam, Backhouse, and Mhlanga (2007, p. 44) advocate "research into how these technologies are capable of transforming students' social and academic lives is essential in substantiating and underpinning the design of educational systems".

Even though strategies and policies to address ICT issues in higher education do exist, the implementation is slow (Meyer, 2016) due to various additional challenges such as "infrastructural constraints, demographic divides, staffing issues, organisational issues, learner issues and pedagogical issues" (Bagarukayo & Kalema, 2015, p. 171). Moreover, some institutions have unique challenges, for example lack of time and resources, inadequate curriculum design, training, shortage of ICT skills and user penetration. These factors severely

hamper tertiary institution's ability to harness the potential benefits that ICT usage may bring to their staff and students.

One of the major benefits of ICT's is that they allow for the acquisition of knowledge and information through online platforms, thereby reducing the impact of differences in quality of instruction. In addition, learning can also take place outside of the classroom context and through online communication with peers (Youssef & Dahmani, 2008). When used effectively, ICT has the potential to affect learning in the following ways: promote student-centred approaches, improve the learning experience, promote knowledge construction, facilitate active learning and alter students' knowledge perceptions and attitudes (Bagarukayo & Kalema, 2015). Evidence suggests that students learn better in contexts where they are provided with both visual and auditory stimuli that cater to various learning styles and practices and actively engage them in their learning (Bester & Brand, 2013). For example, Umbach and Wawrzynski (2005) reported that students reacted favourably when presented with cognitively challenging, interactive and collaborative forms of learning activities on an learning platform with subsequent increases in engagement, learning and value derived from these educational experiences. However, Meyer (2016) warns that the introduction of technology does not guarantee improved learner outcomes. Bharuthram and Kies (2012) propose that successful applications of ICT's are determined by whether ICTs are viewed as having the potential to enhance the quality of teaching and learning or as merely a conduit for instructional delivery, with limited influence on student achievement. Despite the strides that have been made in understanding the influence and impact that technology has on teaching and learning, the achievement of desired learning outcomes and thus student success is still not guaranteed. This emphasises the importance of continued investigation and refinement of the required conditions that foster success in technology-enhanced or supported environments. Educators and developers of educational technologies need to know and be cognisant of the considerations that should inform the execution of interventions in order to manage expectations (i.e. their students and their own expectations) of the affordances and capabilities of the selected technology. Therefore, there are still many lessons to be learned from examining the application of technology in different and varied contexts.

The present study focuses on educational gamification and thus investigates the potential of the affordances that ICT supported learning environments may offer to enrich current teaching and learning practices. As previously stated, very few South African studies have reported on the

use of gamification in educational contexts (see Botha, Herselman, & Ford, 2014; O'Donovan et al., 2013; Vermeulen et al., 2016). With South Africa's diverse student body and evolving educational context an investigation of this nature is warranted in order to further uncover the potential of this approach in a South African context. The next section will focus on the use of gamification alongside educational technology such as the LMS and online learning and as such provides the backdrop for a discussion on educational gamification (refer to section 3.4).

3.2 GAMIFICATION

Gamification is an emerging trend that has grown in popularity across a number of fields, including service marketing, business and education. The term is thought to have been coined in the digital media industry as early as 2002 and first used in 2008, but only gained traction in the literature in the latter part of 2010 (Deterding et al., 2011).

At present a standard definition for gamification does not exist, however Deterding et al.'s (2011, p. 9) conceptualisation "the use of game design elements in non-game contexts" is widely cited. Similarly, Koivisto and Hamari (2014, p. 179) describe the term as "the phenomenon of creating gameful experiences". In essence game elements and mechanics are used to create an interactive system with the intention of motivating and engaging the user (Seaborn & Fels, 2014). The use of game elements and mechanics in non-traditional game environments are thought to invoke similar psychological experiences as those experienced when playing a game (Hamari et al., 2014). The appeal of this approach lies in its potential to strengthen user engagement, change behaviour and support innovation (Caponetto, Earp, & Ott, 2014).

Gamification is also defined by its influence and the psychological and behavioural outcomes it elicits. For example, Robson, Plangger, Kietzmann, McCarthy and Pitt (2015) delineate the concept as the "application of lessons from the gaming domain to change behaviours in non-game situations" (p. 412). While Hamari et al. (2014) conceptualise gamification as the "process of enhancing services with motivational affordances in order to invoke gameful experiences and further behavioural outcomes" (p. 3026). Moreover, gamification is regarded as a means to drive, support or motivate user participation. Kapp's (2012) definition of the term encapsulates the various components and capabilities of gamification and defines it as the use of "game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems" (p. 10).

Gamification is often erroneously clumped with other game-related interventions such as serious games, simulations, game-based learning or the use of game theory, which it is not (Hung, 2017; Robson et al., 2015). Even though each intervention captures various aspects of games, their point of departure differs.

Serious games differ from gamification as they are specialised educational games, designed for a predetermined purpose (Jackson, 2016; Martí-Parreño, Seguí-Mas, & Seguí-Mas, 2016). Moreover, they operate and look like digital games and include all game elements. They may also be user-generated or bought off- the-shelf and are designed to achieve predetermined learning or training objectives (Jackson, 2016; Kiryakova, Angelova, & Yordanova, 2014). Deterding et al. (2011) describe serious games as fully-fledged games supported by "interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment" (p. 6). Akin to serious games are simulations that reproduce or simulate real word activities thus creating a virtual environment in which these activities can be taught and practiced (Wiggins, 2016). Serious games and simulations fall into the category of game-based learning that are developed primarily for learning or behaviour change (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012).

Gamification employs game mechanics and elements to reconstruct the learning experience and make it more game-like. In comparison, game based learning incorporates games into the learning process to achieve a specific learning objective, e.g. skills development (Šćepanović, Zaric, & Matijevic, 2015). In addition, the designed content in game-based learning is constrained to the boundaries of the game and may therefore be used to supplement or replace traditional teaching. Gamification is often utilized in non-game context, such as a LMS, with the express purpose of creating an engaging experience for the student and therefore does not alter the prevailing practice of learning (Šćepanović et al., 2015). Nevertheless, despite the highlighted discrepancies between gamification and game-based learning some authors argue that gamification is a derivative or repackaging of game-based learning (Wiggins, 2016), while others see it as a new approach (Barata et al., 2013).

A number of studies have reported on the positive educational outcomes and benefits in the use of gamification. Some of these outcomes include;

- user engagement (Çakıroğlu et al., 2017; Da Rocha Seixas, Gomes, & De Melo Filho, 2016; Ding et al., 2017; Koivisto & Hamari, 2014; O'Donovan, Gain, & Marais, 2013);
- motivation (Hamzah, Ali, Saman, Yusoff, & Yacob, 2014; Koivisto & Hamari, 2014);
- participation (Barata et al., 2013; Lister, 2015);
- learning (Buckley & Doyle, 2017; Cheong, Cheong, & Filippou, 2013; Landers & Landers, 2014);
- attendance (Barata, et al., 2013; Lister, 2015; O'Donovan et al., 2013);
- satisfaction (Hanus & Fox, 2015); and
- enjoyment (Mekler, Bopp, Tuch, & Opwis, 2014; Songer & Miyata, 2016).

These outcomes are encouraging and desirable but convey an erroneous message that gamification is the answer to effective learning and student engagement. To illustrate, Dichev and Dicheva (2017) conducted a critical review of the application of gamification in education. They found that most investigations of the effect of gamification on students were mixed. For instance, some studies reported positive and/or negative results, while others were inconclusive or cautioned against its use. In addition, the robustness of the evidence supporting the positive and negative findings varied significantly. Dichev and Dicheva (2017) concluded that "(i) insufficient evidence exists to support the long-term benefits of gamification in educational contexts; (ii) the practice of gamifying learning has outpaced researchers' understanding of its mechanisms and methods; (iii) the knowledge of how to gamify an activity in accordance with the specifics of the educational context is still limited" (p. 1). Therefore, in order to temper expectations and ensure a robust execution of the application of gamification in this study, the criticisms of gamification are examined next and followed by a focused review of the literature pertaining to the design of educational gamification.

3.3 CRITICISM OF GAMIFICATION

Despite the reports of the positive impact gamification can have, a number of criticisms are still levelled against gamification with some of the harshest criticism coming from game designers. In 2011, Bogost (2011), game designer and author, vehemently proclaims, "[g]amification is bullshit", in his position statement at the Wharton Gamification Symposium. He argues that it should rather be referred to as "exploitationware" as proponents of gamification are capitalizing on the hype and using the term to entice businesses deceptively to use it. Another game designer Robertson (2010) argued that the term gamification is misleading and should rather be referred

to as pointsification. 'Pointsification' refers to the use of the PBL (points, badges and leaderboards) triad, which is a basic and simplistic application of gamification. Robertson (2010) argued that the use of the term "game" infers an engaging activity or experience however employing points and badges is in essence extracting the least interesting elements of a game, , such as the scoring system (Nicholson, 2012). Much of Bogost (2011) and Robertson's (2010) indignation seems to be aimed at the use of the term where it suggests an easy duplication and replication of game design concepts (Canali, 2016) and gamification strategies that employ extrinsic rewards as a primary motivator (Seaborn & Fels, 2014). In addition, much of their criticism is primarily aimed at gamification in marketing and business. Nevertheless, Callan, Bauer, and Landers (2015) cautioned against using gamification just to be part of the trend as it that may result in applications that are rushed and ultimately a waste of time and money.

In education, similar issues have been highlighted, such as the novelty effect, over reliance on external rewards and the design of gamified systems. The novelty effect describes the initial interest in gamified applications that drive participation (Hamari, 2013). As this effect diminishes the application loses its novelty and players ultimately lose interest. However, El-Khuffash (2013) argues that the motivational effect can be a lasting if gamification principles are applied correctly. Moreover, Werbach and Hunter (2012) propose that emphasising the social aspects, for instance group work activities or discussions can be an effective means of sustaining interest and participation.

An additional concern raised against educational gamification is the over reliance on external rewards, which may place the emphasis on chasing incentives rather than facilitating intrinsically motivated learning (Glover, 2013). External rewards have also been found to decrease intrinsic motivation. In Deci, Koestner, and Ryan's (2001) examination of rewards, they found that all types of external rewards reduced intrinsic motivation. Groh (2012) termed this the overjustification effect whereby intrinsic motivation is shifted towards the extrinsic incentives. The provision of external rewards decreases internal motivation and also requires the reward loop to continue or increase to maintain it (Nicholson, 2013; Zicherman & Cunningham, 2011).

Criticism has also been levelled against the gamified systems or learning environments that are developed. Deterding (2012) provides the following reasons for his disdain for gamified systems;

- they are merely a simplistic application of game design elements;
- they are reward-oriented – using external rewards rather than intrinsic motivators
- they cater to the goals of the system owner rather than the goals of the users/players; and/or
- the interface is often limited and does not offer the structural qualities of games that generate gameful experiences.

Similarly, Glover (2013) argues that gamifying educational activities is not a sufficient prerequisite for creating an engaging experience but that it is more ideally suited to increasing the reward of activities that are already rewarding, for example encouraging students to invest more time in learning. When compared to other digital technologies gamification is prone to the same bugs and errors that associated with new applications that emphasises the importance of beta or pilot testing (Kim & Werbach, 2016). Arnold (2014) states that careless applications of gamification lead to poorly designed examples that fuel the criticism against it. These concerns highlighted the iterative process that is required when applying gamification and the importance of continually redesigning and developing gamified system, especially when they are used in educational settings.

3.4 DESIGNING EDUCATIONAL GAMIFICATION

Dichev, Dicheva, Angelova, and Agre (2014) describe the gamification of learning as the application of game design elements in ways that enrich learner engagement, for example providing and setting goals, opportunities to fail and frequent, specific and informative feedback that supports learning. Learners thus develop a sense of competence by actively attempting new and challenging tasks, adjusting their actions based on feedback that drives progress through the content. Even though the notion of gamification has developed fairly recently, the use of games in education and for educational purposes is not a new occurrence but has been applied and researched since the 1970's (Domínguez et al., 2013). Therefore, the term is novel but the integration of game elements into teaching is not. Hung (2017) proposes that each of the aforementioned educational interventions (i.e. gamification, game-based learning, serious games and simulations) offer different answers to the questions: "What is the most effective way to use games in the classroom? Is it the "game-ness" of the game that holds

the most potential, or the encouragement of playful behaviours that are conducive to learning?" (p. 58).

Some authors argue that elements of gamification are already commonplace in class room activities, specifically the use of incentive systems to reward or punish desirable or undesirable behaviour (Hamzah et al., 2014; Lee & Hammer, 2011). For example, students receive points for completing assignments, the combination of which translate into a badge for a particular module, which determine if students will level up to the following module or year. Despite the presence of these features, a large number of students remain disengaged. Evidently, the existence of game-like elements in the educational context does not translate directly to engagement (Lee & Hammer, 2011).

It is therefore vitally important to understand the building blocks required to create gamified systems. To this end, the systematic review of the education gamification literature primarily focused on the theoretical perspectives, game elements and mechanics and design strategies required to develop a gamified intervention effectively.

3.4.1 Theoretical perspectives in educational gamification

Grund (2015) argued that the successful application of game elements requires an understanding of the underlying mechanisms that influence learning and motivation. The papers sampled in the systematic literature review were content analysed to identify the most pertinent theoretical perspectives associated with educational gamification. The most prominent theories that emerged were theories of motivation namely, theory of self-determination (Ryan & Deci, 2000), motivation theory and the theory of flow (Csíkszentmihályi, 1975, 1990). Additional theories that are not as widely cited include goal-setting theory (Locke & Latham, 2002) and two learning theories: experiential-learning theory (Kolb, 1984) and Blooms taxonomy (Anderson & Krathwohl, 2001) in order to uncover mechanisms that lead to motivation as well as learning. A brief discussion of each theory follows.

3.4.1.1 Theories of motivation

Theory of self-determination. SDT is a macro theory pertaining to the individual growth tendencies and innate psychological needs that inform self-motivation and personality integration, specifically the conditions that foster intrinsically motivated behaviour. Intrinsic motivation refers to the innate gratification resulting from an action (Ryan & Deci, 2000). The

SDT is based on four sub- theories namely; the basic psychological need theory, cognitive evaluation theory, organismic integration theory and causality orientation theory (Deci & Ryan, 1985). Most pertinent to gamification are the psychological needs linked to motivation namely; competence, relatedness and autonomy, that facilitate or discourage intrinsic and extrinsic motivation (Ryan, Rigby, & Przybylski, 2006). These three psychological needs are specifically explained in the sub-theory, basic psychological need theory, which specifies that influences of an activity on wellbeing or need satisfaction are contingent upon the degree to which the activity affords experiences of volition, effectiveness, and social connection. Cognitive evaluation theory, (similar to the self-system model of motivational development discussed in section 2.4.4) states that contextual factors, such as the provision or absence of autonomy (volition or willingness) and competence (need for challenge or feeling of efficacy), either support or hinder intrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2000; Ryan et al., 2006). In gamified systems autonomy can be promoted through game elements such as quests where players can decide how and when they want to complete these quests. A sense of competence can be supported through immediate feedback and rewards. Lastly, social interaction among players collaborating in teams would support relatedness.

Motivation theory. As discussed in Chapter 2, motivation is conceptualized as two primary types: intrinsic and extrinsic. Intrinsic and extrinsic motivation is at the heart of why people do things and is thus the source of a player's actions within a gamified system. Intrinsic motivation is the inherent satisfaction derived from performing a task, for example because it is interesting or enjoyable. Intrinsically motivated behaviour is energised by challenge or fun rather than external rewards or pressures. In contrast, extrinsic motivation is the performance of tasks for external outcomes that have instrumental value. Game elements, such as points and badges, act as extrinsic motivators, while elements like status, challenge and mastery sustain intrinsic motivation.

Intrinsic motivators tend to have longer-lasting effects than extrinsic motivators. Moreover, extrinsic motivators may actually lead the users to resent the gamified application (Nicholson, 2012). This occurs when extrinsic rewards are provided for an intrinsically interesting task and people feel controlled by the rewards, which could decrease intrinsic motivation (Deci & Ryan, 2000).

Theory of flow. Csíkszentmihályi (1975, 1990) developed the theory of flow to explain an immersive psychological state or experience characterised by a deep concentration, focus and

engagement in a task. Flow is therefore an expression of optimal intrinsic motivation and may be accompanied by a sense of gratification and immersion in the experience, when creativity and performance are at their peak (Dichev et al., 2014). A flow state occurs when an individual experiences optimal conditions of high enjoyment and motivation while doing a task (Nakamura & Csikszentmihalyi, 2014). Flow can also influence intrinsic motivation through the structure of an activity and the extent to which it provides; 1) a challenge that matches an individual's perceived skills; 2) is aligned with personal goals; 3) provides immediate feedback; and 4) stimulates intense concentration. Flow is thus conditional on the subjectively perceived balance between the difficulty of the task and the skill required to complete it (Dichev et al., 2014). In contrast, challenging tasks that exceed the individual's skill will lead to anxiety and too low challenge and skills required may lead to high levels of boredom or apathy. The flow state is thus an intrinsically rewarding experience stemming from conditions that stimulate, excite and engage an individual in the learning process.

Goal setting theory. Goal setting theory is well established and postulates on the role goals play in motivation and tasks performance. Locke and Latham (2002) proposed that goals are underpinned by four mechanisms: goals provide focus and attention towards goal relevant activities; they energise efforts towards attainment or completion of these activities; they influence sustained persistence and effort; and have an indirect impact on an individual's actions, for example stimulating curiosity, discovery or summoning pre-existing knowledge and strategies. In addition, there are a number of moderators that impact goal setting and goal performance or attainment including: goal commitment, feedback, task complexity and personal goals as mediators of external incentives and satisfaction (Locke & Latham, 2002).

Goal commitment is a key moderator (especially for goals that are more difficult) that will be determined by the perceived importance attributed to the goal and self-efficacy. Feedback plays an informational role by informing the progress made in relation to the goal. An individual will thereby adjust their level of effort, direction of effort or the strategies employed, based on feedback.

Task complexity determines the level of skill and the strategy required to attain the goal. Setting more difficult or complex (assigned) goals may require higher levels of skill or a variety of strategies that are subject to an individual's capability. Goal difficulty is mediated by personal or self-set goals and self-efficacy (Figure 3.1), as well as mediating the effect of external

inducements. The last moderator is satisfaction and refers to the satisfaction or dissatisfaction associated with attaining a goal or not (Locke & Latham, 2002).

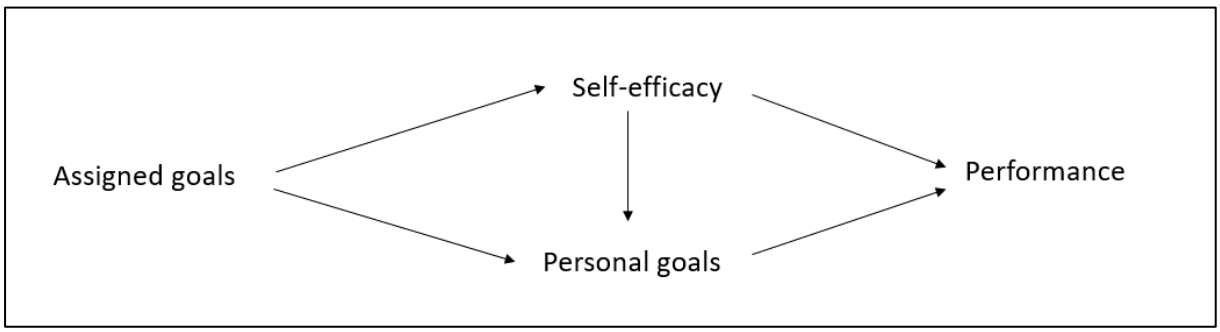

Figure 3.1. Relationships between assigned goals, self-set goals, self-efficacy, and performance. Adapted from Building a practically useful theory of goal setting and task motivation: A 35-year odyssey by E. A. Locke & G. P. Latham 2002, American psychologist, 59, p. 709.

Goal setting can also be meaningfully applied in gamification through game elements such as points, leader boards and badges (Grund, 2015; Landers, Bauer, & Callan, 2015). These elements encourage players to set their own goals to pursue by either deciding how many points they wish to accumulate, if a badge is worth pursing or whether he/she wishes to compete against peers on the leaderboard. The game elements thus subtly motivate behaviour or action in the game (Landers et al., 2015). The provision of specific rules/goals that are explicitly communicated within the game supports a motivation to learn (Landers, 2014). Grund (2015) proposes that game elements may also reinforce goal commitment. For example, peers higher up on the leader board may serve as "role models" or targets to which to strive. Two avenues to strengthen self-efficacy are to provide easier tasks at first to create success experiences and build confidence, and then steadily increasing the difficulty of tasks to build self-efficacy. For example, in gamification, points can provide feedback on performance or be used as an achievement tracker.

3.4.1.2 Learning theories and taxonomies

Experiential-learning theory. Kolb (1984) developed the experiential learning theory to explicate the internal cognitive process of learning through experience. Simply stated, Kolb (1984) proposed that "[l]earning is the process whereby knowledge is created through the transformation of experience" (p. 38). Central to this theory is the learning cycle constituting four stages, namely concrete experience (encountering a new situation or experience), reflective observation (reflecting on the experience), abstract conceptualisation (drawing conclusions or

learning from the experience) and active experimentation (applying what has been learnt) (Kolb, 1984). Correspondingly, each stage is associated with a specific activity, such as feeling, watching, thinking and doing. The learning cycle emphasises an integrated process of learning that stems from continuously constructing, modifying and applying new knowledge (Kolb, 1984).

Bloom's taxonomy. The use of Blooms taxonomy has proliferated since its development in 1965. The taxonomy provides a classification of levels of cognitive processes that range from simple to complex types of thinking. The levels were recently adjusted by Anderson and Krathwohl (2001), and include: remembering, comprehension, application, analysis, synthesis, evaluation and creation. Bloom's taxonomy is widely used in education and a number of studies in educational gamification use it as a guiding framework when designing gamified learning activities (Berkling & Thomas, 2013; Kapp, 2012; Stott & Neustaedter, 2013). In gamification, Bloom's taxonomy can find application in the design of learning activities on which quests or challenges, which players may engage in, are based. The tenets of each of these theories were considered in the development of the design principles, which are discussed in section 3.4.3.

3.4.2 Game elements and mechanics

Descriptions of gamification often include terms such as game mechanics (Park & Bae, 2014), game elements (Grund, 2015; Khaleel, Ashaari, Tengku Wook, & Ismail, 2015) and game thinking (De Sousa Borges, Durelli, Reis, & Isotani, 2014; Dichev et al., 2014; Khaleel et al., 2015; Park & Bae). Faiella and Ricciardi (2015) describe these terms as game features or components that underpin the frameworks and metaphors employed to effectively conceptualise the term gamification.

Simplistic applications of gamification may begin with the basic combination of points, badges and leaderboards (PBL), an approach which is heavily criticised. There are, however, a wealth of game concepts such as, goals, rules, conflict, competition and cooperation, time, rewards structures, feedback, levels, storytelling, curve of interest and aesthetics, that can be incorporated into a gamified learning environment (Kapp, 2012). Kapp (2012) refers to each of these game concepts as representations of reality that create a modelled reality or "operating model" on which a game is based. Game elements are thus abstractions of events, ideas and reality.

Two commonly cited classifications of game elements are provided by Deterding et al. (2011) and Werbach and Hunter (2012). Deterding et al. (2011) proposed a taxonomy of game design elements categorised according to five levels of abstraction, beginning with more concrete (e.g. game interface design patterns, game design patterns and mechanics, game design principles and heuristics) to abstract game design elements (game models and game design methods). The description and an example of each level is provided in Table 3.1.

Werbach and Hunter (2012) categorise the game elements into three groups termed; dynamics, mechanics and components. According to this perspective, gamification is driven by certain processes (mechanics) that are based on the higher-level conceptual elements (dynamics) that inform the implicit structure or big picture of the game (see Figure 3.2). These mechanics and dynamics are represented by the components that are implemented at a concrete level.

Table 3.1

A Taxonomy of Levels of Game Design Elements

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementation	Badges, leaderboards, levels
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraints, limited resources, turns
Game design principles and heuristics	Evaluate guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety pf game styles
Game models	Conceptual model of the components of games or game experience	Challenge, fantasy, curiosity, game design atoms, Core Elements of the Gaming experience (CEGE)
Game design methods	Game design-specific practices and processes	Play testing, play centric design, value conscious design

Note. Adapted from “From game design elements to gamefulness: Defining "Gamification"” by S. Deterding, D. Dixon, R. Khaled, and N. Lennart, 2011, *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments,* p. 4. Copyright 2011 by the Association for Computing Machinery (ACM).

The afore-mentioned classifications highlight the multi layered nature of gamification. In addition to this, Nah et al. (2013) proposes that most gamified applications are built on five pillars or goals of design that include; Goal orientation, Achievement, Reinforcement,

Competition and Fun orientation. First, gamified applications have a *goal orientation* and should provide well-defined short, medium and longer-term goals to provide structure and break down the learning process. For example, players complete tasks that challenge their knowledge and skills as they advance in the game. Second, *achievement* is driven through recognition provided by badges or kudo systems (e.g. trophies, ranks, awards). Third, *reinforcement* is supported through a reward structure based on performance and a feedback system (e.g. points or virtual currency). Fourth, *competition* or competitive engagements are necessary inclusions that are used to sustain player engagement and focus on the learning tasks. Competition is enforced though clearly defined, explicit rules. The fifth pillar is a *fun orientation* and the integration of fun and enjoyment to motivate and engage learners. These goals of design are encapsulated in the game dynamics and mechanics discussed above, but find concrete expression on the learning platform through system design elements or components that are generally referred to as the game elements.

Figure 3.2. Hierarchy of game elements. Adapted from *For the win: How game thinking can revolutionize your business* by Werbach, K., & Hunter, D. (2012). Philadelphia, PA: Wharton Digital Press.

A number of authors have attempted to list, categorise and describe the various game elements that exist (Robinson & Bellotti, 2013; Werbach & Hunter, 2012). To this end, Zicherman and Cunningham (2011) offer six primary elements: points, levels, leaderboards, badges, challenges/quests and social engagement loops.

1. Points are numerical units that can be rewarded and accrued for activities/behaviours completed within the gamification environment (Pedreira et al., 2015). They can serve as indicators of success, achievement, effort, progress and/or rank (Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2014; Seaborn & Fels, 2014). To this end different types of points may be used, for example experience points (XP) or a score.
2. Levels represent environments of increasing difficulty in which a player would be required to gain certain abilities and powers in order to progress to the next level. Progression to a new level may be linked to accumulation of point-based rewards (Pedreira et al., 2015) or serve as a reward system to encourage players to continue the game. Levels are also known as stages, areas or worlds.
3. Leaderboards create a sense of competition by displaying and ranking the success of the players involved. The position on the leader board is often determined by points or levels and enable comparison with other learners (Nah, Telaprolu, Rallapalli, & Venkata, 2013; Pedreira et al., 2015). This creates an eagerness to improve performance and advance up the rankings (Nah et al., 2014). Leaderboards are also referred to as rankings or scoreboards.
4. Badges are visual representations (i.e. icons) that denote task accomplishment or recognition of effort in the process of goal achievement (Nah et al., 2013; Nah et al., 2014). Moreover, they motivate and inspire continued engagement in goal focused learning tasks. Badges are also referred to as trophies.
5. Challenges/ quests are small tasks that players have to fulfil within a game and take place within a meaningful storyline. The task the player has to complete, the addition of game elements such as story make it more attractive.
6. Social engagement loops – viral loops that are capable of continually reengaging users. A social engagement loop is created when "[a] motivating emotion leads to player re-engagement, which leads to a social call to action, which flows to visible progress and/or rewards, which loops back around to a motivating emotion" (Cunningham & Zichermann, 2011, p. 67).

Even though the game elements described above are commonly used, the lists should be considered non-exhaustive (Sailer, Hense, Mandl, & Klevers, 2013). To illustrate, Nah et al. (2013) proposed additional game mechanics that can also enhance user engagement including: "feedback, teams/social dynamics, rules (explicit and player generated), market place/economies, avatars, visual/3D space/sounds, narrative context role play" (p. 104). Feedback is important to reinforcement and can also be achieved through elements such as points, levels and progress bars that provide information about the current status of a player towards a goal (Seaborn & Fels, 2014). Teams or social dynamics can introduce and enhance competitive or collaborative elements of a game (Nah et al., 2014). Rules provide a sense of control as they convey what it takes to win and advance though the game. Lastly, avatars, visual/3D space/sounds, narrative context and role play can be harnessed to add a fun component to the game (Nah et al., 2014).

The actual application of game elements to non-game contexts is proposed as a six step process by Werbach and Hunter (2015) that involve; defining the business objectives, delegating and identifying the target behaviours, describing and identify the users, devising activity cycles and deploying the appropriate tools, elements or mechanisms. These proposed steps are situated within a business context however within the education context, a number of strategies are proposed for the application of gamification and construction of gamified systems (see Aparicio, Vela, Sánchez, & Montes, 2012; Hansch & Newman, 2015; Kapp, 2012; Kapp, Blair, & Mesch, 2014; Kiryakova et al., 2018). For instance, Huang and Soman (2013) offer a similar set of steps that are comparable to those proposed by Werbach and Hunter (2015). They include; understanding the target audience, defining learning objectives, structuring the experience, identifying resources and applying gamification elements. When comparing these two strategies for implementation and application three basic principles are evident. First, a well-considered understanding of the audience the application is intended for. Second, determining the objective of the application (e.g. the learning outcomes that are envisioned) and how they will be achieved. Finally, the third commonality is the selection of appropriate game elements and activities that will foster the desired behaviour required to achieve these outcomes. These basic tenets are applied in this study and further explicated in section 3.4.4.

3.4.3 Gamification design principles for engagement

As the study is guided by a design-based research framework (refer to Chapter 4), the approach requires the development of solutions to address the research problem. In other words, for this

study, preliminary gamification design principles for student engagement were developed to guide the development of the initial solution to an identified problem, specifically to develop a gamified intervention that facilitate student engagement. To this end, the student engagement and gamification literatures were consulted to develop preliminary design principles that support and guide an engagement-oriented approach to gamification. The design principles were based on a framework, proposed by De Byl and Hooper (2013), of key strategies to increase engagement in gamified learning environments. Each strategy was translated into a design principle and the reviewed literature was integrated to further explain how each principle could facilitate student engagement through gamification. This section outlines the development of the design principles and highlights pertinent elements for consideration when designing a gamified application.

De Byl and Hooper (2013) examined the instructional design (education) and game design (games) literature and extracted the key attributes that offer the greatest benefit for engagement (Csikszentmihalyi, 1990; Furlong & Christenson, 2008; Jones et al., 1994; Lepper & Malone, 1987; Schlechty; 1997). The common attributes shared by instructional design and game design literature were formulated as key strategies that can increase engagement in classroom and online settings. Refer to Table 3.2 for a brief description of each attribute and strategy (De Byl & Hooper, 2013, pp. 223–224).

Table 3.2

Key Attributes Common to Instructional and Game Design for Promoting Engagement

Key attributes	Strategies
Focused goals	Provide focused goals that give participants a purpose for being involved in the system and interacting with it.
Challenging tasks	Provide challenging tasks that are scaffolded and customised to a participant's skill level as to not be too easy or too difficult to achieve.
Clear instructions	Provide clear instruction to provide rules, guidelines and scope to the system.
Rapid feedback	Provide rapid feedback to maintain constant communication with participants about their status and behaviours within the scope of the system.
Affirmation of performance	Affirm performance and communicate constructive quantitative and qualitative measures to participants about their progress toward their goals.
Social networking	Include social networking that allows inter-participant negotiation of knowledge for testing understandings.
Safety from failure	Create safety from failure such that the system constitutes a safe-haven in which participants are free to learn from mistakes without real-world repercussions.
Curiosity and novelty	Incorporate curiosity and novelty that provide intrinsic motivation to explore and push the boundaries of the system.
Fantasy	Add fantasy to aid in suspension-of-disbelief and the use of imagination to create authentic problem-solving environments not elsewhere accessible to participants.

The educational design principles for student engagement were thus created by integrating the theoretical perspectives and game elements discussed. Each design principles are explained next.

Design principle 1: Provide focused goals that establish and convey the purpose of the learning activities.

Engagement in gamified learning environments is supported by goal-orientated activities. The environment can be structured to have various levels or layers of goals (Nah et al., 2013; Šćepanović et al., 2015). Clear and well-defined short, medium and longer-term goals provide structure and the learning process. For example, each activity is typically oriented towards the accomplishment of a short term goal, such as completion of the activity. Levels can be incorporated to provide structure by group activities at each "level" and once all the activities are completed the student will progress to the next level. This creates a medium term goal. The long term goal is therefore the completion of all activities at each level to "win" the game (Nah et al., 2013).

The goals of the game are also encapsulated in the dynamics or high level game elements such as the narrative, constraints or progression (refer to Table 3.3) (Werbach & Hunter, 2012). These dynamics are explicitly conveyed through clearly defined rules and instructions for the game and the learning activities that provide information on how to progress towards or achieve the established goals (Landers, 2014). Drawing on goal setting theory, Grund (2015) advocated the use of specific, difficult, and obtainable goals. Thus, goals (e.g. completion/mastery of learning activities) should be challenging and clearly defined, but still be within the student's ability to complete the task. In addition, points and leader boards can also be used to strengthen goal commitment and reinforce the perceived importance of the goal (refer to section 3.4.1). Lastly, providing students with goal focused activities also creates a sense of progression that can sustain motivation and engagement (Nah et al., 2013).

Design principle 2: Provide challenging tasks that are aligned with a student's level of knowledge and skill.

The provision of challenging tasks can foster a sense of competence by providing activities framed as quests or challenges within the gamified learning environment. Learning activities should first and foremost be aligned with the learning objectives or outcomes of the module. Kiryakova et al. (2014) and Simões, Redondo, and Vilas (2013) outlined key guidelines for

developing effective learning activities for gamified learning. First, the activities should allow repetition to support knowledge retention and skill improvement, thereby achieving the goal of the activity. Second, the activities should be achievable and provide an optimal level of challenge that is aligned with the student's expected level of knowledge or skill. Third, each subsequent activity should increase in difficulty or require more effort from the student corresponding to their newly acquired knowledge and skills. Finally, multiple paths should be created that allow the development of various skills and allow students to build their own learning strategies (which is also one of the key characteristics of active learning). To this end the activities can be designed in accordance with the experiential learning cycle (Kolb, 1984) or Bloom's taxonomy (Anderson & Krathwohl, 2001) in order to incorporate various types of activities and cater to different learning styles (Grund, 2015). Learning activities could also be designed to support autonomy (by allowing students the choice of which activities to do) and relatedness (through collaborative group work assignments).

Design principle 3: Provide rapid feedback regarding progress through the learning activities.

The importance of feedback as part of the learning process is well established. Dichev et al. (2014) contend that one of the most compelling arguments for the use of gamification in education is the timely manner in which feedback can be provided. Games generally provide immediate, focused feedback that guides the player to improve their performance or alter their tactics. In a gamified learning environment feedback reinforces learning by providing information regarding performance on an activity or progress towards the goal. This is often conveyed through the reward mechanisms (e.g. points, grades or virtual currency). However, Kapp (2012) argues that the most effective feedback is informative of how the student has performed and should form part of the design of the learning environment. Some examples he proposes are self-paced activities, visual cues, question-and-answer activities, a progress bar, or written (qualitative) comments. Points and grades can also be used to provide feedback (i.e. indicate correct or incorrect responses) but are limited in terms of providing guidance to improve performance (Dichev et al., 2014). In sum, learning can reinforced by rewarding performance in the learning activities (e.g. completion or mastery) and further supported by the feedback system (Nah et al., 2013).

Design principle 4: ***Affirm performance by recognising achievements and providing indicators of progression.***

An important part of maintaining motivation and engagement within a gamified learning environment is to recognise achievements and convey progress. This creates a sense of satisfaction for attaining short term goals and motivates further participation. Reward mechanisms such as points, leaderboards and achievement icons (badges or trophies) are used to reward accomplishments or performance and thereby incentivise desired behaviour (Šćepanović et al., 2015). However, to be effective careful consideration should be given to when the reward is assigned and whether it is perceived as meaningful. Dichev et al. (2014) propose that linking a reward to actual performance makes it meaningful and maximises motivation and satisfaction derived from receiving it.

Progression is another necessary and influential dynamic within a gamified learning environment (Dichev et al., 2014; Grund, 2015; Šćepanović et al., 2015). Game elements such as levels, a progress bar or character/avatar upgrades provide a visual representation of a student's advancement over time (Dichev et al., 2014; Šćepanović et al., 2015). Progress tracking provides the student with insight into their goal attainment and the effect that certain behaviours and actions have within the system. As such, progress tracking is similar to providing feedback, and is a key technique for sustaining motivation as student success is visually represented (Dichev et al., 2014). In addition, Stott and Neustaedter (2013) suggest that psychological needs, such as competence and relatedness, can also be enabled if individual progress tracking (advancement in the game) is visible or shared with peers

Design principle 5: ***Create opportunities for social interaction through competitive or collaborative engagements.***

Huang and Soman (2013) emphasise the importance of selecting mechanisms that promote achievement and social elements. 'Self-elements' promote competition with the self and recognition of personal achievement (e.g. points, levels, badges or time restrictions). Alternatively, 'social-elements' promote competition or collaboration that place the student in a community of their peers and where their progress and achievement are made public.

Design principle 6: ***Create an imagined environment that inspires curiosity and novelty and allows for creative thinking and authentic problem solving.***

Creating an imagined environment is a means of incorporating the fun orientation proposed by Nah et al. (2013) through a narrative and/or storyline. A narrative provides structure and context to the learning activities incorporated into the game, whereas a storyline compliments it by filling in relevance and meaning. By employing these elements, a realistic context or safe environment is created in which new knowledge and skills can be tested or reinforced. In addition, Kapp, Blair, and Mesch (2014) suggest that the use of fantasy or story telling can evoke curiosity which has been linked to intrinsic motivation. On an emotional level the use of fantasy may also allow players to engage with the learning experience while suspending the fears or concerns that may be present in the real world.

These six design principles provided a framework that served as a blue print for the development and construction of the educational gamification intervention to be used in this study. Werbach and Hunter's (2012) hierarchical classification of game elements (i.e. dynamics, mechanic and components) (refer to Figure 3.2) was consulted and consideration given as to how the design principles would be expressed in the game. As it is impossible to include every type of game element (given the capabilities and affordances of SUNLearn and the nature of the game) only the most applicable game dynamics, mechanics and components were selected based on the contribution to attain the purpose and goal of the intervention. In Table 3.3, the game elements chosen to express each design principle are presented with a brief definition, together with a description of the application in SUNLearn (the platform for the gamified intervention).

Table 3.3

Application of Design Principles and Associated Game Elements in SUNLearn

Dynamics	**Mechanics**	**Components**	**Application in SUNLearn**
***Design principle 1*: Provide focused goals that establish and convey the purpose of the learning activities.**			
Constraints.		*Rules.* The explicit definitions of the game, its structure, and the sequence of play	The number of attempts on the knowledge check is constrained to 3 attempts. A player can only move to the next level once they had completed compulsory tasks in the current level. Suggest deadlines for submission but leave completion of the quests at the player's discretion. Award bonus points for completion of quests by the suggested dates.
Progression. Provides a feeling of development and growth within the game experience		*Levels*. The separate steps of the games that players can progress through as they pass from level to the next	Group course content into themes/units. Each unit represents a level in the game. The player moves from one level to the next after the completion of compulsory tasks within the theme/unit.
***Design principle* 2: Provide challenging tasks that are customised to a student's level of knowledge and skill**			
	Challenges. Tasks or activities to be completed	*Quests.* The goals players need to achieve and the level of their performance.	Present learning activities as challenges/quests that need to be completed in order to progress to the next level
***Design principle 3*: Provide rapid feedback regarding progress within the scope of the application**			
	Feedback. The element informing players about how they are doing throughout the game.		Provide feedback on performance using rubrics that informed mark/point allocations and descriptive
		Points. The numerical representations of players' performance	Assign points for various activities including: quizzes, class attendance, in class activities and group quests. Allocate points for the completion of these tasks. Lecturer allocates bonus points at her own discretion for additional activities or participation.
***Design principle 4:* Affirm performance by recognising achievements and providing indicators of progression**			
		Leader boards. The lists of the players ranked based on their performance in the game.	Display the ranking of the 5 students with the highest number of points accumulated on an individual leader board.

Dynamics	Mechanics	Components	Application in SUNLearn
			Displayed the top 5 group rankings on a group leader board
		Progress bar. Visual representations of progress	Display progression and completion of activities in each level on a progress bar linked the completion tracker.
***Design principle 5*: Create opportunities for social interaction through competitive or collaborative engagements**			
Relationships. The interaction between players	*Cooperation*. Individuals or groups working together to reach the win-state.	*Teams*. Groups of players working together to reach a common goal	Players work collaboratively with their peers to complete learning activities and learn from each other Players work in a small team of 3-4 members to complete group quests.
	Competition. Individuals or groups working against each other to reach the win-state.	*Leaderboards*. The lists of the players ranked based on their performance in the game.	Encourage competition between individuals as well as groups through the leader boards
***Design principle 6*: Create an imagined environment that inspires curiosity and novelty and allows for creative thinking and authentic problem solving**			
Narrative. The manner in which a game is structured and involves the combination of various elements to create a meaningful experience (i.e. a persistent story or context) underpinned by a particular purpose.			Frame the game with a narrative/story line that allows players to project/envision themselves into an imagined future as a practicing occupational therapist. The premise of the game is that the player is building an occupational therapy practice informed by industrial psychology principles. The goal is to collect as many points as possible as a measure of success

In the following section the strategy followed to guide the application of the design principles and game elements in this study, is outlined and discussed.

3.4.4 Strategy for creating a gamified intervention

As previously mentioned, most gamification strategies share three basic commonalities;

- they begin with a well-considered understanding of the target audience;
- the objective/s of the gamified system are identified and how they will be achieved is considered; and
- the appropriate game elements that will foster the desired behaviour are selected.

An overview of each step is provided in the subsequent sections.

3.4.4.1 Understanding the target audience

The first step requires an understanding of the target audience, particularly who they are and the nature of the context in which they operate (Huang & Soman, 2013). The definition and awareness of student characteristics or profiles ensures that the appropriate tools and techniques are selected (Kiryakova et al., 2014). Factors to consider include for example the audience's age, level of knowledge or skill and tendencies to interact and participate in learning activities. Contextual information such as group size, setting (e.g. classroom or online) and time frame of the course of learning activities may offer insights into factors that hinder learning or advancement in the module or programme.

3.4.4.2 Defining learning objectives

The learning objectives convey what a student is expected to achieve and should therefore be explicit and clearly defined. The objectives may take the form of: general instructional goals (e.g. the completion of a project), specific learning goals (e.g. understanding primary concepts), or behavioural goals (e.g. increasing engagement in online learning activities) (Huang & Soman, 2013). Once the objectives have been established, the stages and milestones in the learning process are demarcated and linked to specific learning objectives within the gamified intervention. This is achieved by first delineating the target behaviours or learning objectives, which are then aligned with the learning activities, and assessments that are created (Simões et al., 2013; Werbach & Hunter, 2012). Learning objectives therefore inform the selection of suitable content and learning activities as well the game elements that will be employed to achieve them (Hansch & Newman, 2015). The practices for facilitating engaged learning should also be incorporated, for instance, making use of active learning and incorporating opportunities for collaborative learning (see section 2.4.5).

3.4.4.3 Selecting and applying elements

The final step involves the selection of game elements (that express the mechanics and dynamics) that will support the learning objectives and the activities created. Moreover, the components chosen for a gamification application depend on the intention of the designer, the purpose of the activity and the target group. Most elements, when used separately, do not necessarily make an activity engaging (Hansch & Newman, 2015). Nevertheless, a carefully planned combination of appropriate elements could significantly increase interest in the activity and motivation to continue (Pedro, Lopes, Prates, Vassileva, & Isotani, 2015).

Kapp et al. (2014) distinguish between two types of gamification, namely structural and content gamification. Structural gamification makes use of game-elements to create a structure around the content to propel a learner through the content. No modifications are made to the content itself, and only the structure is game-like. This approach is intended to motivate interaction with the content and engage the learner in the process of learning. Structural gamification includes elements such as rules, leaderboards, rewards structure, points, badges and levels. In contrast, content gamification is the application of game elements and game thinking to alter learning content to make it more game-like (Kapp et al., 2014). For example, introducing learning objectives as instructions or a challenge. This does not imply the creation of a fully-fledged game, but rather gamifying curriculum content by applying elements such as a storyline, challenge, curiosity, characters, feedback and freedom to fail. The intervention in this study made use of a combination of structural and content gamification.

Lastly, various tools are available for the application of gamification that may fully support or contribute in part to learning. This stage requires consideration of how activities can be gamified as well as the platform (LMS) on which it will be hosted (Huang & Soman, 2013). Careful consideration should also be given to the functionality and affordances of the LMS.

3.5 SUMMARY: CHAPTER 3

The primary objective of the chapter was to present the theoretical foundation of gamification that would inform the development of a framework of design principles. The chapter began with a discussion of ICT use in South African higher education, highlighting some of the benefits and challenges. Next, gamification was put forward as an emerging paradigm with the potential to enhance existing learning environments followed by a discussion on the benefits and criticisms. The focus then shifted to the design of educational gamification. The key theoretical perspectives and the building blocks of gamification design (i.e. game elements, mechanics and dynamics) were synthesized to create a framework of six educational gamification design principles for student engagement. The proposed set of tentative design principles guided the development and construction of the gamification interventions in this study. The chapter concluded with an overview of a strategy for applying gamification. The methodology for the empirical evaluation of the gamification intervention is discussed in the following chapter.

CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

The guiding framework for this study is design based research (DBR) as this mode of inquiry is proposed to be best suited to the field of educational technology development (Herrington, Mckenney, Reeves, & Oliver, 2007). DBR is endorsed as an approach that has the potential to create and widen the reach of knowledge pertaining to the development, enactment and sustainability of learning environments (Design-based Research Collective, 2003). Furthermore, DBR is a holistic approach and emphasises the context in which an educational intervention is investigated, rather than focusing on isolated variables (Plomp & Nieveen, 2007). Hoadley (2004) advocated that the strength of this approach lies in

> "… helping connect interventions to outcomes through mechanisms and can lead to better alignment between theory, treatments, and measurement than experimental research in complex realistic settings like the classroom … design-based research views outcomes as the culmination of the interaction between designed interventions, human psychology, personal histories or experiences, and local contexts" (p. 204).

DBR thus acknowledges the influence of contextual factors on the enactment and outcome of the educational intervention. Based on the discussions in the preceding chapters, this study primarily focused on the application of existing knowledge of student engagement and gamification in an educational setting and the following overarching research question was stated: *What are the characteristics of an educational gamification design framework that facilitates student engagement in a first year Industrial Psychology module?*

The investigation thus required a robust, methodologically sound and systematic approach to design and evaluate a framework of principles, tested in a real world application. The DBR approach is therefore ideally suited to this investigation. In order to generate a rich, holistic description of the phases in the DBR process, three case studies are documented to comprehensively explore student engagement and meet the set objectives as indicated in Chapter 1 namely:

- to propose and refine educational gamification design principles for student engagement within the HE context, based on literature;
- to apply a framework of educational gamification design principles within an online setting for student engagement within the HE context;
- to explore and describe the outcome of applying an educational gamification design principles framework for student engagement within an online learning management system; and
- to propose a revised design framework of educational gamification design principles that can be applied and used feasibly to support and facilitate student engagement within an HE context.

This chapter aims to clarify the methodological choices made. The subsequent sections outline the research paradigm that underpinned the selection and application of the various elements of the methodology. In addition, the methodological framework or approach (i.e. way of doing research within a particular research community) is encapsulated in the discussion and explanation of the DBR philosophy and process. Finally, the research methodology that includes mixed methods data collection techniques, measures and analyses are described and justified.

4.2 RESEARCH PARADIGM

Paradigmatic perspectives are essentially basic beliefs, schools of thoughts or worldviews that influence the researchers *modus operandi* as well as dictate how research data is interpreted (Guba & Lincoln, 1994; Kivunja & Kuyini, 2017). Guba and Lincoln (1994, p. 107) described a paradigm as follows:

> "a worldview that defines, for its holder, the nature of the "world," the individual's place in it, and the range of possible relationships to that world and its parts … beliefs are basic in the sense that they must be accepted simply on faith (however well argued); there is no way to establish their ultimate truthfulness."

A paradigm is thus an expression of the researchers philosophical orientation that informs and guides inquiry as it governs every aspect of the research process, including the selection of the methodology and methods used (Guba & Lincoln, 1994; Kivunja & Kuyini, 2017).

Paradigms are characterised by their; *ontological* (i.e. the nature of reality and how it is organised or understood); *epistemological* (i.e. the nature and form of knowledge specifically how it is generated, captured/attained and disseminated); and *methodological* (i.e. the rationale for and execution of data collection strategies and analyses) stance (Guba & Lincoln, 1994; Morgan, 2007; Scotland, 2012). These views are often opposing and traditionally categorised as scientific or naturalistic (Guba & Lincoln, 1994) or positivist and constructivist (Tashakkori & Teddlie, 1998) resulting in much debate as each endorses a mono-method approach to research (Armitage, 2007). More specifically, they are often linked to a specific epistemological stance that promotes varied assumptions of reality and knowledge reflected in the methodology and methods associated with each, for example a quantitative approach denotes a positivist paradigm and qualitative approach implies a constructivist approach (Armitage, 2007; Lodico, Spaulding, & Voegtle, 2006; Scotland, 2012).

With the more prevalent combination of qualitative and quantitative methods to address research problems, the pragmatic paradigm as the "third way" gained momentum as an alternative research paradigm to mono-methodological positions (Armitage, 2007, p. 1). The pragmatic paradigm emerged as a response to the aforementioned debate offering a pluralistic alternative better aligned to mixed method and mixed model approaches (Armitage, 2007; Creswell, 2003). Tashakkori and Teddlie (2010) endorse pragmatism as a sufficiently robust epistemological base that offers an alternative and practical middle position to other paradigms, both philosophically and methodologically. However, Biesta (2010) argues that pragmatism should not be conceptualised as a philosophical stance but rather as a "set of philosophical tools that can be used to address problems − not in the least problems created by other philosophical approaches and positions" (p. 97). The pragmatic logic is underpinned by the notion that the researcher makes a choice about the mix of methods and procedures that would best answer the research problem at hand (Johnson & Onwuegbuzie, 2004). However, despite the utilitarian application of this paradigm it also endorses engagement in philosophical debate, if the purpose thereof is to address problems.

Pragmatism has become synonymous with action-oriented approaches in applied research (Lodico et al., 2006) such as the mixed-method research and the practical application and evaluation of interventions (Tashakkori & Teddlie, 2010). Moreover, it advocates an outcome-oriented approach with a particular focus on meaning and interpretation (Onwuegbuzie & Johnson, 2006) and the products of research (Biesta, 2010). Shannon-Baker (2016) described

pragmatism as having an "emphasis on communication and shared meaning-making in order to create practical solutions to social problems… based on the belief that theories can be both contextual and generalizable by analysing them for 'transferability' to another situation" (p. 322).

Pragmatists select the most appropriate methods to describe or answer the research question at hand (Creswell, 2003). In addition, Johnson and Onwuegbuzie (2004) assert that pragmatism offers a "practical and outcome-oriented method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt" (p. 17). This also requires collaboration with knowledgeable participants and the use of tools and theories to search for and improve settings and problems (Lodico et al., 2006).

The pragmatic paradigm is therefore best suited to the present study as it supports the DBR approach as well as a mixed (i.e. qualitative and quantitative) data gathering strategy. Moreover, engagement is considered a reflection of an individual's interaction with the context (Fredricks et al., 2004), which requires a recognition, understanding and inclusion of a number of factors that cannot and should not be examined in isolation. The research strategy selected for this study was thus based on the correspondence between the problem and the approach, the researcher's own experiences as well as the target context and audience (Creswell 2003).

4.3 METHODOLOGICAL APPROACH

The education context is a multifaceted environment that is confounded by a myriad of influences that make research in this domain both difficult and complex (Reeves, 2006). Educational research has been criticised for the weak links between theory and practice and perceived weaknesses in the measures, methods and designs employed. This sentiment is supported by the Design-based Research Collective (DBRC) (2003), in their view "educational research is often divorced from the problems and issues of everyday practice − a split that creates a need for new research approaches that speak directly to problems of practice and that lead to the development of "usable knowledge"" (p. 5). The DBRC refer to this as the "credibility gap" that they attribute to unscientific research approaches that are employed in the investigation of educational interventions. When focusing specifically on educational technology research, Reeves (2006) contended there is "a legacy of ill-conceived and poorly conducted research that results in no significant differences or, at best, in modest effect sizes" (p. 57).

An emergent approach that has developed in response to this line of criticism is design-based research (DBR) where the focus is on the scholarship of learning and the systematic design and examination of instructional approaches and tools, within specific contexts (Brown, 1992; Collins, Joseph, & Bielaczyc, 2009; Design-based Research Collective [DBRC], 2003). Moreover, it is described as a sequence of approaches through which new theories, artefacts, and practices that explain and possibly influence learning and teaching in naturalistic settings are produced (Squire & Barab, 2004). The DBR researcher thus acknowledges the influence of contextual factors on the enactment and outcome of the educational intervention. Barab (2014) argues that the goal of DBR is to "use the close study of learning as it unfolds within naturalistic context that contains theoretically inspired innovations, usually that have passed through multiple iterations, to then develop new theories, artefacts and practices that can be generalised to other schools and classrooms" (p. 151). The philosophy underpinning DBR has led to the development of multiple perspectives of educational design research that aim to satisfy the call for robust examinations of educational issues, that further theoretical understanding but also propose and test solutions to these problems (McKenney & Reeves, 2012). What follows is a description of the DBR approach and the process enacted in this study.

4.3.1 Design based research description

The DBR approach has emerged in response to the increasingly evolving (mostly) technologically driven learning environment. It is primarily applied in educational research and is defined by Wang and Hannafin (2005) as the "systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (p. 7). The defining characteristics of a design-based research study are that

(1) it is situated in a real educational context,
(2) it focuses on the design and testing of a significant intervention,
(3) it adopts mixed-methods to provide better guidance for educational refinement,
(4) it involves multiple iterations to reach the best design of intervention, and
(5) it promotes collaboration between researchers and practitioners (Anderson & Shattuck, 2012).

DBR is akin to, design research (Reeves, Herrington, & Oliver, 2005), developmental research (McKenney & Van den Akker, 2005), design experiments (Brown, 1992) and action research (Anderson & Shattuck, 2012). Although these research approaches have slight differences in focus they also overlap and are essentially driven and underpinned by the same underlying goals and characteristics. DBR, in particular, is pragmatic; grounded; interactive, iterative and flexible; integrative; and contextual (Wang & Hannafin, 2005). Refer to Table 4.1 for descriptions of these characteristics.

Table 4.1

Characteristics of Design Based Research

Characteristics	Explanations
Pragmatic	• DBR refines both theory and practice. • The value of theory is appraised by the extent to which principles inform and improve practice.
Grounded	• DBR is theory-driven and grounded in relevant research, theory and practice. • DBR is conducted in real-world settings and the design process is embedded in, and studied through, design-based research.
Interactive, iterative, and flexible	• Designers are involved in the design processes and work together with participants. • Processes are iterative cycles of analysis, design, implementation, and redesign. • The initial plan is usually insufficiently detailed so that designers can make deliberate changes when necessary.
Integrative	• Mixed research methods are used to maximize the credibility of ongoing research. • Methods vary during different phases as new needs and issues emerge and the focus of the research evolves. • Rigor is purposefully maintained, and discipline applied appropriate to the development phase.
Contextual	• The research process, research findings, and changes from the initial plan are documented. • Research results are connected with the design process and the setting. • The content and depth of generated design principles varies. • Guidance for applying generated principles is needed.

Note: Adapted by permission from "Design-based research and technology-enhanced learning environments", Wang, F. & Hannafin, M.J., 2005, *Educational Technology Research and Development, 53(4),* p. 8. Copyright 2018 by Springer Nature. Adapted with permission.

In particular, DBR shares several commonalities with action research which can be ascribed to their comparable epistemological, ontological, and methodological foundations (Anderson &

Shattuck, 2012). Both approaches are led by the pragmatic paradigm, are participatory and conducted in naturalistic settings (i.e. real life contexts) (Anderson & Shattuck, 2012; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). In addition, both can be categorised as applied research and involve iterative rounds of planning, action and reflection (Anderson & Shattuck, 2012). However, methodologically, action research emphasises action and reflection and views the use of empirical methods less favourably. Its process is embodied in a cyclical method of planning-acting-reviewing and evaluating which allows teachers to act and reflect on their practice in order effect social change. In comparison DBR, emphasises both the development of learning environments and the systematic examination of the effected outcomes (Cobb et al., 2003). It also entails iterative cycles of testing and revision to refine the designed learning environment through qualitative and quantitative methods of evaluation. DBR's contribution highlights the evaluation of design principles that not only cater to the needs of the local environment but advance the understanding of theoretical relationships too (Barab & Squire, 2004).

The robustness of DBR research is achieved via systematic educational design processes that iteratively analyse, design, evaluate and revise activities for the purpose of improving teaching and learning (Herrington et al., 2007). The design of the learning environment/application and theory development are thus intertwined and a central goal of this approach. In addition, the application of these designs and theories are an account of how they function in a specific authentic setting from which pertinent methods, implications and outcomes are communicated and disseminated to the community at large. This, therefore, requires the documentation of success and failures as well as all interactions that refine our understanding of the learning issues involved (DBRC, 2003). Correspondingly, Reeves (1999) advocated that in educational design research "our research and evaluation efforts should be primarily developmental in nature … the purpose of such inquiry should be to improve, not to prove" (p. 18).

The present study sought to harness and encapsulate the characteristics of rigorous design based research. The tenets discussed above guided the development and enactment of the DBR in the current study and are demonstrated in the discussion, application and reporting of the DBR methodology and resultant findings of this study.

4.3.2 The design-based research process

The general consensus in the literature is that DBR is a long-term approach with multiple iterations of design, development and improvement (Amiel & Reeves, 2008). Hence, its suitability for studies that span shorter terms (e.g. Masters and PhD studies) has been questioned (Pool & Laubscher, 2016). In response, McKenney and Reeves (2012) proposed a generic model for DBR that is more suited to short term projects (see Figure 4.1). This model was adapted from the fundamental principles of instructional design and curriculum development and elaborated on the previous models and frameworks of DBR, with specific focus on the researcher perspective. The generic model is thus adaptable to various approaches and contexts as it adheres to, and incorporates, the essential elements of educational design research : that isthree core phases (namely; analysis and exploration; design and construction; and evaluation and reflection) in a flexible, iterative structure with a dual focus on theory and practice and indications of being use-inspired (McKenney & Reeves, 2012).

The iterative enactment of the three primary phases, by implication, involve collaborations with practice that influences the generation of theoretical understanding and improvement of an intervention, thus increasing its scope and use over time. The generic model depicts a unified design and research process that allows both iterative and flexible phases of empirical and practice focused actions (McKenney & Reeves, 2012). This approach supports the identification of improvements but also allow for changes to be implemented and evaluated throughout the process (Herrington et al., 2007).

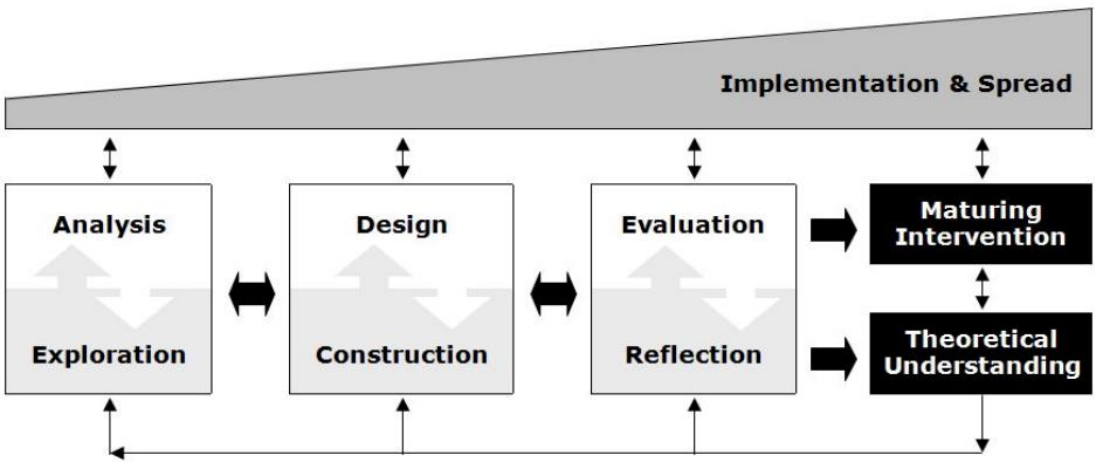

Figure 4.1. Generic model for conducting design research in education. Reprinted from *Conducting Educational Design Research* by S. McKenney & T. Reeves, 2012, New York: Routledge p. 77.

McKenney and Reeves (2012) expanded on this process by visualising the subcomponents in terms of macro-; meso- and micro-cycles (see Figure 4.2). Each phase of the model represents a micro-cycle as each is distinguished by its unique cycle of action and reasoning. The authors argue that the first analysis and exploration cycle and last evaluation and reflection cycle are empirical in nature due to the data gathered in these phases. In contrast, the design and construction cycle is generative and results in the development of an intervention informed by the literature or insights from practice. A meso-cycle is a thus a combination of the three micro-cycles but does not represent the complete process. A macro-cycle can be comprised of two or more meso-cycles and thus represents the research process in its entirety (McKenney & Reeves, 2012). Long term DBR projects generally involve numerous meso-cycles over an extended period of time.

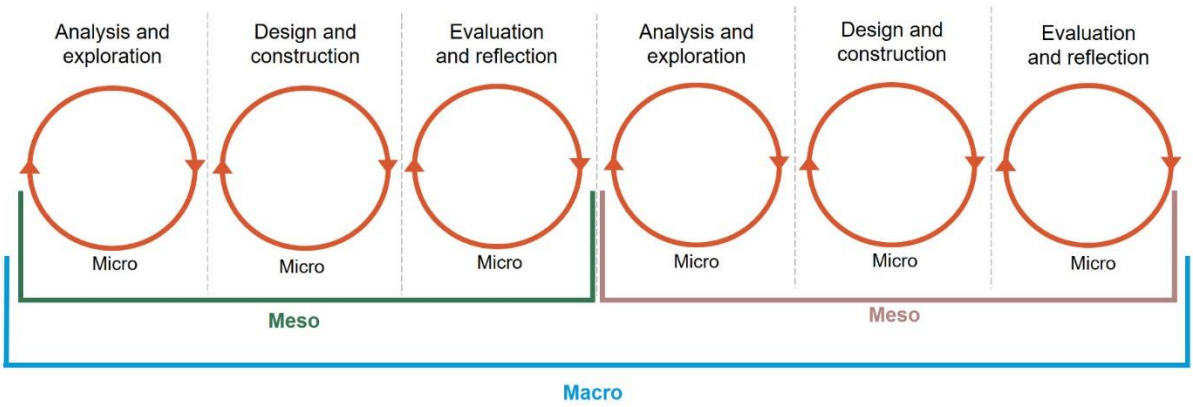

Figure 4.2. Micro-meso and macro-cycles in educational design-based research. Adapted from *Conducting Educational Design Research* by S. McKenney and T. Reeves, 2012, New York: Routledge, p. 78. Copyright 2018 Taylor and Francis Limited UK. Adapted with permission.

The dominant research goal in educational design studies is to solve and/or contribute to solving teaching, learning and performance problems and the outcomes or products of the design process are an important contribution to this body of knowledge. The DBR process culminates in outputs in the form of both knowledge and a product (referred to as theoretical understanding and maturing intervention in their generic model – see Figure 4.1). The knowledge product takes the form of design principles or "evidence-based heuristics that can inform future development and implementation decisions" (Herrington et al., 2007, p. 4095). Design principles develop from retrospective reflection and consideration of findings and observations that may hold relevance to the context at hand or have broader applicability. Both theoretical understanding and the product of design (i.e. the intervention) evolve through the micro – and meso-cycles of the DBR process. Therefore, the development and improvement of the

intervention enriches practice directly and also makes an indirect contribution to theoretical understanding (McKenney & Reeves, 2012). In addition, Herrington et al. (2007) include societal output as a further contribution and describe it as the consequent professional development of all participants in the study, including the researcher and all their collaborators.

The generic model guided the planning and execution of this study (see Figure 4.3). The findings are presented as three case studies that explicate the entire research process (i.e. macro-cycle). Each meso-cycles is inclusive of three micro-cycles thus, the entire study included nine micro-cycles in total.

Figure 4.3. Micro-, meso- and macro-cycles in the present study

The phases of the generic model outlined in the following paragraphs provides a theoretical schema for the three case studies and a brief description of the micro cycles and the specific activities actioned at each phase.

4.3.2.1 Analysis and exploration

The DBR approach is initiated by a micro-cycle of analysis and exploration of an educational problem that informs the purpose for the study (Herrington et al., 2007). This phase is exploratory and draws on a number of sources to define the research problem clearly and to assess and learn how others have sought to solve similar problems. The analysis and exploration was reported in Chapters 2 and 3 to identify and articulate the constructs under investigation. This involved engagement with both the literature as well as practitioners in order to clarify the research problem and derive preliminary design principles that could guide the development of a solution to address the research problem (Herrington et al., 2007; Mckenney & Reeves, 2012). Refer to Table 3.3 in Chapter 3.

In DBR the research problem is defined as the discrepancy that exists between the current state and the desired state within the specific context (McKenney & Reeves, 2012). The desired state was thus to promote and facilitate student engagement through gamified learning activities (i.e. the application of gamification principles and game elements). The *analysis* of the literature on the constructs of interest (i.e. student success, student engagement and gamification in education) led to the clarification of the research problem and identified theoretical inputs pertaining to the problem and context. In addition, the researcher also *explored* comparable problems and related solutions by forging close collaborative relationships with individuals in practice (Herrington, Reeves, & Oliver, 2010; McKenney & Reeves, 2012). The researcher established collaborative relationships with practitioners[5] (e.g. instructional designers, and blended learning coordinators) and subject matter experts[6] (e.g. seasoned academics and lectures) in the fields of gamification; blended learning; instructional design and development; and student engagement. These interactions were chiefly informal discussions, conducted throughout the research process that provided practical and theoretical insights that enhanced the understanding of the problem and guided the development of the solution. This undertaking yielded a tentative list of theoretically derived design principles that informed the development of a gamified prototype. These principles were further refined throughout the research process.

4.3.2.2 Design and construction

The design and construction of a solution involves developing and following a logical and clearly documented process. The solution is informed by the literature and is often an intervention, tool or practice that is proposed (McKenney & Reeves, 2012). The focus of this micro-cycle is on creating a conceptual model rather than testing it. Herrington et al. (2007) therefore advise generating a well-defined theoretical framework to provide a firm grounding for the development of practical design guidelines. Design, therefore, requires articulation and justification of ideas, techniques and solutions that are grounded in practice or theory. Construction, on the other hand, concerns the application of design ideas to develop the solution (e.g. an intervention).

In this study, the literature provided the central themes, perspectives and practices used in the facilitation of student engagement and application of educational gamification. The design

[5] Magda Barnard, Mine de Klerk, JP Bosman

[6] Magda Fourie Malherbe, James Gain (UCT),

component included informal brain storming sessions with instructional designers and experienced practitioners, which culminated in potential solutions. These sessions thus served to explore and generate ideas as well as assess their feasibility. In addition, the researcher sought to collate and synthesise the educational gamification literature to identify game elements and design principles that could be leveraged to increase student engagement in a higher education context (section 3.2).

The researcher, with the assistance of an instructional designer, constructed two interventions for this study. The design principles developed in Chapter 3 informed this endeavour. The SUNLearn learning management system served as the platform for the intervention. On this platform each module that a student is enrolled for is assigned a page. The design principles and game elements selected through the design process were applied to create a gamified learning environment with various activities. The design decisions and principles and the construction of the intervention for each case are described in Chapters 3 and 5 respectively.

4.3.2.3 Evaluation and reflection

The design and construction cycle is followed by the micro-cycle of evaluation and reflection. Mckenney and Reeves (2012) broadly define this phase as any type of empirical assessment conducted on or through an intervention. Evaluations are therefore conscious, systematic and formalised and may examine the "soundness, feasibility, local viability, broader institutionalization, immediate effectiveness, and/or long-term impact" (p. 80) of the design or intervention. Through this activity qualitative and/or quantitative data is collected and analysed to assess the impact the intervention had in a particular context (Herrington et al., 2007). Moreover, theoretical understanding advances through reflection: that is active and contemplative deliberation of the organically derived combination of research and development. This process of systematic evaluation and critical reflection supports a considered examination of the findings (i.e. accepting, refining or refuting tentative assumptions or principles) to produce new insights and modifications to the design documents or intervention (McKenney & Reeves, 2012).

The present study encompasses three meso-cycles (Case 1, 2 and 3) of research conducted over a period of two years. Consideration was given to the various methods and techniques available and best suited to meet the objectives set out (see Section 4.3.7). Hence, the collection and

analyses of both quantitative and qualitative data formed the basis of the empirical investigation of the intervention.

4.3.2.4 Overview of the meso-cycles in the study

The first two meso-cycles took place in the Industrial Psychology 132 module (Occupational therapy) and the third was conducted in the Industrial Psychology 152 module (Career Psychology) presented by the Department of Industrial Psychology. Each meso-cycle is reported as a separate case study. In Chapter 5, each case study will describe the context and participants involved and serve as a report and discussion of the findings. Section 4.3 provides a detailed description of the research methodology and data collection techniques selected for the evaluation of the three interventions. An overview of each meso-cycle is briefly outlined below.

Meso − cycle 1: The first iteration took place in the first semester of 2016 and served as an initial implementation of the constructed intervention. The intervention ran for a period of 13 weeks. A focus group interview facilitated the collection of qualitative data that was audio recorded and transcribed as well as the course evaluation completed at the end of the module. These documents were analysed to ascertain the most salient experiences of the students' exposure to the gamified intervention and to identify refinements that could be made to the intervention.

Meso – cycle 2: The second iteration took place the following year (2017) in the same module with a new cohort of students. The intervention was refined and once again implemented for 13 weeks. Data collection in this phase involved the collection of qualitative focus group data and quantitative data using a questionnaire. The questionnaire measuring student engagement was compiled and piloted in preparation for use in research cycle 3. The questionnaire was placed on Stellenbosch University's online survey platform, Checkbox. Students were invited to complete the questionnaire and the data analysed in order to confirm the psychometric viability of the questionnaire (see Section 5.2.3.2). The inclusion of quantitative data collection techniques provided a further means to evaluate the application of the gamified learning platform empirically through the assessment of the extent to which student engagement was influenced.

Meso – cycle 3: The third iteration entailed the application of the design principles garnered from the first two iterations. A process of redesign, enactment and review was followed to develop a new intervention building on the learnings from the first two iterations.

At the start of the module (prior to the implementation of the new intervention), enrolled students were exposed to a "normal/un-gamified" SUNLearn page for a 4 week period. They were provided with two learning activities and required to complete a compulsory online test during this time. In the 5th week of the semester, the new intervention was introduced, implemented and run over a period of 4 weeks. A within-subject experimental design was selected to evaluate the impact of this intervention. All enrolled students could access and interact with the gamified intervention on SUNLearn, however, participation in the study required the completion of the pre- and post-test measurement of student engagement. Students who volunteered to participate in the study had a week at the start of the intervention to access and complete the questionnaire and at a second time point after the intervention. Analyses of the pre- and post-test data primarily sought to identify differences in the item scores in the questionnaire and ascertain whether these differences were significant or not. In addition, the researcher conducted a focus group interview; extracted learning analytics from the SUNLearn platform and invited students to complete an online feedback form (e-survey) for additional qualitative information. The quantitative and qualitative data were analysed, interpreted, and integrated.

Lastly, a reflection on the findings and identified or proposed refinements followed each meso-cycle of the study. The identified refinements also contributed to the improvement of the design principles in the following cycle. An integrative discussion combining and comparing the findings across all three iterations is presented in Chapter 6. A final set of design principles for an educational gamification application for student engagement is also put forth as one of the principle contributions of this research project. The following sections document the research methodology encapsulating the strategies, methods and techniques selected to carry out the study.

4.3.3 Integrating DBR and Case study research methodology

A pragmatic logic endorses the use of "procedures that "work" for a particular research problem under study" (Creswell, 2012, p. 563). This is particularly important in an education setting as the classroom represents an objective reality but it is also subject to a subjective reality

experienced by each individual that engages with the classroom setting. Therefore, to fully understand a problem in this setting one would need to acknowledge and consider these opposing "realities". Moreover, these realities would require various forms of data collection as one method would not suffice. For this reason, adhering to a pragmatic logic promotes the use of various methods to understand the research problem and thus endorses the collection of both qualitative and quantitative data (Creswell, 2012).

Guided by this rationale a multiple, instrumental case study design was selected to inform and compare subsequent cases. A case study is defined as an "empirical inquiry that investigates a contemporary phenomenon in depth and within its real life context, when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 2009, p. 18). This design thus promotes a multifaceted approach that allow for a phenomenon to be revealed and understood within its context (Baxter & Jack, 2008). Rather than controlling or manipulating variables the researcher observes how these variables may interact (Dooley, 2002). This enquiry is guided by specific theoretical propositions and multiple sources of evidence that are analysed and triangulated in order to examine and understand the variables of interest (Yin, 2009).

An essential element of a case study design is the case. A case signifies a singular or prolonged observation of a delimited phenomenon (Gerring, 2007) or bounded system (Stake, 2011) that is constrained to a particular time frame, place, or physical boundary that is to be studied. A case provides a comprehensive description of an individual, activity, event, process or problem as it unfolds. This results in a comprehensive written account of the context, individuals involved, and the consequence of interactions which may include; problems, conflicts, failures and successes. An attempt is therefore made to provide a balanced, yet intricate portrayal of a narrow sample of events or conditions resulting from a comprehensive contextual analysis (Dooley, 2002).

Each case included in this study is holistic in nature and offers a description of the application of gamification in order to explore the effect of the intervention on student engagement. By Stake's (1995) definition, these cases can be classified as collective instrumental cases as the aim is to develop insights specific to each context; to facilitate understanding through the examination of its finer contextual details and interactions; and draw comparison across cases in order to derive broad design principles that may be transferable between contexts. Each case is also descriptive and exploratory in nature as each is used for exploration, where the outcome

of an intervention is not clear, and also provides a description of an intervention, phenomenon and context in which it transpires (Yin, 2009).

Darke, Shanks, and Broadbent (1998) advocated the use of multiple cases or cross case analysis as appropriate for the examination and comparison of diverse contexts. Multiple cases may be selected where similar outcomes are envisaged (literal replication) or to produce contrasting outcomes for predictable reasons (theoretical replication). In this study, the first case outlined the evaluation of the gamification prototype that was developed. The second case was considered a literal replication of the first case as the same design prototype was applied in a similar context (i.e. an Industrial Psychology module), using a homogenous cohort, and with minor improvements to the prototype. The third case can be characterised as a theoretical replication of the two preceding cases as it was applied in a different classroom context in order to establish the transferability of the design principles. It was evaluated quantitatively through an experimental design, in addition to the qualitative evaluations that were previously applied. The inclusion of three case studies also facilitated a multiple case comparison to strengthen the analytical generalisations stemming from this study.

4.3.4 Challenges with DBR and case study research

DBR and case study research often receive harsh criticism when compared to other methods of inquiry that are considered more rigorous approaches. On the one hand, case study research is often considered to be weaker in comparison to other methods and judged as lacking rigour (Hyett, Kenny, & Dickson-Swift, 2014; Yin, 2009) or (regarding DBR) is criticised for not being a well-defined research method (Prediger, Gravemeijer, & Confrey, 2015). In both cases these prejudicial judgements can either be attributed to deficient exemplars in which the investigator has neglected to follow a systematic procedure or has based their findings and conclusions on ambiguous evidence or subjective views (Yin, 2009). In DBR the research may adopt a careless and haphazard approach to data collection and analysis resulting in biased conclusions. In addition, evaluative criteria for designed artefacts may also be weak or missing. Juuti and Lavonen (2006) propose that specific goals should guide the evaluation of a prototype and appropriate changes made if these goals are not achieved. In addition, Yin (2011) advocates the use of various forms of triangulation to safeguard the quality of case study research. These techniques can also be applied in DBR.

Furthermore, case studies offer limited evidence for scientific generalisation. Yin (2009) argued that a case study and experiment are comparable, in the sense that, a single case or a single experiment (and DBR cycle) cannot be considered a representative sample on which conclusions can be reliably based and that replication is required before conclusions are accepted as fact. The phenomenon under investigation therefore needed to be observed under various conditions (e.g. a set of experiments or multiple-case studies). Therefore, the goal in case study, experimental research and design-based research is not to calculate frequencies (statistical generalisation) but rather to develop and generalise theories (analytic generalisation) on the basis of empirical observations (Gibbert & Ruigrok, 2010; Yin, 2009). The aim is therefore to generalise to theoretical propositions and not populations. In DBR, findings can thus be evaluated according to how successfully the derived knowledge informs theoretical understanding and translate into artefacts or interventions that improve teaching and learning (Juuti & Lavonen, 2006).

Further criticism that applies to DBR and case studies is the protracted time lines and amassing of unmanageable amounts of data (Yin, 2011). Juuti and Lavonen (2006) advise that periods and data gathered should be sufficient for the purpose of the study and not be unnecessarily prolonged or extended.

Despite the criticism levelled against case study research, Yin (2009) contends that case study research can and should be approached in a systematic, rigorous manner. Borrowing from the positivist tradition, rigour is embedded in the degree to which internal validity, construct validity, external validity, and reliability can be established (Campbell, 1975; Campbell & Stanley, 1963). Hence, Gibbert and Ruigrok (2010) and Yin (2009) argue that measures can be taken to achieve methodological rigour by focused improvements of the validity and reliability of case study research. In the same token, these measures can be applied to DBR and are discussed next.

4.3.5 Ensuring methodological rigour in DBR

As mentioned, the four criteria for assessing rigour include: internal, construct, and external validity, as well as reliability (Gibbert & Ruigrok, 2010; Yin, 2011).

Internal validity refers to the underlying interaction between variables and results. This entails the provision of credible causal argumentation through logical reasoning that can persuasively support the derived conclusions. Gibbert and Ruigrok (2010) propose that internal validity can

be achieved through the formulation and provision of a clear research framework and use of pattern matching and theory triangulation in the data analysis phase.

Construct validity refers to the *quality of the operationalisation of a concept.* Construct validity is addressed in the data collection phase by ensuring that the select techniques or methods provide accurate observations of the reality (Denzin & Lincoln, 1994). Measures employed to improve construct validity can include establishing a clear chain of evidence to ensure that that the procedure is replicable; and triangulation by means of varied data collection strategies and data sources (Gibbert & Ruigrok, 2010).

External validity is a direct indication of generalisability. It refers to the extent to which theories that have been proven to explain a phenomenon in one context can be extended to other contexts. As previously mentioned, statistical generalization is not possible in case study and design research (Yin, 2009). However, analytical generalizations can be enhanced through cross case analysis of multiple cases. More importantly, a clear rationale for how cases were selected should be provided and supported by a detailed account of the contextual considerations that informed this selection (Gibbert & Ruigrok, 2010).

Reliability refers to the extent to which the steps a researcher has taken are explicated for future use, put differently, “the degree of consistency with which instances are assigned to the same category by different observers or different occasions” (Silverman, 2005, p. 210). In qualitative studies reliability is conveyed through transparency and replication. Transparency refers to a detailed and precise account of the research procedure or protocol followed. This specification of how the research was conducted is inclusive of the data that was collected, for example transcripts or excerpts. This meticulous and authentic practice facilitates the effective replication of the case study for subsequent investigators. Silverman (2005) recommends increasing reliability by: including recording of interviews, careful transcription of these encounters, inter-rater reliability checks on the coding of data, as well as presenting extracts of data in the research report. To ensure methodological rigor the strategies reported in Table 4.2 guided the study.

Table 4.2

Steps Taken to Ensure Validity and Reliability in the Present Study

Criteria	Tactics	Research phase	Actions
Construct validity	Use multiple sources	Data collection	Use of focus group interviews, a survey, feedback forms, activity logs and metrics.
	Establish chain of evidence	Data collection	Electronic copies of various sources of evidence were stored e.g taped and transcribed focus group interviews, output of statistical analysis, documents etc.
Internal validity	Pattern matching	Data analysis and reporting	Conducted cross case comparisons
	Explanation building	Data analysis and reporting	Identified links between game elements and dimensions of student engagement
External validity	Replication logic across multiple cases	Research design	Investigated three cases using replication logic
Reliability		Data collection	
	Develop case study database	Data collection	Transcribed interviews, documents of record, feedback forms

The next important consideration was the selection of the research population and sample.

4.3.6 Research population and sample

The three samples selected were from three industrial psychology modules offered by the Industrial Psychology Department at Stellenbosch University, thus a non-probability, purposive sampling strategy. The selection of the samples was driven by the purpose of the study and the researchers reasoning or assessment of which units of observation would be most appropriate or illustrative (Babbie, 2010). Moreover, Babbie and Mouton (2001) argued that the researcher "seeks to maximise the range of specific information that can be obtained from and about that context, by purposefully selecting locations and informants that differ from one another" (Babbie & Mouton, 2001, p. 277). The decision to use these modules was determined by the practicality, convenience and accessibility to the modules. This strategy is also referred to as theoretical sampling whereby the researcher identifies sources of information that may provide the richest data that are central to the phenomenon in question (Creswell, 2012).

The researcher had taught and/or coordinated the modules over a period of five years and thus had access to the modules and module content. This placed the researcher in the unique position

of being both practitioner (i.e. lecturer) and researcher. In addition, the two modules contrasted significantly in terms of the content and student profile.

The first module, Industrial Psychology 132 (Occupational Therapy), was used twice in this study and is a service module offered to occupational therapy students. The class size is relatively small as this is a selection programme with restrictions on student numbers (approximately 50 students). The majority of students are female, with the exception of one male student (2016 and 2017). The module is offered in English with an interpretation service, however, the module content (e.g. slides and other resources) and assessments are provided in English and Afrikaans. Students were encouraged to ask questions, engage with peers and complete assignments in the language with which they are most comfortable. The module has a high pass rate and classes are well attended. Students are generally diligent and the majority complete all the required assessments.

The second module, Industrial Psychology 152 (Career Psychology), is an elective module offered to BCom, BA and in some cases, BSc students. The class sizes for this module are relatively large with approximately 300 to 400 students enrolled each year. The module is offered in a parallel language format (separate lectures), with one English class and one Afrikaans class. Gender groups are generally evenly distributed. The module's pass rate is moderate (> 70-75%) but has fluctuated between 58.8% in 2014 to 77.1% in 2016. Low class attendance has been an ongoing issue in both the English and Afrikaans classes despite attempts to improve this (e.g. recording attendance).

For the purposes of this study, the online module content (i.e. formative and summative learning activities) in each module was gamified. All the students enrolled in the modules thus had access to the gamified SUNLearn platforms. Consent was sought from the course coordinators of both modules to gamify the learning activities on the LMS and to conduct the research. Both module coordinators were open to updating the online course material and learning resources. This provided a unique opportunity to redesign the online platforms in each module and create interactive learning activities. The activities were educationally aligned to the content, challenging and promoted collaboration between students.

The qualitative data collection procedure made use of a non-probability, purposive sampling design with voluntary participation. Inclusion criteria were:

- enrolled in an Industrial Psychology module in 2016 or 2017

- opted into and participated in the gamified activities
- accessed and interacted with the activities placed on the gamified platform

The data collection procedures selected for this study are discussed next.

4.3.7 Data collection procedure and methods

In keeping with the DBR approach and case study methodology, qualitative and quantitative data collection techniques were selected to gather and analyse data from the three classroom contexts. Qualitative data was gathered to explore and gain a deeper understanding of student engagement and an in-depth review of the literature established the central themes, perspectives and practices that are currently followed in the facilitation of student engagement and application of gamification. Focus group interviews elicited and explored the experiences of the participants. The qualitative data were primarily used to refine the design principles generated from the literature and strengthen the application of the gamified intervention in the next iteration. In addition, it was used to triangulate the quantitative data and provide insight into these findings (Bryman, 2012).

Concurrent with the qualitative data collection, a quantitative instrument was compiled and used to evaluate whether the use of a gamified intervention, based on design principles gleaned from the literature, positively influenced student engagement. The reason for collecting both quantitative and qualitative data was to bring together the strengths of both forms of research in order to compare, corroborate and explain the results across the three cases (i.e. classroom contexts). Stake (2011) argued that this method of inquiry is underpinned by rich descriptions of the phenomenon that help the reader towards an understanding of the phenomenon being examined. Moreover, this approach supports the triangulation of the data thereby improving the validity and providing clarity for the resultant interpretations and conclusions. A description and justification of the selected techniques for both the qualitative and quantitative methods follows.

4.3.7.1 Literature review

The review of the student success and student engagement literature followed a traditional narrative review of the literature. This approach supported the development of a substantive argument pertaining to the predictive role of student engagement when examining student

success. By examining the student engagement literature an understanding of the nomonological network of variables became evident.

The focus shifted to a systematic review of the educational gamification literature. The systematic review has been selected on the basis of the systematic rigour provided by this approach. A systematic review is characterised by an adherence to "a set of scientific methods that explicitly aim to limit systematic error (bias), mainly by attempting to identify, appraise and synthesize all relevant studies (of whatever design) in order to answer a particular question (or set of questions)" (Petticrew & Roberts, 2006, p. 10). A systematic review furthermore follows a structured protocol for the collection of relevant pieces of literature that are further analysed and synthesised. A nine-phase process for conducting systematic reviews prescribed by Gough, Oliver, and Thomas, (2012) was identified to guide this phase. The nine phases of the review included the following steps:

1. establishing the review question
2. defining inclusion and exclusion criteria
3. articulating the search strategy, including information sources
4. screening the articles to see if they meet the inclusion and exclusion criteria
5. reporting the results of the search strategy
6. extracting relevant data from included studies
7. assessing the methodological quality or rigour of the included studies
8. synthesising, either quantitatively or qualitatively, the collective evidence of the included studies
9. drawing conclusions and communicating these findings in a manner which is relevant to readership

Despite the fact that the field of educational gamification is relatively young a number of reviews examining this topic were identified. The decision was therefore taken to conduct a systematic review of the existing reviews on gamification in education. The systematic literature review was conducted to examine current reviews of gamification in education and specifically identify common theories, game elements and strategies that inform gamification development. A systematic review follows a structured protocol for the collection of relevant

pieces of literature that are further analysed and synthesised. The steps are briefly discussed in the following paragraphs.

Establishing the review question: A number of literature reviews and mappings of the literature have been published (Dicheva et al., 2015; Hamari et al., 2014) which prompted the need to examine the state of the evidence holistically. The review was guided by the question: *How do researchers or gamification developers in local and international studies in higher education contexts use the current theories, approaches, perspectives, frameworks or game elements (for engagement) to design gamified learning applications (gamification)?*

The following questions were formulated in order to comprehensively answer this question:

- How is gamification defined in the context of education?
- What are the minimum requirements (i.e. game elements) for the design of a gamification application for student engagement?
- What are the theoretical considerations (theories, theoretical frameworks, and theoretical perspectives) that inform gamification development in education?

Defining inclusion and exclusion criteria: Prior to beginning the search explicit inclusion and exclusion criteria were established in order to systematically and critically identify papers that would be best suited to the integrative review. Because the integrative review focused only on reviews pertaining to gamification in education, only papers that were presented as systematic mappings, systematic literature reviews or narrative literature reviews were considered. In addition, the reviews had to focus specifically on the use of gamification in education contexts and could also examine gamification in conjunction with related concepts such as game-based learning or outcomes such as learning, engagement or motivation. Only peer-reviewed papers were included.

Papers that were excluded met the following criteria: papers focused only on games or serious games, duplicates found across different databases, papers that were only available as abstracts, papers not in English, masters or doctoral theses or dissertation chapters.

Data sources and search strategy: The systematic search requires the application of various methods to numerous sources of data in order to ensure that the search strategy is both rigorous

and comprehensive (Booth, Papaioannou & Sutton, 2013). The search process began by selecting the relevant search terms and databases that would be accessed.

The search terms were selected on the basis of the type of articles that were required and included Boolean AND to link the major search terms and Boolean OR to indicate alternative terms that appeared in the title, abstract or keywords. The search string was then applied to all the databases as follows:

“gamification” AND “education” AND “systematic” OR “literature” OR “review” OR “mapping”

The electronic databases selected for the review were aligned to those used in other review articles and judged on their relevance to education, information technology and social science. The databases included EBSCO host (academic source premier), ERIC (Education Resources Information Center), Scopus, ACM (Association for Computing Machinery) digital library, IEEE (Institute of Electrical and Electronics Engineers) Xplore, Science Direct and Proquest.

Screening of articles and quality assessment: The search yielded a number of papers that were seemingly relevant. Each paper was screened by title and abstract to ascertain whether it was relevant to gamification or education. Papers that did not pass the initial screening were excluded. Following the screening procedure a backward chain was applied: that is, the references of the relevant papers were screened to identify other papers that may be relevant but were not picked up in the search. The back ward chain did not yield any new articles for inclusion.

Reporting the results of the search strategy: The search yielded the following:

- In total 214 references were identified by applying the search criteria
- 48 references were found to be potentially relevant from the titles, abstracts and keywords
- 22 references were removed based on relevance, inability to access full text and duplication (the same paper found in different databases)
- 26 full text papers were included for further analysis

Extracting relevant data from included studies: The full text papers were uploaded to the ATLAS.ti programme for further analysis and coding. The programme provides a platform on

which qualitative data can be coded and extracted to create output that can be meaningfully interpreted within the context of the study. The data were analysed using open, descriptive coding to extract relevant content or themes for analysis and synthesis. Descriptive coding is used to highlight topics that may be present in a body of text that is organised as "categorized inventory, tabular account, summary, or index of the data's contents" for further interpretation (Saldaña, 2009, p. 72). The most pertinent themes that were extracted included definitions of gamification, game elements and techniques for application, the theoretical perspectives employed and criticisms/limitations of gamification or the studies included in the reviews.

Synthesizing, drawing conclusions and communicating findings: The highlighted themes and accompanying text were extracted and synthesised. The data explicated key focal areas in educational gamification which were presented and discussed in Chapter 3. The review also guided the researcher to pertinent texts and articles that were incorporated into the literature study. Furthermore, the development and creation of the design principles that informed the manner in which the gamified learning management system was designed and developed was underpinned by the outcomes of the systematic literature review.

4.3.7.2 Focus group interviews

The use of interviews in engagement research is supported by Fredricks and McColskey (2012) as this approach has the benefit of providing

> "insight into the reasons for variability in levels of engagement to help understand why some students do engage while others begin to withdraw … can provide a detailed descriptive account of how students construct meaning about their school experiences, which contextual factors are most salient, and how these experiences relate to engagement" (p. 37).

However, the interview is susceptible to the interviewer's knowledge, skills, and preconceptions that may influence the *quality, depth, and type of responses.* There is also the concern that the interviewee/participants may provide responses that are deemed socially desirable rather than a true account of their experiences (Fredricks & McColskey, 2012). Nevertheless, the focus group provides the best opportunity to elicit rich, descriptive data that may not be present in the literature or that could elucidate key focus areas arising from the participants' experiences. Bryman (2012) notes that this technique is best suited to establish the collective understanding or experiences of a group of participants through their responses to a predetermined set of questions.

A focus group interview is a researcher-led interview conducted with a group of participants in the form of a guided discussion (Babbie, 2010; Given, 2008). The focus group interview lends itself to modification in terms of the amount of structure provided by the researcher (i.e. unstructured, semi-structured or structured) and can be used for a number of purposes (Given, 2008). The size of the focus group also tends to vary but may range from smaller groupings of four to six participants to as many as 15 participants (Babbie, 2010). Creswell (2012) holds that the value of this technique lies in the information garnered from the interaction amongst participants as well as the opportunity to collect data from a number of individuals simultaneously, thus saving the time it would take to conduct individual interviews (Babbie, 2010). The technique also lends itself to an in-depth examination of a particular phenomenon in which multiple perspectives highlight themes that may be missing from an individual interview.

The focus group interview was used extensively in this study. In all three DBR iterations students were invited to participate in a focus group following their engagement with the educational gamification intervention. The focus group borrowed from interactive qualitative analysis, which is structured according to the tenets of social constructivism and places the onus on the group to construct and convey meaning of variables (Northcutt & McCoy, 2004). Participant experiences were systematically derived from the focus group interactions to allow participants to generate and analyse their experiences (data). The analyses of the experiences was directed by the participants as their knowledge and expertise is essential in the coding of data; and generation and grouping of themes (Bargate, 2014). Refer to appendix A for the protocol followed.

A knowledgeable facilitator with experience in the selected technique facilitated the focus groups. The discussions were audio recorded as it is advocated as the most reliable means of capturing a high level of detail with the least possible intrusion (Given, 2008). The transcribed interviews were analysed to clarify the ideas and resultant themes that the participants generated. The themes that emerged spoke to the most pertinent features of the gamified platform and informed the subsequent phases of the DBR method. In Chapter 5, the findings from the focus group interviews are presented and discussed in their respective cases.

4.3.7.3 Measuring student engagement

Student engagement is a multidimensional construct that encompasses students' in-class and out-of-class experiences and acknowledges the multifaceted nature of the student experience (Coates, 2007). Coates (2006) describes it as a "point of intersection between individuals and things that are critical for their learning … how an individual participates in educationally purposeful activities" (p. 17). Engagement within an educational context also subsumes an individual's level of behavioural and emotional intensity when actively involved in a task (Reeve et al., 2004). Moreover, it incorporates various elements of motivation such as intrinsic motivation, self-determination, goal orientation and mastery (Reeve et al., 2004).

The student engagement measurement instrument, compiled for the purpose of this study, is a multidimensional measure that was developed by combining scales from the Student Engagement Questionnaire (SEQ) the Intrinsic Motivation Inventory (IMI) (Intrinsic Motivation Inventory, 1994) and the Motivated Strategies For Learning Questionnaire (MSLQ) (Pintrich & De Groot, 1990). The measures are available in the public domain and were selected to measure the three dimensions of student engagement namely; behavioural engagement (from the SEQ), emotional engagement (from the IMI) and cognitive engagement (from the MSLQ) as well as general engagement (from the SEQ).

The student engagement questionnaire was administered through the SUNSurvey Checkbox system. An email invitation containing a link to the online questionnaire was sent via the SUNLearn platform, inviting all enrolled students to participate in the study by completing the online questionnaire. The email outlined the purpose of the study and the steps needed to access and complete the questionnaire, should the respondent volunteer to do so. Respondents were also required to provide their student numbers, if they consented, in order to track their academic analytics on SUNLearn.

As previously mentioned, the online questionnaire was compiled from existing measures of student engagement and also included other proxy measures of engagement (selected for their direct relationship to the dimensions of engagement). Each measure will discussed and elaborated on below.

Student Engagement Questionnaire: The Student Engagement Questionnaire (SEQ) was originally developed in response to the need to understand how engagement manifests in campus-based students with a focus on their use of online and general learning practices

(Coates, 2007). The instrument was composed of 73 items representing two dimensions; one pertaining to engagement through online learning and the students' use of the online system and the other, including more general facets of campus-based student engagement**.** Campus based students' online engagement was composed of seven subscales namely; online engagement, online active learning, online academic relevance, online teaching, online collaboration, online social interaction and online contact with staff. General campus-based student engagement consisted of nine subscales that include constructive teaching, supportive learning environment, teacher approachability, academic challenge, active learning, student and staff interaction, complementary activities, collaborative work and beyond-class collaboration. All the subscales of the instrument served as indicators of behavioural and general engagement and thus the complete questionnaire was included in this study.

The SEQ subscales show acceptable psychometric properties, have reliabilities between .7 and .8 and are purported to validly measure each of their targeted constructs (Coates, 2007). Moreover, high construct stability, face and content validity have been established and the instrument has been found to be effectively replicable in different institutions and fields of study (Coates & Mahat, 2013; Krause & Coates, 2008).

Motivated Strategies for Learning Questionnaire (MSLQ): The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich and De Groot (1990) as an indicator of motivational orientations and use of learning strategies amongst college students (Pintrich, Smith, Gracía, & McKeachie, 2015) and as a measure of cognitive engagement (Fredricks & McColskey, 2012; Pintrich & De Groot, 1990).

Motivational beliefs and self-regulated learning strategies are reflected across 44 items measuring five factors. The MSLQ measures Motivational beliefs through the self-efficacy (9 items; α = .89) and intrinsic value (9 items; α = .87) scales and self-regulated learning Strategies through cognitive strategy use (13 items; α = .83) and self-regulation (9 items; α = .74) scales (Pintrich & De Groot, 1990, p. 35). For the purpose of this study scales were selected from cognitive strategy use (i.e. rehearsal (α = .69), elaboration (α = .76) and organisation (α = .64) and self-regulation (i.e. metacognitive self-regulation (α = .79). The selected scales have been found to be positively correlated with engagement and other factors such as interest, efficacy, task value and various assessments (e.g. assignments and tests) (Fredricks & McColskey, 2012; Pintrich & De Groot, 1990).

The items were randomised, and respondents were required to answer each item on a 7-point Likert type scale ranging from 1 (not at all true for me) to 7 (very true for me). Four items in the MSLQ required reverse coding (items 22, 23, 33 and 34). For clarity, slight adjustments were made in the wording of the items to ensure their relevance in the online context.

Intrinsic Motivation Inventory (IMI): The IMI was developed to assess an individual's subjective experience when engaging a particular activity, with a specific focus on intrinsic motivation and self-regulation (Intrinsic Motivation Inventory, 1994). According to Fredricks and McColskey (2012) emotional engagement scales are varied and may comprise a number of topics connected to -

> "[E]motional reactions to school such as being happy or anxious; expressing interest and enjoyment; reporting fun and excitement; reacting to failure and challenge; feeling safe; having supportive or positive relationships with teachers and peers; having family support for learning; expressing feelings of belonging; and perceiving school as valuable" (p. 772).

The focus in this study was on the emotional reaction as well as interest and enjoyment as these indicators of emotional engagement would be most salient in an online environment.

At face value, the items included in the Intrinsic Motivation Inventory (IMI) were aligned with the emotive indicators of emotional engagement. The measure was used in sport and exercise studies (Markland & Hardy, 1997) but has also been applied in mental health (Choi, Mogami, & Medalia, 2010) and research on motivation in school students (Koka & Hein, 2003). The instrument consisted of seven scales of which three were selected as indicators of emotional engagement namely interest (7 items; α = .60), perceived competence (6 items; α = .86) and value/usefulness (7 items; α = .70) (Tsigilis & Theodosiou, 2003). The interest subscale was a self-report measure of intrinsic motivation. Perceived competence was proposed to be a positive indicator of intrinsic motivation and the value/usefulness scale was suited to studies whereby an individual would internalise motivation and become self-regulated in their actions because of their assessment of whether or not an activity has utility or is of value to them. Lastly, the effort/importance subscale was also selected as an indicator of cognitive engagement.

The wording of the questions in the subscales was reformulated according to the context of the study and activity under investigation. Participants answered the items on a 7-point Likert-type scale ranging from 1 (not at all true) to 7 (very true).

***Academic analytics*:** Learning management systems are able to track and record all the actions executed by users when interacting with activities on the platform. The use or reporting of this data is referred to as academic analytics and the analysis thereof provides applicable data that is directly relevant to student engagement and the evaluation of learning activities (Beer et al., 2010; Campbell, Oblinger, & DeBlois, 2007; Dawson & McWilliam, 2008). One form of academic analytics are activity logs generated by the LMS. These activity logs record every action (i.e. click) and capture activities such as viewing the course material/forums, accessing information, submitting/completing online activities. This provides authentic and objective evidence of student engagement in the online environment (Ma et al., 2015).

In this study, the activity logs were used to assess how often students engaged with the gamified learning platform (as a measure of behavioural engagement) prior to the start of the intervention (T1: 17 July – 15 August 2017) and during the intervention (T2: 16 August – 22 September 2017). The respondent's student number was used to draw a log of their online activity on the module platform and ensured the protection of their anonymity and confidentiality. The activity logs served as a proxy for behavioural engagement (i.e. participation) and constituted a list of every action that an individual executes on the LMS platform. The frequency of activity was calculated by adding all actions before the start of the intervention (Time 1) and all actions during the intervention (Time 2). A repeated measures analysis of variance was conducted to ascertain whether the intervention had an impact on activity scores. Further insights were gained with the evaluation of the co-variation between the academic analytics and the student's self-reports on behavioural engagement.

***Attendance records*:** In previous studies on behavioural engagement, class attendance has been used as an indicator of behavioural engagement (Beer et al., 2010). A card reader was used to log each student's presence (attendance) electronically when he or she scanned his or her student card. Attendance was captured for the nine lecture sessions presented during the intervention, from 16 August to 21 September 2017.

Documents and records: Official and unofficial documents and records pertaining to the selected modules were analysed. These included module outlines, module feedback, throughput statistics and departmental websites. These documents and records provided additional sources of information that shaped the understanding of the context and the students under investigation, as well as documentary evidence that the observations and interview data could be cross-validated.

4.3.7.4 Pilot study

In the second cycle of the study, the researcher piloted the questionnaire designed to measure student engagement (Appendix B) on the 2017 cohort of students (n = 51). An email invitation with a link to the questionnaire was sent at the end of the semester. Baker (1994) suggested that an adequate sample size of a pilot study is equivalent to approximately 10-20% of the actual sample. In this study, 26 students responded to the questionnaire but only 20 cases were retained for analysis. The purpose of the pilot study was to identify weaknesses in the instrument and possible changes that could be implemented (Baker, 1994). Section 5.2.4.2 provides an outline of the results of the analyses of the piloted questionnaire and includes a discussion of the changes made.

4.3.7.5 Experimental research design and procedure

The third cycle of the study employed a quasi-experimental research design as part of the quantitative assessment of student engagement. This approach empirically evaluated the effect that the treatment in which gamification design principles have been applied (i.e. intervention), had on student engagement.

An experimental design is defined as "a test under controlled conditions that is made to demonstrate a known truth or examine the validity of a hypothesis" (Muijs, 2017, p. 13). A fundamental component of this design is the control of the environment in order to focus solely on the variables under investigation. In classical applications participants are assigned to different conditions, in a controlled abstract environment in an attempt to establish the effect of the independent variable on the dependant variable (Charness, Gneezy, & Kuhn, 2012; Creswell, 2012). The two primary constructions of the experimental design are between-subject and within-subject designs.

Pure experimental designs are generally constructed as a between-subjects design. In this design, a treatment/intervention is selectively introduced to one group of participants and not the other. It is argued that if participants are randomly assigned one is then able to control for extraneous variables and isolate the effect an intervention or procedure has on a particular outcome (dependent variable) through statistical group comparisons (Creswell & Plano Clark, 2011). If changes in the dependent variable are observed in only the experimental group one could argue that the intervention may have brought about these changes (Babbie, 2010).

However, the primary deficiency of this approach is its artificiality, as the experiment may not have the ability to replicate reality.

In contrast, a within-subject designed experiment exposes each subject to two or more treatments. Causal approximations are therefore derived from examining changes in participant behaviour that may occur from one treatment to another (Charness et al., 2012). This design is also referred to as a repeated measures design, as data is collected from each subject before and after exposure to each treatment (Gavin, 2013). The absence of random assignment therefore implies a quasi-experimental design. The focus is thus on each individual subject rather than a group of participants. Hence, the individual subject becomes its own comparison in the experiment (Creswell, 2012).

The strength of a within-subject design lies in the researcher's ability to both increase the statistical power and reduce the error variance caused by individual differences (Hall, 1998). Statistical power is achieved because of the larger sample or number of participants included in the experiment. In comparison to the between subjects design that was initially considered for this study, the number of participants would not be 'split' into two groups or assigned to two treatments thus essentially halving the sample (Hall, 1998). Groups created in a between subject design, even with randomly assigned subjects, are also susceptible to individual differences that may influence the dependent variable, whereas in within-subject designs individual difference variables are held constant, across each condition/treatment.

The fundamental weakness of the within-subject design is the possibility that carryover effects may occur. This refers to the phenomenon whereby "participation in one condition may effect performance in other conditions, thus creating a confounding extraneous variable that varies with the independent variable" (Hall, 1998, p. 1). The carryover effects may manifest as either practice or fatigue effects. In essence, fatigue effects result when one treatment adversely influences the subject's performance in a later treatment. A practice effect occurs when one treatment positively influences the subject's performance in a later treatment learning may take place from one treatment to the next (Creswell, 2012; Goldstein, 1993; Hall, 1998). In the present study carryover effects are not anticipated as the first treatment does not require the subjects to conduct any strenuous mental or physical activity and does not prepare the subject for the second treatment.

Furthermore, careful consideration was given to the context in which the experiment would be conducted. Muijs (2017) proposed that in an educational context pure experimental designs may raise ethical concerns when an intervention that is thought to be effective is applied to one group of students and not another. As previously noted, a between-subjects design was initially considered but given the possible positive outcome of gamification on the educational experience, the researcher felt it would be unethical to withhold the treatment from a control group or students who did not choose to participate in the study. Moreover, the intervention was integrated with the learning activities in the module and was not a stand-alone application where students could opt out. However, consent was sought if students volunteered to participate in the study.

It is acknowledged that even though the use of a between-subjects design would have been a more stringent assessment of the effect of the intervention on student engagement, there are limitations within the context that has been selected. Moreover, although the within-subject design has more power, it is particularly susceptible to confounds that could skew the results. Thus, it was deemed important to include a demographic questionnaire as well as other descriptive items (e.g. rating of computer skills, game play habits and enjoyment of games) that could be included as covariates in the analysis.

4.3.7.5.1 Hypotheses

The aim of the study was to examine the effect the independent variable (i.e. gamified intervention) had on the dependant variable (i.e. student engagement) through a quasi-experimental, within-subject design. To this end, the following hypotheses were stated:

> *Hypothesis 1: Behavioural engagement scores will be higher following a student's interaction with a gamified intervention.*
>
> *Hypothesis 2: Emotional engagement scores will be higher following a student's interaction with a gamified intervention.*
>
> *Hypothesis 3: Cognitive engagement scores will be higher following a student's interaction with a gamified intervention.*
>
> *Hypothesis 4: General engagement scores will be higher following a student's interaction with a gamified intervention.*

4.3.7.5.2 Treatment conditions

Two conditions were created for the purpose of the study. In *Condition A* the SUNLearn platform was presented in the same format as previous years; that is, learning activities without game elements. This condition ran for four weeks in the third term of the second semester of 2017 (17 July – 15 August). Thereafter, *Condition B* was launched wherein gamification principles were applied to the SUNLearn platform and the Career Hero game was introduced to the students. At the onset of *Condition B* students were invited to partake in the study and complete the Student Engagement Questionnaire to establish a baseline level of student engagement. The treatment followed for four weeks (16 August – 22 September). Following this period, invited participants again completed the student engagement questionnaire.

The design enabled an investigation of the influence the treatment had on each participant over a period of time. By measuring student engagement both before and after the treatment, some evidence to assess any changes in student engagement was gathered. The cautionary position taken here is attributed to the recognition of the threats to validity that will be discussed briefly in the subsequent section.

4.3.7.5.3 Threats to validity

Experimental designs are particularly susceptible to threat. The range of threats to internal and external validity were carefully considered in the selection of the design and the development of the experiment.

Threats to internal validity: Threats to internal validity may influence the inferences drawn about the causal relationships or covariations between the intervention and the outcome observed. Campbell and Stanley (1963) present the following classes of extraneous variables that, which "if not controlled in the experimental design, might produce effects confounded with the effects of the experimental stimulus" (p. 5). These threats can jeopardise the outcome of an experiment as a result of the fact that they stem from the design of the experiment and the procedures used (Goldstein, 1993). Creswell, (2012) collated the work of Campbell and Stanley (1963); Cook and Campbell (1979) and Cook, Campbell and Shadish (2002) and categorised the internal threats according to threats related to participants, treatments, and procedures.

The first category comprises the threats related to participants and includes history, maturation, regression, selection, mortality, and interactions with selection. *History* refers to unintended

influences of events that may take place through the duration of the study, (between the pre-test and post-test measurement) along with the experimental variable, that may influence the outcome (Campbell & Stanley, 1963; Creswell, 2012). *Maturation* points to the processes within the participants that naturally take place over time (e.g. become older or more experienced) and that may influence the scores between the pre- and post-test. Creswell (2012) suggested that the issue of maturation may be minimised by selecting participants who progress at a comparable pace such those at the same year level. *Regression* denotes the selection or assignment of participants who have very high or low scores. These individuals are more likely to fare better or worse on the pre- and post-test irrespective of the intervention. Extreme scores could mistakenly be interpreted as an outcome of the intervention. Similarly, *selection* involves the inclusion of individuals who may be more open to or familiar with the intervention, which may also affect the scores of the outcome variable. Experimental *mortality* is the withdrawal of participants from the comparison groups that may hamper the researcher's ability to draw conclusions based on measurements that were conducted. Finally, the threats mentioned above may have *interactions with selection* thus creating further threats to the experiment. For example, participants that opt to partake in the study may mature at different rates, come from vastly differing backgrounds or have different interpretations of the measures used. These uncontrolled historical and innate factors may influence the derived scores and the heterogeneous nature of the proposed sample may further compound this issue.

Threats related to the treatment include diffusion of treatments, compensatory equalization, compensatory rivalry and resentful demoralization (Creswell, 2012; Goldstein, 1993). These threats pertain to the experiences of the control group and how their responses could influence the outcome. Due to the use of a within subject design and the exclusion of a control group these threats were not applicable to the design at hand.

The last category addresses the threats related to the procedures used in the experiment. These include testing and instrumentation. *Testing* refers to the effect that having previously taken a test may have on the second testing opportunity. The participants may remember their responses or become more aware of the outcome being measured. *Instrumentation* denotes to changes brought about by the corrections to or adaptions of the measurement instrument or the instrument used for the pre- and post-test may differ. In some instances, changes in the observers or scorers may also affect the measurement of the outcome variable. In order to

minimise these threats a standardised procedure was be employed and the same instrument was used in the pre- and post-test (Babbie, 2010; Creswell, 2012; Goldstein, 1993).

Most of the afore-mentioned threats are common to between-subject designs. Creswell (2012) proposed that for within-subject studies threats to internal validity are more controlled and therefore less relevant, specifically threats related to selection, treatments, mortality, maturation, regression, and interactions with selection.

Threats to external validity: Threats to external validity limit the accuracy of inferences that can be drawn from the sample data to other individuals, contexts, treatment variables, and methods. The generalisability of the findings could be affected by one or a combination of the following threats:

- *Interaction of selection and treatment* refers to the lack of generalisability to groups beyond the scope of the experiment (e.g. other levels of student groups).
- *Interaction of setting and treatment* points to the lack of generalizability across different settings indicating that the results found in one setting my not be applicable in another setting (e.g. face-to-face teaching and blended or online learning).
- *Interaction of history and treatment* may develop when the researcher attempts to generalise the results to past and future situations. The timing of the experiment may have an influence on the outcome of the experiment which may limit the replication of the findings (e.g. heightened participation prior to a test).

Threats to external validity and generalisability are highlighted in the discussion of the limitations of the study (refer to Chapter 6) and will serve to underpin the need for replication of this research in different settings and at different periods.

4.3.8 Data analysis

Qualitative and quantitative methods of data collection were employed. This required that appropriate data analysis techniques be employed to each type of data.

4.3.8.1 Qualitative data analysis

The qualitative data gathered in this study was analysed both inductively and deductively. Inductive analysis involves a detailed review of the data and assigning codes to concepts as

they emerge (Bradley, Curry, & Devers, 2007). Deductive analysis is led by a predefined structure of codes informed by theories or preconceived notions or assumptions (Thomas, 2006). The focus group data was analysed using open, descriptive coding to extract relevant content or themes for analysis and synthesis with the aid of Atlas.ti and MAXQDA. Descriptive coding was used to highlight topics that may be present in a body of text that is organised for further interpretation (Saldaña, 2009). The outcome of the analysis was used to inductively build a conceptual and theoretical understanding of the elements required for the further development of a gamification intervention. Moreover, salient themes pertaining to student engagement were deductively extracted (according to the definitions of student engagement) to examine the influence of the intervention on student engagement.

4.3.8.2 Quantitative data analysis

Reliability: Reliability analyses on the four student engagement scales included coefficient alpha, item-total correlations and inter-item correlations analysis and ensures that the items consistently reflect the construct being measured by each scale (AP Field, 2009). The Cronbach alpha coefficient reflects the average correlation of items within a scale and acceptable values of internal consistency range from .7 to .8 (AP Field, 2009; Nunnally, 1978). Each scale was considered against a Cronbach's alpha value of .7 and inter-item correlations of .3 and above (Hair, Black, Babin, Anderson, & Tatham, 2006; Tabachnick & Fidell, 2007). The set criteria guided the analysis of the scales and items included in the pilot questionnaire and the main questionnaire.

Analysis of variance: The data was analysed using parametric methods including mixed model repeated measures analysis of variance (ANOVA) and analysis of covariance (ANCOVA). This statistical technique is used when examining two or more experimental conditions. The within subjects' factor (time) was included as a fixed effect and had two levels namely the pre-test and post-test. When comparing the student engagement scores at Time 1 and Time 2, the observed disparity in means can be attributed to the intervention, variations within subjects or error (unexplained variation). In addition, the identity of the respondents was indicated as a random effect[7] in the analyses, rather than a fixed effect. Therefore, the responses were treated as a

[7] Field (2013) defines a random effect as follows; "an effect is said to be random if the experiment contains only a sample of possible treatment conditions. Random effects can be generalized beyond the treatment conditions in the experiment" (p. 792). With random effects, the expected value of each mean square depends not only on the variance of the error term, but also on the variances contributed by the random effects.

sample of a larger population of possible levels rather than comparing each case at Time 1 and Time 2 (Pennsylvania State University, 2018). The emphasis was thus placed on the variability of the levels of student engagement across the three cases. This approach acknowledges the variance contributed by the sample of students drawn from the population of students enrolled in the module. This approach also ensured that all the Time 1 and Time 2 data was included in the analysis. Successful results would indicate an increase in scores of the dependant variable (i.e. student engagement) over time.

In addition, a within group analyses of covariance (ANCOVA) was applied to further explore the mean differences over time, whilst statistically controlling for enjoyment (refer to section 5.3.4.2.5 for a discussion of the rationale). The data was analysed using Statistica (version 13).

4.4 ETHICAL CONSIDERATIONS

The researcher is employed by Stellenbosch University and is a registered Industrial Psychologist with the Health Professions Council of South Africa. Based on these roles, the importance and applicability of the stipulations set forth by the HPCSA and the institutional research guidelines regarding ethical conduct in all areas of practice (specifically research), are emphasised and are particularly relevant. The study was therefore guided by the stipulations set forth in Annexure 12 of the Ethical Rules of Conduct for Practitioners Registered under the Health Professions Act (Act no. 56 of 1974) (Republic of South Africa [RSA], 2006) and the Standard Operating procedures of Stellenbosch University.

The most pertinent concern of the researcher is to ensure the protection of the dignity, rights, safety and well-being of the research participant's involvement in this study may infringe on these to some degree. This inevitability warrants a reflection on the ethical risks that may be present and whether the cost to the participant as an individual is balanced when compared to the benefit to the body of knowledge and the wider society (Standard Operating Procedure, 2012).

In case 1 and 2, the research participants were enrolled in a course presented by the researcher. As a result of the participants' role as students, the power relationship between the student and the lecturer should be acknowledged and the necessary steps taken to mitigate the possible coercive influence the researcher may have over the student's decision to participate in a study. All research participants had the right to volunteer to participate in the research after careful consideration of the relevant information provided to them. The stipulations in Annexure 12 of

the Ethical Rules of Conduct for Practitioners Registered under the Health Professions Act (Act no. 56 of 1974) (RSA, 2006) was used when obtaining informed consent from research participants.

In meeting these rules, the following actions were taken:

- informed consent (stated clearly and in understandable language and explained verbally) was obtained from those individuals who willingly agreed to participate in the study;
- further information was provided in a document and included -
    - the aim and purpose of the research;
    - what participation would entail;
    - the manner in which research findings will be disseminated and used;
    - the identity of the researchers; and
    - with whom they are affiliated.
- The participants were also informed of their rights to seek clarification of their understanding of the research and who to contact regarding their rights as participants (Standard Operating Procedure, 2012).

The Rules of Conduct also make special mention of the care that needs to be taken when research participants are also students or subordinates of the researcher. The researcher took the following steps to mitigate the ethical risks involved with using this student sample:

1. A trained facilitator was appointed to invite participation and to also oversee and facilitate the focus group data collection process.
2. Research participants were reassured (in the invitation and the focus group discussion) that their participation, or not, would have absolutely no bearing on any evaluations conducted by the lecturer for the concerned course.
3. The researcher explicitly stated that participation was voluntary.

The use of a student sample also requires the researcher to obtain institutional permission from the organisation or institution from which the sample was drawn and thus institutional permission was obtained from Stellenbosch University. The ethical clearance application (including the consent formulation) was submitted together with the research proposal to the

Research Ethics Committee Human Research (Humanities) of Stellenbosch University (see Appendix C).

The information obtained in the research and that could be identified with the participant remained confidential and would be disclosed only with permission of said participant or as required by law. The confidentiality of the participant was maintained using pseudonyms (e.g. participant 1, 2, 3 etc.). The participants were therefore not required to provide their names.

4.5 SUMMARY: CHAPTER 4

In this chapter the research paradigm, design-based research approach and the methodology selected for this study were outlined and justified. The DBR framework guiding the development of the intervention and evaluation thereof was discussed together with the selected quantitative and qualitative data collection techniques. What follows, in the next chapter, is the presentation and discussion of the results that stemmed from the systematic execution of the micro-cycles in the DBR process.

CHAPTER 5

RESULTS AND DISCUSSION

The preceding chapter provided a detailed description of the design-based research methodology and process that guided this study. In this chapter, the application and description of the outcome of applying educational design principles to a learning management system are detailed. The results of the three, iterative meso-cycles are reported as three instrumental cases. Each case will briefly explain the context and subjects included, followed by the presentation and discussion of the findings stemming from iterative micro-cycles of research conducted. Comparisons will be drawn between each case and the results will be integrated to inform the primary contribution of the study namely; the framework of design principles and implications for designing a gamified intervention to facilitate student engagement.

5.1 CASE 1: MESO-CYCLE 1

The first iteration (meso-cycle 1) took place in 2016. As mentioned, the module was selected as it was convenient and accessible to the researcher, who was responsible for the development of the course content and learning activities. Moreover, in 2016, the prescribed textbook for the module was discontinued which presented the opportunity to redesign the content and assessments in the module. What follows is a detailed account of the execution of the three primary micro cycles that constitute this meso-cycle.

5.1.1 Context and subjects: IP 132, 2016 cohort

Industrial Psychology 132 (IP 132) is a six-credit service module presented by the Industrial Psychology Department to first-year Occupational Therapy (OT) students. Occupational Therapy is a degree offered by the faculty of Medicine and Health Sciences. Approximately 50 students are selected each year based on academic performance at school, non-academic merit (e.g. leadership, community service, sport, rural origin, language proficiency etc.) and performance on the National Benchmark Test. The selection criteria and process of selecting candidates for this degree is therefore relatively stringent.

The researcher has been personally involved in the module over the last five years, as both lecturer and course coordinator. From prior experience, the students are generally enthusiastic

and diligent. The pass rate for the module is exceptionally high (i.e. above 98%). Students enrolled in the Occupational Therapy degree programme are subject to strict throughput criteria in that failure in more than one module, results in an enrolment discontinuation. Students that do fail the Industrial Psychology module often also fail other modules and thus rarely repeat it in a subsequent year. The aim of the module is specified as follows:

> The course objective of Industrial Psychology 132 (Occupational Therapy) is to equip students with the relevant knowledge and skills to be able to apply basic industrial psychology principles and practices in an occupational therapy practice, specifically within the context of South African labour legislation.

The content presented includes the psychological theory (i.e. motivation, individual differences, and research aspects) and specific human resources processes (i.e. labour legislation, recruitment, selection, training, performance management, leadership development) that are involved in the study of individuals and groups in the workplace. The content is particularly tailored to environments in which occupational therapists may operate.

In 2016 there were 48 students registered for the IP 132 module. The group comprised 47 female and one male student. The ages ranged from 18 – 26 years (M = 19). The demographic breakdown of the group was: African (13%), coloured (25%), Indian (10%) and white (52%). The majority of the students indicated that English was their educational language of preference (83%) with the remainder indicating Afrikaans as the preferred language of tuition.

5.1.2 Micro-cycle 1: Analysis and exploration

The study was initiated by an extensive review of the student engagement and gamification literature which is presented in Chapter 2 and Chapter 3. The specific context and needs of the students in the selected module were also explored and analysed by revisiting feedback documents completed by past students (in 2014 and 2015). The feedback revealed that students sought learning opportunities that: facilitated the practical application of the content that was taught; that was relevant to their field of study and which facilitated engagement and supported effective preparation for tests and exams. The feedback thus revealed desired outcomes that would guide the improvement of the current learning activities and assessments in the module. The learning management system and learning activities were thus identified as an appropriate environment in which to apply and evaluate the design principles gleaned from the literature.

5.1.3 Micro-cycle 2: Design and construction

The design and construction of the intervention, briefly articulated in section 4.3.2.2, was based on the extant literature on the design principles of gamified interventions. These principles were discussed in detail in Chapter 3. The application of the design principles and selected game elements (see Table 3.3) thus underpinned the construction of the intervention, named *OT Tycoon*. The premise of the game required the students to build and manage an imaginary occupational therapy practice through the application of industrial psychology principles. To accomplish this goal the student had to complete several tasks in order to collect as many points as possible as a measure of success in the game. Each activity had a set of instructions and additional resources (e.g. templates or videos) to support understanding and learning pertaining to each topic. Figure 5.1 provides a depiction of the layout of SUNLearn.

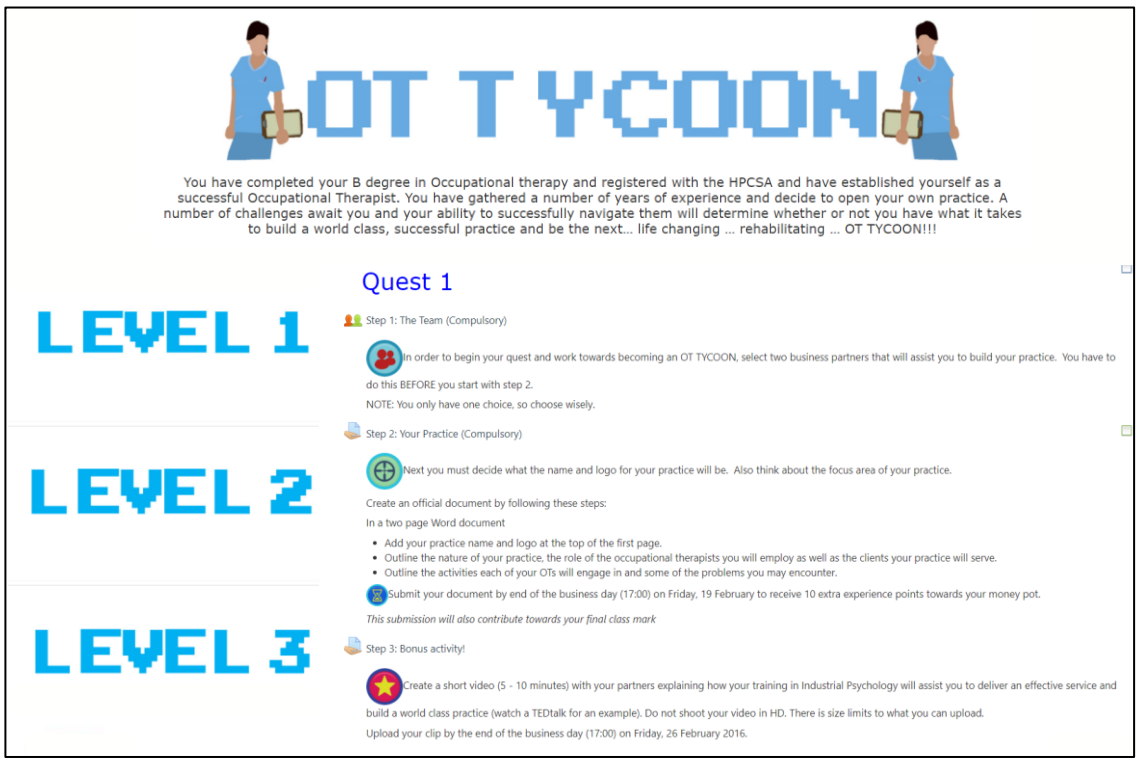

Figure 5.1. Example of the layout of the SUNLearn platform

The intervention was constructed by applying the game elements to the IP 132 page on SUNLearn with modifications to the layout of the page and the creation of levels. The module content was grouped as a unit to form a level (see Figure 5.2). This served to organise the content as well as create a sense of progression through the game, signified achievement and roused curiosity for what would come next (Zicherman & Cunningham, 2011). The first level,

'Resources', included the instructions, course information and the PowerPoint presentations. Each level thereafter contained (a) quiz(zes) and short learning tasks (assignments). To promote engagement the activities encouraged collaborative and active learning as they required students to work in groups (quests) and provided opportunities for practical application of the content, the use of alternative resources and novel formats of presentation, for example videos, presentations, infographics, etc. (Beer et al., 2010). The lecturer scaffolded the activities by presenting the content in-class and providing examples of real-world application. The activities created centred on real world tasks that required the student to consider the content and find ways to address the challenge presented to them. Each quest had a suggested deadline, but students could decide when to complete the activities. The final deadline for all activities was the end of the semester. As suggested by Gaytan and Mcewen (2007), the researcher designed rubrics for each learning activity to support the assessments and provide timely and informative feedback.

In addition, quizzes, referred to as 'knowledge checks', afforded students the opportunity to test and practice their knowledge of the relevant concepts. Time and attempt restrictions were activated (e.g. 10 minutes to complete a 10-question quiz, with three attempts) as well as automatic grading to ensure immediate feedback on performance. The system assigned points for the completion of the activities and bonus points were awarded if the quizzes were attempted before the beginning of the first lecture each week and for the submission of quests completed by the suggested deadlines. These conditions rewarded students who consulted the content before a class and continuously engaged with the content and assessments. Some (but not all) of the learning activities contributed to the class mark (as part of the overall performance mark attained in the module). As the knowledge checks contributed 5% and the learning activities contributed 15%, these were considered 'low stakes' assessments. The class mark is weighted 40% and the examination 60% towards the final performance mark of the module.

The points accumulated informed the individual and group leader boards. Points were also awarded for class attendance and in class group activities. The leader boards gave students an indication of their standing, in comparison to their peers (Werbach & Hunter, 2012), and encouraged competition amongst the groups and to assess their performance with regard to the specified goals (Nah et al., 2013). The completion tracking function was activated to create a progress bar that provided a visual display of progression and completion of specific activities in each level (see Appendix D for examples of the game elements in SUNLearn).

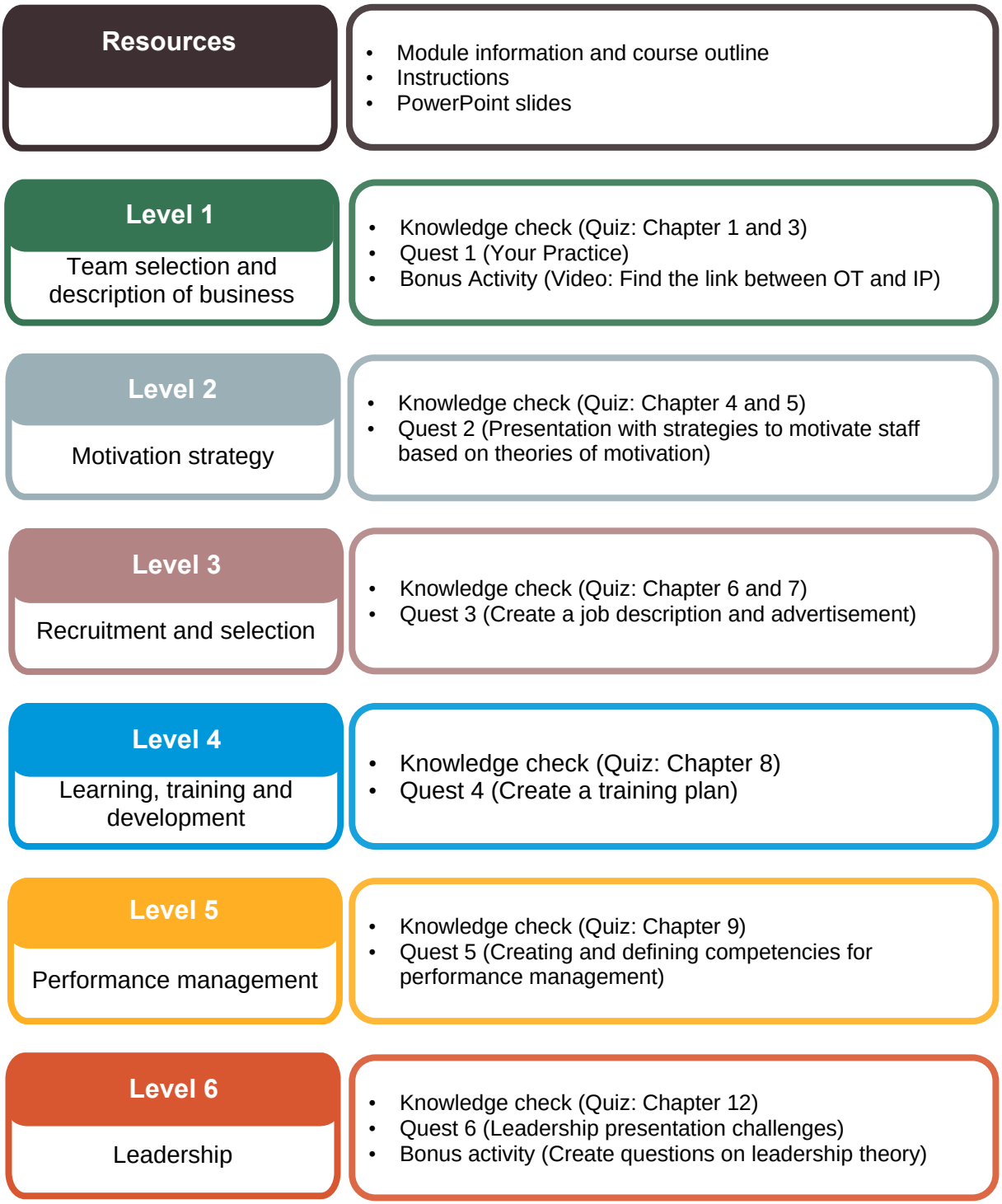

Figure 5.2. Case 1: Levels with assigned tasks and learning activities

Implementation of the intervention to the IP 132 module took place in the second week of the first semester of 2016. A short classroom presentation, conducted by the researcher, introduced the students to the concept of gamification; the general purpose and narrative of the game; the instructions for moving through the game; and the allocation of points and marks for the learning activities. The intervention ran from February to June 2016.

5.1.4 Micro-cycle 3: Evaluation and reflection

The third micro-cycle involved the evaluation of the gamified intervention, OT Tycoon, in practice and a reflection on the implementation of the intervention in light of the results. The evaluation of the intervention was primarily underpinned by qualitative focus group data. Module feedback forms and lecturer observations also informed the reflection on the outcomes.

5.1.4.1 Participants

All enrolled students received an email invitation via SUNLearn to participate in the focus group interview (at the end of the first semester − June 2016). Of the 48 students registered for the module 10 volunteered to participate, however only six students attended the focus group session. In accordance with the purposive sampling design the six participants were all exposed to an application of gamification within their learning context and therefore met the inclusion criteria for participation in the focus group. The demographic distribution of the group included six female participants representing black African, coloured and white groups (two each, respectively).

5.1.4.2 Procedure

A trained facilitator conducted the focus group interview after she was briefed on the focus group protocol (Appendix B). The interview was audio recorded and transcribed by the language services centre at Stellenbosch University. The transcriptions served to provide an accurate account of the discussions in order to; first, report the themes identified by the participants and second, to provide a primary data source for further analysis to code and identify themes related to the dimensions of student engagement (i.e. behavioural, emotional and cognitive engagement).

5.1.4.3 Focus group results: 2016 cohort

The outcome of the focus group discussion resulted in the emergence of a number of salient themes. The participants collaboratively derived themes from their engagement and experiences with the OT Tycoon gamified platform. Table 5.1 provides a concise description of each theme followed by a discussion of each theme.

Table 5.1

Salient Themes and Descriptions Derived from the Focus Group Discussions (Case 1: 2016 Cohort)

Theme	Description
Competition	The effect of individual and group leader boards and activities that prompted competition between groups
Communication (instruction and feedback)	The allocation of marks and points to the activities in the gamified platform and the instructions provided
Structure	The physical layout and organisation of content on the gamified platform
Group work	The experiences of members and interaction with members of a self-selected team
Content	The learning activities which included the knowledge checks and the challenges
Concept	The presentation and use of gamification on the learning platform

Competition. The gamified platform stimulated competition using individual and group leader boards and activities. The focus group participants viewed competition as both positive and negative. They proposed that the positive or negative appraisal of competitive elements was dependant on an individual's personal preference or predisposition. One student reported that it challenged her to achieve, while another indicated that it promoted healthy academic competition ("Healthy academic competition"; "It encourages a challenge towards accomplishment"). On the other hand, some participants did not enjoy the competition, as they did not view themselves as being competitive ("Made me feel uncomfortable at times because I am not competitive. Too much pressure. Not enough focus on actual task"; "I'm not much of a competitive person so during group work if one of the members were competitive (which happened in my case) there is a lot of strain on you to also be competitive").

The competitive element negatively affected the group experience for some of the participants due to the perceived pressure by their peers to conform or act in a competitive manner. This caused some discomfort as they felt that it detracted from the focus on the task at hand ("I think it could also be positive … there were people in my group who were competitive which kind of helped because now it forces you to do the extra activities and then in that way you got other knowledge and it just helped but it also can be bad").

The participant's perceptions of competition are in agreement with other studies such as Sillaots (2014) and De Schutter and Van den Abeele (2014), who also reported that students had mixed reactions to competition. In these studies, competition served as a source of motivation and

encouraged participation by compelling students to complete the tasks. Burguillo (2010) proposed that competition has the potential to have a constructive influence on learning through the social pressure created by this mechanism to achieve, which is also evident in this instance. However, even though these findings align with the proposed positive effects of competition created by social pressure, they also alluded to the negative effect the inclusion of competitive mechanisms may have on students' motivation and satisfaction (Deci et al., 2001; Hanus & Fox, 2014). A cautious approach to the use of competitive elements such as leader boards is thus noted.

Communication: Instruction and feedback. The most pertinent concern was the ambiguity caused by the use of marks and points ("I sometimes felt uncomfortable about the fact that I was unsure how certain things were marked and what exactly was course marks."). The participants stated that communication of the points and grades lacked clarity as they struggled to distinguish which activities were for a grade (that counted towards the academic mark) or points (for the leaderboard), which caused some uncertainty and confusion. They also felt that the evaluation criteria for the activities was not clear and did not provide a good indication of the depth required in the assignments, for example; "Marks and points allocated differently. Sometimes a bit confusing – not clear criteria and confusion when is it for marks and when is it for points. Maybe it's because we don't always read properly".

Another point of contention was delayed feedback. The knowledge checks were graded immediately (and thus provided immediate feedback) but the feedback for the assignments was delayed. The assignments were marked manually and feedback (both the mark/point allocation and written feedback) was only provided a week or two later, for example; "With quizzes we would get feedback right away. With the activities we didn't always get the feedback…".

The findings suggest that respondents did not regard the communication of the OT Tycoon rules as effective. As previously stated, clear communication of the rules of the game, and thus the reward system, is critical to reinforce performance, but also to maintain interest and engagement (Nah et al., 2013). In this instance, where points and grades were separated, a lack of clarity could have influenced the student's decision of where to invest time and effort. For some respondents, a good grade may be more important than collecting points, for example; "They could have given us an activity and I would have done it, but I wouldn't have done it for the bonus points. So, it also depends on the individual whether that would be an incentive or not. I don't find points rewarding".

Furthermore, the findings suggest that students appreciated the automatically graded activities that provided explicit and immediate feedback. The literature states that feedback is an essential part of a gamified activities as it motivates desired behaviour (Cheong et al., 2014; Werbach & Hunter, 2012). However, when feedback is delayed, De Byl (2012) contended that it detracts from the motivating effect created by rapid feedback. The ambiguity in the student's subjective assessment of their progress, for example, whether they meet the requirements for successful performance, could result in decreased motivation to participate. This is aligned with Sadler's (1989, as cited in De Byl, 2012, p. 9) contention that successful performance is based on a student's knowledge of "1) what good performance is; 2) how their current performance rates with respect to good performance; and, 3) how to turn their current performance into good performance". It is thus important to consider the timing of feedback but also provide students with clear guidelines (or rules) for performance and, where possible, allow opportunities to evaluate their own performance (Kapp et al., 2014).

Structure. This included the levels through which the student had to progress, the manner in which the content was organised on the learning platform and the "rules" applied to the tasks/activities. Each level included compulsory and voluntary activities. Upon completion of the compulsory activities, the next level opened (a student could therefore move to the next level by completing the compulsory activities only). The use of levels served as a measure of progression through the game. However, in OT Tycoon, unlike an automated PC or video game where a player can move to a new level immediately, a new level only opened at the beginning of each week. Thus, delaying progression to the next level. Despite the delay, the anticipation of a new level still had a motivational effect that encouraged the students to complete the activities at each level. ("If there's levels that open up to you, it encourages you to complete the level. But all those levels were there. So having the levels there was good because it was structured, but it would be great if it was even that when you compete the level, the next opens up. So it encourages you to complete a level").

This effect is supported by the literature in that game elements such as progress bars and levels drive behaviour by tapping the motivation generated from feelings of progression (Cheong et al., 2014; Dichev et al., 2014).

With reference to the "rules" of the game, the participants highlighted the format of the knowledge quizzes and the point vs. grade allocation. The knowledge quizzes were set to allow students three attempts at the activity. The students reported that they appreciated the

opportunity to improve their scores and the repeated opportunities to attempt the quiz. Points and grades were once again mentioned, but in this instance the fact that some activities were not for marks and only for points, served to alleviate the pressure to complete them ("Some tasks were just for practice (points only), not for marks. Not as much pressure to complete them by a specific time"). Thus, the settings were viewed as both positive and negative. Students were more inclined to complete tasks that contributed directly to their class mark and earned points, but were less likely to complete bonus activities that were only for points. ("… in general if the bonus activity was just there and it wasn't for marks and it wasn't for bonus points the chance that someone would do it is much less but because it was at least for points those people who wanted to do it for extra it encouraged them to do it …"; "They could have given us an activity and I would have done it but I wouldn't have done it for the bonus points").

The completion of activities for the sake of obtaining better grades or completing non-compulsory activities to only accumulate more points could be indicative of extrinsically motivated behaviour. However, intrinsically motivated students would be more interested in the learning opportunity provided regardless of the points or grade. Buckley and Doyle (2017) state that students who were intrinsically motivated derived the most benefit from gamification especially if they had a motivation to know or a motivation towards stimulation. Similarly, making use of all the attempts on the quizzes could also be intrinsically motivated as it lead to a mastery of the content.

As previously mentioned, the use of levels also served to structure the content on the SUNLearn platform. This was viewed as being beneficial for revision and studying purposes ("Work was split into 'levels'. Each section is in its own level, easy to use to look back for studying"). Hansch and Newman (2015) attribute favourable perceptions of a gamified platform to effective user experience design whereby the game elements support coherent and intuitive engagement with the content. By grouping related content at each level ensured that the content and activities was not only conveniently accessed, but logically connected.

Group work. *Group work* referred to the experiences as a member of a self-selected team and the interactions with other members of the team. The participants acknowledged the value of working in a group or team that facilitated the building of relationships with their peers and awareness of the dynamics related to teamwork ("Helped to get to know fellow classmates"). On the other hand, the group expressed frustration with the learning tasks that required group work. They reported that some team members did not live on or close to the campus, which

made it inconvenient to meet and complete the tasks ("… can be inconvenient to get group work done e.g. not all members live close"). The time and work demand of their programme exacerbate their frustration ("Not enough time to meet up with groups sometimes – school work is demanding").

Group work tends to elicit similar reactions across other student populations. For example, participants in studies by Sillaots (2014) and Šćepanović, Zaric and Matijevic (2015) valued the opportunity to work with their peers but were frustrated by aspects such as group formation or interpersonal conflict in the group. Hence, even though students may acknowledge the value of collaborative learning, group work could cause frustration for a variety of reasons.

Content. The participants conceptualised content as the learning activities that included the knowledge checks and the challenges. Šćepanović et al. (2015) stated that the most important feature of gamification is the content and learning material, which is aligned with the participant's point of view on the assignments and learning activities. Students spoke positively about the knowledge they obtained through the activities, particularly the practical application of the content. They felt the activities were meaningful, worthwhile, relevant and directly related to their degree ("It was very applied to OT and it helps us to see the purpose in it if it's focused on OT and not very broad"). The activities compelled them to revisit the notes or textbook on a weekly basis ("And I feel like also the activities sort of force you to go back and read your notes … when you do the activities, you're sort of forced to open your textbook and actually go over the stuff"; "the self-activities, like the quizzes and stuff, it really helped that it was structured to every week"). The quizzes assisted them with test preparation as they both engaged with the content and revised the prescribed curriculum on a weekly basis ("Helped a lot with consuming knowledge also preparing for exams. I'm usually a last-minute person so it helped me a lot"). However, one participant mentioned that the actual activities and not the gamification of the content had a greater contribution to her learning ("I think it was the content of the tasks and things that helped me more than the overall gaming concept. So, it was more how the application, the content that was in each assignment helped more than the game concept ").

On the one hand, Alabbasi (2017) argues that gamification leads to cognitive development as it "increases the level of competence, enhances the recall memory, improves concentration, and attentiveness" (p. 192). Moreover, she attributed this to the motivational influence a gamified learning system may have by virtue of the good learning habits it enables and encourages, for

example revision, task completion and engagement with the learning content. Domínguez et al. (2013) state that gamification has a limited influence on the cognitive aspects of educational content. However, they proposed that altering the structure and design of learning content to create activities that are fun could increase the motivational impact of these activities.

The participant responses seem to support these arguments. Through the interaction with the OT Tycoon game (i.e. completing activities linked to specific game elements), students engaged in behaviours that supported learning and preparation for assessments. This may suggest that gamification can guide and support students to take responsibility for their learning (Des Armier, Shepherd, & Skrabut, 2016) or, at the very least , it may encourage on-task behaviour (Kapp, 2012). It is however important to note that participation does not necessarily translate into learning (Alabbasi, 2017).

Concept. The concept is the presentation or idea behind the gamified platform. The concept was perceived as a creative approach that was visually appealing, novel and interesting compared to their other modules ("Creative. Looks different from other SUNLearn pages"; "It made the work feel more interesting and achievable"). The concept also generated a sense of curiosity and excitement for what would come next ("Concept had creativity and appeal … it's different, it's interesting, it's creative, it's something to look forward to"). The practical nature of the learning activities was once again highlighted as a positive feature that could be attributed to both the concept and the content ("I can see now that the whole concept of the game was your OT business which would also be applying everything and everything that we did was from an OT perspective so it could, if we take a broader perspective, it could be concept or if you're looking at just the task then it could be content. Its OT centred content in a gamification concept").

Through the application of Industrial Psychology knowledge to scenarios occupational therapists may be exposed to, the participants were able to "see the purpose of doing the subject". The role of the lecturer was highlighted as a contributor to perception of the concept for example;

> "If I think of one of my high school teachers in particular, if she had to use the gamification concept it wouldn't have worked as well, I think. The lecturer, the actual person who was carrying out this whole thing did make a very big difference." (Participant 6)

> "I really didn't have a good approach to industrial psychology when I first walked in because I didn't like it at all. I was like "I don't know what I'm gonna do with this subject". But the whole gamification concept and the way that everything was just so organised, I really enjoyed it much more. And the way that she approached it in class. It really made a big difference to me and it changed my whole approach to the subject. Compared to other content, I actually enjoyed going through this content." (Participant 2)

Despite the general positive orientation toward the gamification concept, one participant did not find gamification appealing or helpful to her learning ("Playing a game with my work didn't really appeal to me. Feel like the game aspect didn't really enhance my learning"). This may have been a sentiment shared by other students, enrolled in the same class.

The findings are aligned with other studies in which gamification was applied and positively appraised by participants (Alabbasi, 2017; Cheong et al., 2014; Sillaots, 2014; Stansbury & Earnest, 2017). As discussed under the Content theme, gamification, particularly the use of game elements, may motivate students to participate and engage in positive behaviours that support learning. Some research suggests that students may be drawn to participate due to the novelty of gamification use (Des Armier et al., 2016) and that interest as well as engagement decreases as the novelty wears off (Faiella & Ricciardi, 2015; Koivisto & Hamari, 2014). In addition, Stansbury and Earnest (2017) compared a traditional and a gamified learning context and found that even though the use of game elements did not increase learning outcomes, it did improve students perceptions of learning and the course. They reported that it "led to significantly higher perceptions of understanding course content, increasing student confidence, keeping students involved in the class, reinforcing key concepts, developing their reasoning ability, and increasing application of course content relative to the traditional condition" (Stansbury & Earnest, 2017, p. 44).

5.1.5 Reflection on meso-cycle 1

The focus group discussion elicited the salient elements of the student's experiences and interactions with the gamified intervention. These included; the competitive elements created by the leader boards; communication of instructions and feedback provided by points and grades; the challenges and value of working in teams; the structure and sense of progression the levels provided; perceived value of the content (i.e. learning activities) and the concept of gamification. These findings were also compared to the activity logs, feedback and general observations.

An examination of the activity logs showed that the majority of students completed the activities on SUNLearn; that is, two students did not complete all the knowledge checks but all the groups submitted all of the assignments. Based on the written commentary in the module feedback form (completed by 40 of the 48 students enrolled), the general perception of OT tycoon was positive and corroborated the findings from the focus group discussion. For example, the students enjoyed the quizzes and assignments, which they perceived as helpful, interesting and conducive to learning ("The online tasks provided for this module allowed the work to be taught in an interesting way and gave us sufficient practise of our work"). Some students also reported that they enjoyed working in teams ("Having to do group tasks that applied the work that we learned. It helped me understand how this module is relevant to my course"). In contrast, aspects that required improvement included; the workload (i.e. there were too many tasks to complete) and quicker feedback on the assignments.

The issues communicated during in-class interactions and email communications with students included: requests for clarity on the assignment instructions and point/mark allocations; when feedback would be provided and issues with errant group members. This highlighted a need to provide clearer explanations of the point system and requirements of the assignments in future. Furthermore, the lecturer oversaw all the administrative tasks associated with the game including the grading of assignments. In the past, students accepted a waiting period of one to two weeks for feedback on the assignments however; in a game environment, feedback expectations were more pressing. Lastly, some students reported frustrations pertaining to group work. For example, some groups complained that their fellow members did not contribute equally or did not participate at all. Remedial responses to these challenges could include; the provision of examples and face-to-face discussion of the assignments during class time; sharing the administrative tasks with a student assistant to speed up feedback; and implementing peer ratings for group work.

There were also limitations and technical issues associated with the game elements and the LMS. The functionality of the LMS restricted the extent to which modifications to the platform or environment could be made to make it more game-like. Restrictions included the background that could not be altered, the points that had to be manually calculated and uploaded and only appeared in the grade book, and that students could not adopt pseudonyms which is common practice in some games. Nevertheless, the narrative, levels, leader boards, point system and progress bars seemed to provide a sufficient framework for the gamified activities. Another

limitation, albeit paradoxical, was that the majority of students complied with the requirements of the game, making it difficult to differentiate between high performing players and distinguish a clear winner. The outcome was that the same names remained on the leader boards and created the impression that it was not updating. In addition, the completion tracker/ progress bar did not restrict access to new levels, irrespective of the completion of tasks. Students could therefore move to the next level, which as one student mentioned, "It takes away some sense or feeling of progress or achievement". Lastly, not much thought was given to the reward for winning the game at the time and a prize was therefore not awarded to the top achiever.

In addition to some of the suggested improvement proposed above, the students also offered suggestions on pertinent issues regarding the design elements related to possible changes to the interventions. Reflection on and consideration of these qualitative findings underscored necessary refinements to improve the gamification experience. In Case 2, the learnings and modifications are implemented and discussed.

5.2 CASE 2: MESO-CYCLE 2

The second case represents Meso-cycle 2 and serves to explicate the follow-up evaluated iteration of the gamification intervention (Meso-cycle 1). The three primary micro cycles conducted at this phase are a literal replication of the previous case (see section 4.3.3), with some improvements made to the design and construction of the intervention. In this iteration, a pilot test of a quantitative questionnaire to measure student engagement was included as part of the data collection strategy. In the reflection, the findings from Case 1 and Case 2 are compared and integrated to inform the design of the intervention in Case 3.

5.2.1 Context and subject: IP 132, 2017 cohort

In 2017, 51 students enrolled for the Industrial Psychology 132 module. The majority of the group was female (98%) and the ages ranged from 18 – 27 years (M = 19). The demographic breakdown of the group included; African (11.8%), coloured (23.5%), Indian (3.9%) and white (60.8%) students. English was the preferred language of instruction for most of the students (76.5%). For students who indicated Afrikaans (23.5%) as their preferred educational language an interpretation service was offered during the lectures. Only two students made use of this service.

5.2.2 Micro-cycle 4: Analysis and exploration

The focus group conducted with the 2016 cohort of students provided valuable insight into areas of development that required attention. The researcher critically reflected on the findings from micro-cycle 3 and regularly engaged with the blended learning coordinator and instructional designer. The literature was consulted for studies in which similar issues were encountered to identify proposed actions to address them. Solutions were furthermore sought from peers and through presentations of the findings at both national and international conferences.

The following list of actions addresses the most pertinent areas of concern and refinement of the intervention:

- Re-write the learning activities (i.e. short assignments) to provide clearer criteria and guidelines to the student. Attempt to combine some of the activities and minimise the number of levels that students have to complete.
- Set deadlines for the completion and submission of the learning activities.
- Amalgamate points and marks to have the same value and contribute to the class mark (e.g. 10 marks = 10 points). All the learning activities contribute to the class mark. Remove bonus activities.
- De-emphasise competition by removing the in-class activities that require groups to compete against each other.
- Offer tangible rewards as prizes to students who excel in the game.
- Assign a student assistant to assist with grading of assignments and provide more timely feedback.
- Provide class time for group work.
- Bring technical issues on the LMS (e.g. the levels and progress bar) to the attention of the instructional designer for correction.

The implementation of each proposed action informed the redesign and construction of the intervention. The refinements to each game elements are explained next.

5.2.3 Micro-cycle 5: Redesign and construction

The OT Tycoon intervention was adapted prior to the start of the first semester of 2017 and commencement of the module. The specified game elements that required adaption were addressed as follows:

Quests. The criteria set out for each learning activity was stipulated more clearly. In addition, some of the activities were expanded to include more than one topic in order to build in complexity and prompt learners to synthesize information and build connections across topics (see Figure 5.3). Bonus activities (i.e. formative non-compulsory activities for additional points) were removed and all the activities included contributed to the semester grade (20 % in total).

Rules. A deadline was set for each of the assignments. In the previous iteration students were able to complete the assignments at any time but additional points were allocated if the groups submitted by a suggested deadline. This, however, made it difficult for the lecturer to provide prompt feedback as this administrative task was time-intensive and feedback sometimes delayed.

Feedback. The lecturer contracted a student assistant to improve the turnaround time on feedback. He assisted with grading the learning activities and updating the grades on the system when required, for example loading points for class attendance.

Teams. Students had complained that it was inconvenient or difficult to find time for group work due to logistical and time pressures (especially for students not living on or close to campus). In response, one lecture period every second week was availed for the completion of group work activities. Attendance was mandatory and gave groups an opportunity to work together, with all members present, to complete the activity as a group.

Points. The point system remained the same but included additional rewards. Respondents from case 1 suggested that offering tangible rewards would be more motivating, resultant in the inclusion of rewards in the form of mugs, badges and stickers. Furthermore, Neelsie vouchers (i.e. for the Student Centre) to the value of R100 served as prizes to the winning group and individual with the highest number of points at the end of the course. The rewards selected were novel and could not be purchased or obtained elsewhere.

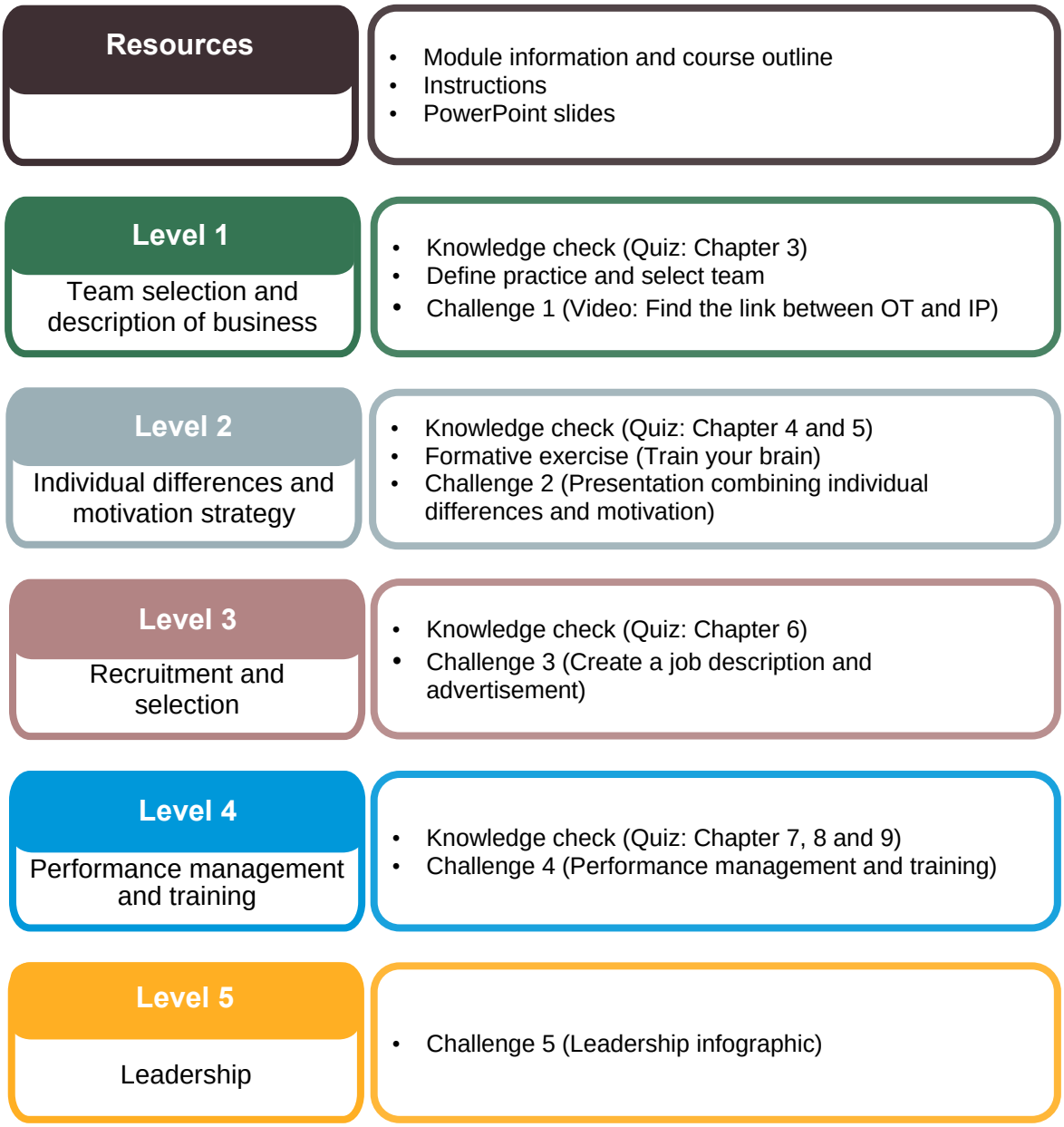

Figure 5.3. Case 2: Revised levels with assigned tasks and learning activities

Leader boards. The competitive elements in the game were downplayed, as the primary intention was to promote peer learning and collaboration amongst the students, rather than creating a competitive environment. This required the removal of the in-class activities that promoted competition amongst groups and the individual leader boards. Students were, however, still able to individually view the points they had accumulated in the gradebook feature on SUNLearn.

Progress bar. Lastly, the students also indicated that the progress bar or completion tracker did not work correctly. In some cases, a new level opened even though all the activities from the

preceding level had not yet been completed, which detracted from the feeling of progression. This also had implications for the leader board, which updated incorrectly. The instructional designer rectified the technical issues.

As with the first iteration, the intervention was presented to the class and the rules, goals and other important information communicated to the students. The intervention once again run for 13 weeks (February to June 2017).

5.2.4 Micro-cycle 6: Evaluation and reflection

The refined intervention included qualitative and quantitative evaluations. A focus group discussion ascertained the student's evaluation of the game and their salient experiences when interacting with the intervention. The focus group interview followed the same procedure (instructions, process, recording and transcription) as the previous year and a trained facilitator conducted the focus group interview. In addition, the researcher compiled a questionnaire to measure student engagement and piloted the instrument. What follows is a discussion of the results and findings stemming from the analysis of the qualitative focus group interview, followed by a report of the findings from the quantitative pilot study.

5.2.4.1 Focus group interview results: 2017 cohort

The focus group interview comprised of ten students who responded to the invitation to participate. The demographic distribution of the group included seven white (70%), one African (10%) and two Indian (20%) female participants.

The recording and transcription of the focus group interview were content analysed to understand and elucidate the primary themes elicited from participants. The themes that emerged highlighted the most pertinent features of the gamified platform and the design principles that were applied (Table 5.2). Each generated theme is described and reflected on below.

Table 5.2

Salient Themes and Descriptions Derived from the Focus Group Discussions (Case 2: 2017 Cohort)

Theme	Description
Sources of motivation	The positive and negative influences of game elements on motivation
Group dynamics	The experience and challenges associated with group work
Positive outcomes	The positive perception of the lecturer
Structure of module	The structure of the online layout and the rules of the learning activities
Learning: consolidation and relevance	The students subjective experience of the learning process
Alternative approach to learning	The learning activities and alternative mediums employed
Pressure: time and logistical	The workload and pressure create by time and logistical constraints

Sources of motivation included the positive and negative effects the gamified intervention had on the student's motivation. The participants responded positively to the intervention and reported that the game presented the content in a manner that encouraged them to attain high scores which was experienced as enriching. They were motivated to perform but the pressure this created was also perceived as being stressful at times.

One participant noted that the knowledge of having to participate in a game and working towards a prize created a feeling of competition and an expectation to do well and aim for high scores on the activities ("Because you could win a game, you worked harder in tasks"). This, however, also resulted in a sense of pressure to do well, which may be motivating for some, but demotivating for others (e.g. "I think it was positive in the end because it motivated you to do better, but it was also kind of stressful at the same time"). Another participant also explained that she felt pressure to perform well because of having to match the level of effort that her team members were putting in. These findings are aligned with Banfield (2014) proposition that social pressure is a constructive consequence of competitive elements. However, seeing as competition is a matter of perception, De Schutter and Vanden Abeele (2014) posit that the effect on motivation may vary as some students who perceive themselves as being less skilled than their peers, may resent competition. In case 1 the influence of competitive elements elicited similar responses from participants.

The participants identified the sources of motivation as the incentives (i.e. prizes and points/grades) and the feedback received on completion of the learning activities. The grade generated after completion of the quizzes was immediate and therefore provided an indication of whether the students' performance was sufficient or not. The participants reported being more motivated when they were doing well but were also driven to work harder or put more effort in when they were not satisfied with their grade ("you're given feedback straight after completing the quiz. You'd be given your mark straight afterwards. So, this is what you got. So you're like okay, now I need to work harder or I can relax a little bit"). De Byl (2012) refers to this phenomenon as the social engagement loop whereby the learner is required to complete an activity, then subsequently receives feedback (e.g. a grade or points) and feels motivated to complete more activities. Feedback pertaining to progress is favoured by students (Cheong et al., 2014) as it maintains their interest in the activity and motivates continued participation (Alabbasi, 2017; Franco-Mariscal, Oliva-Martínez, & Almoraima Gil, 2015).

One participant stated that because the activities were part of a game she did not perceive them to be contributing to her predicate or semester grade as an assignment or test ("because it was a game, it didn't really feel like it will contribute to your 'predpunt'. It felt like it's just something I have to do … it didn't feel like an actual test or an assignment"). The informal manner in which marks were accumulated was perceived negatively because she did not take it seriously. However, other participants disagreed as they found the informality created by the game was more motivating. The participant's response raises an important consideration when implementing gamification; that is, that participants should perceive it at meaningful and not meaningless (Nicholson, 2012). Sanmugam, Abdullah, and Zaid (2015) examined a number of studies that used gamification and found that learners will reject gamification if it does not meet their needs or if certain activities are perceived as unattractive (i.e. too challenging or lacking a clear purpose). This is referred to as meaningless gamification and they concluded that it determined whether students invested in their learning or not.

Another participant thought that the game lacked a competitive element as there was no leaderboard against which to assess her group's performance ("But maybe something like feedback of where each group is and how many points each person... So maybe that would add to that competitive feel. It would make it feel more like a game."). This finding is a testament to the individual preferences discussed in Case 1. Some students may desire and thrive on

competitive elements whereas others may not or react negatively to them (De Schutter & Vanden Abeele, 2014; Sillaots, 2014) and thus should be applied with caution (Sillaots, 2014).

Group dynamics. The general sentiment about group work was that it presented a challenge. First, students felt that due to the nature or format of some of the tasks it was not easy to divide the work among the group members. In some cases, it resulted in one person doing the majority of the work or focusing on completing the task rather than learning from it ("Sometimes, you're not really learning cause you're just typing. Which the aim of it is so that you can learn, but it becomes like just a task orientation rather than a learning orientation."). Participants also reported that they relied on their group members and therefore felt accountable to them, which could either be perceived as positive or negative. For example, they felt bad when they could not attend a class or missed a class with perceived repercussions for the group (perceived social pressure created by group work).

Despite these challenges, the participants acknowledged that working in a group aided their learning as they could share ideas and learn from their peers. ("Group work allowed for a more in-depth understanding through reflection"). This is aligned with Sillaots (2015) findings that students enjoyed collaborative interactions with their peers as they helped them to create new knowledge through discussions and preparation of their assignments. Šćepanović et al. (2015) also argue that group collaboration provides students of various skill levels an opportunity to contribute and develop understanding through interaction with their peers.

Structure of module. The general opinion about the structure of the game as it appeared on the LMS was positive. Tasks were set for each week and therefore required students to work consistently which assisted to keep them up to date with the learning material "I feel like structure could actually lead to consistent effort required … Because there's structure and because it's consistent for each week, you are required to work consistently". The structure also fostered a sense of progression through the content ("I saw it like you had to do a task, so you have to do it to move on to the next level. So that kind of gave the game feel to me. Like you have to do that task … to go to the next level.")

The participants recounted that they were able to redeem themselves if they did badly in one quiz as they had more than one opportunity to attempt the knowledge checks. The system offered them flexibility as they could attempt and access the activities in their own time and decide when and where they wanted to do the work ("I feel structure was more like the layout

of the whole thing … Like the structure allows you to, if you did slack off somewhere, to pick up again; Flexibility offered in terms of quizzes, it could be done at home in one's own time"). Participants also appreciated that online submission of assignments were possible, thus accommodating them further.

The participants' perceptions regarding the structure of the LMS are similar to those expressed by the participants in Case 1. The levels provided a sense of progression and encouraged continuous engagement with the learning activities (Cheong, 2014; Dichev et al., 2014). Participants in both groups reported a positive user experience as the design and game elements provided structure and organisation to the content and accommodated flexibility, reflecting a coherent and intuitive user design experience (Hansch & Newman, 2015).

Learning: consolidation and relevance. The respondents perceived the learning activities as a very positive feature of the gamification intervention that directly influenced their learning experience. The participants felt the activities were beneficial to their learning as the content was relevant and applicable to their studies ("I think the purpose of the activity, like for me it motivated me cause I saw how it was gonna be relevant to what I'm studying. While otherwise I would've been like ah, this is just something I'm not gonna use and just disregard it"). It also forced them to engage with the content, but assisted them to understand the work better, as they were required to apply what they had learnt to various scenarios. One participant remarked that the assignments demonstrated how the content was relevant to them as students but also as a practitioner someday. The application of the content also ensured that they had an effective means of consolidating their learning and revising the learning material, ("Tasks ensure you understand the work. It's consolidating work and having to interact with it"). They highlighted the knowledge checks (i.e. quizzes) as being particularly useful in this regard. Group work and the opportunity to learn from and with their peers facilitated deeper understanding and reflection on the learning material.

The findings align with the Content theme in the 2016 focus group. Correspondingly, the embedded learning activities were a central and valued feature of the gamified intervention and is also aligned with a number of other studies (Alabbasi, 2017; De Byl, 2012; De Schutter & Vanden Abeele, 2014; Ibanez, Di-Serio, & Delgado-Kloos, 2014). The concept of meaningful gamification offers an explanation of the findings in this study. Nicholson, (2012) argues that if learners self-identify with the goals of gamification (or purpose of the activity) and perceive them as meaningful they are more likely to exhibit autonomous, internalised behaviours.

Therefore, positive perceptions of the activities are a consequence of the extent to which personal goals and needs are integrated with the perceived purpose of the activity, and as such meaningful gamification results (Deci & Ryan, 2004).

Alternative approach to learning. One feature that participants gave particular attention to in the discussion was the novel format of the gamified intervention. The format of the game and the activities was perceived as fun, enjoyable and interesting ("I think that it's different to other tasks we had to do in other subjects, it's more fun"). The presentation of the assignments was different to what they were normally exposed to and also provided alternative approaches to learning through the variety of tasks they were required to complete ("Unconventional learning format; Alternative approach to learning"). Some examples of these included video presentations and infographics. Three participants stated that they valued the use of technology and various mediums of presentation that the learning activities accommodated. One participant noted that even though the gamified activities encouraged or required creativity, which was positively appraised, being creative sometimes became an effort due to time and other constraints. These findings aligned with the Concept theme in the 2016 focus group. Both groups perceived the game as novel and enjoyable which encouraged participation, and is supported in literature (Des Armier et al., 2016; Koivisto & Hamari, 2014).

Pressure: time and logistical. The pressure perceived by participants was attributed to time and logistical constraints. Time was a pertinent theme throughout the discussion. The participants had a negative perception of the frequency of the activities as they had to spend a considerable amount of additional time and effort to complete the tasks ("I think it was lots of time that you had to spend outside of the classes. Like doing lots of extra work for the assignments"). A few participants stated that there were too many assignments and little time to complete them all. As a result, they often felt rushed ("I felt that every week we get a task. And then constantly you know you've got all of this stuff to do, but you're gonna get a task. So it really made me feel a lot of pressure"). To illustrate, one participant felt that the learning activities (i.e. the quizzes) followed too quickly after the lectures, which therefore left little time to reflect on and process the content thereof. Moreover, the requirements for other modules, within their degree programme, alongside the deadlines imposed by the learning activities in the Industrial Psychology module, placed constraints on their time. The pressure demotivated some participants ("And maybe if there weren't as frequent tasks … Because that's kind of demotivating in a sense, cause now I just wanna get it done instead of putting effort into it").

The student perceptions of the workload are similar to those expressed by the 2016 focus group (i.e. group work theme) and remained even after attempts to increase the interval between tasks. De Schutter and Vanden Abeele, (2014) attribute this perception of a heavy workload to the frequency of tasks in a gamified application. In comparison to other modules, where students perceive that work is only required at specific time (e.g. a test or assignment), the continuous requirement to complete small tasks may be perceived as burdensome. The logistical issues were predominantly linked to getting all group members together to work on the assignments (not all group members lived on campus), even though a class was scheduled for these interactions ("you can't really get everyone together all the time").

Positive outcomes: The participants reported that the effort put into the online structure of the game and the activities by the lecturer gave them the sense that the lecturer wanted the best for them and strengthened their confidence in the lecturer's knowledge, skills and commitment toward student learning ("And I think another positive of the gamification and stuff, it gave me more confidence in my lecturer because I could see how much effort was put in online and stuff. Like I knew that she wanted the best for us, so it gave me a lot of confidence in everything that she told me and stuff"). Students felt they had a better relationship with the lecturer as they respected the effort she put into the gamification intervention. Çakıroğlu et al. (2017) findings corresponded with these results where students also reported increased confidence in their teacher when game elements (leader board and points) were applied in the course.

5.2.4.2 Pilot study: Student engagement questionnaire

An invitation to complete the pilot survey was sent to the 2017 cohort of Industrial Psychology 132 (Occupational Therapy) students (n = 51). Data was gathered via Checkbox and the final recorded data set exported for analysis. Prior to conducting the analysis, data cleaning techniques were employed that included the removal of cases with missing values, deletion of duplicate responses and assigning code labels to each item. After several reminders, only 26 responses were received, however only 20 cases were retained for analysis, as they did not contain any missing data. Descriptive statistics included reliability analyses on the scales of the Student Engagement Questionnaire (SEQ). The procedure and criteria against which the data was examined is as reported in section 4.3.8.2 in the preceding chapter.

The respondents (n = 20) included only female students with ages ranging from 18 – 26 years (M = 19.10; SD = 1.96). The sample included white (45%), coloured (30%), black African

(10%), Indian (10%) and Multiracial (5%) respondents. The majority indicated English (60%) as their home language, followed by Afrikaans (30%), isiXhosa (5%) and isiZulu (5%).

All the respondents rated their computer skills between average and very good and 35% indicated that they *seldom or never* played games in their free time. The majority did not know about the concept of gamification before the module (80%) and 85% enjoyed the gamified activities of SUNLearn.

5.2.4.2.1 Reliability analysis: Student Engagement Questionnaire (SEQ)

The SEQ comprised four engagement dimensions (i.e. behavioural, emotional, cognitive and general) with 23 scales (120 items) across these dimensions. An examination of the scales in each dimension revealed that 11 of the scales obtained alpha coefficients above the .7 criterion for satisfactory internal consistency (Field, 2013), nine scales obtained alphas between .5 and .7 and one scale in the behavioural engagement dimension had the lowest coefficient alpha of .3. Refer to Table 5.3. The inter-item correlations below .3 were noted and considered for adaptation or deletion (Field, 2013). The results were interpreted with caution as the sample was small (n = 20).

Table 5.3

Summary of Pilot Study Reliability Analysis

Dimensions	**Scales**	***No. of Items***	***M***	**α**
Behavioural Engagement [a]	Online engagement	4	3.43	.68
	Online active learning	5	3.24	.30
	Online contact with staff	3	2.20	.65
	Online collaboration	4	2.23	.76
	Online teaching	6	3.15	.72
	Online academic relevance	4	3.33	.51
Emotional Engagement [b]	Interest	7	3.87	.87
	Perceived competence	6	4.58	.79
	Value/usefulness	7	5.90	.91
Cognitive Engagement [c]	Effort regulation	4	4.14	.60
	Effort/importance	5	4.23	.87
	Cognitive and metacognitive strategies: Rehearsal	4	5.21	.53
	Cognitive and metacognitive strategies: Elaboration	6	5.56	.90
	Cognitive and metacognitive strategies: Organisation	4	5.60	.63

	Metacognitive self-regulation	12	4.56	.58
General Engagement [d]	Constructive teaching	6	3.37	.69
	Collaborative work	5	3.26	.60
	Teacher approachability	4	3.71	.73
	Student and staff interaction	5	2.08	.82
	Active learning	6	3.18	.63
	Academic challenge	5	3.22	.63
	Beyond class collaboration	4	3.28	.74
	Supportive learning environment	4	3.44	.85

Notes. n = 20. [a] Likert type response scale 1 - 4; [b] Likert type response scale 1 – 7; [c] Likert type response scale 1 – 7; [d] Likert type response scale 1- 4

In the *behavioural engagement* dimension, the mean scores for each subscale were moderate (>2) to high (>3). In addition, four items (out of 6) in the online teaching scale and three items in the online academic relevance scale (out of 4) showed inter-item correlations below 0.3. In the *emotional engagement* dimension, the mean scores were moderate (>3) and all the items performed satisfactorily. However, one item (out of 6) in the *perceived competence* scale obtained an inter-item correlation below the set criterion of .3. In the *cognitive engagement* dimension eight weak items were identified, two items in the effort regulation scale (out of 4), two items in the rehearsal scale (out of 4) and four items in the Metacognitive self-regulation scale (out of 12). The mean scores for each subscale was moderate (between 4 and 5). The *general engagement* dimension included seven weak items; two items in the collaborative work scale (out of 5); two items in the active learning scale (out of 6); two items in the academic challenge scale (out of 5) and one in the beyond class collaboration scale (out of 4).

These results were somewhat satisfactory, however the content of each of the items were re-evaluated. The rehearsal, elaboration and organization cognitive strategies scales (as measures of cognitive engagement) were removed as these were more focused on established study skills that were not directly applicable to the completion of online activities. The Motivated Strategies for Learning Questionnaire MSLQ was revisited and the decision made to add two other scales for the second round of data gathering namely; intrinsic goal orientation and extrinsic goal orientation. These scales were deemed more relevant to the measure of cognitive engagement in the online environment. General engagement was excluded as it was argued that an individual's engagement with the institution (which was the primary framing of the subscale) would probably not be altered significantly by one module within a degree programme. Lastly,

for the sake of conformity the rating scales in the questionnaire were all changed to 7-point Likert-type scales.

5.2.5 Reflection on meso-cycle 2

The findings from the focus group discussions were analysed together with the quantitative SEQ, activity log data and the module feedback forms and personal observations. The activity logs revealed that the completion of the activities on SUNLearn remained high. However, in comparison to the previous group (Case 1), 11 students only completed some of the knowledge checks. Nevertheless, all the groups completed and submitted the assignments.

The improvements to the intervention seemed to minimise some of the frustrations reported in case 1, for example “We were clearly instructed on what assignment needed to be done and the expectations of us”. The themes that emerged in case 2 were more positive and emphasised the motivational elements of gamification and the consequent learning that took place. For example, in case 2, the game itself was seen as a source of motivation as it created an expectation to do well and encouraged the participants to perform. Even in the absence of a leaderboards, students still perceived a sense of competition that they attributed to having to gather points to win the game and trying to match the effort of their peers when doing group work. However, the pressure this created had a similar effect to competition: that is, motivating for some but stressful and demotivating for others.

The perception of learning activities was once again positive and viewed as beneficial, relevant and practically applicable to the content. This enabled students to consolidate their learning and assisted with revision and test preparation. The levels provided structure and the activities in each level offered flexibility but also ensured they worked consistently and stayed up to date with the work. The novel format of the game encouraged participation as the approach was fun, enjoyable and interesting. Moreover, the different styles of presentation and mediums supported an alternative approach to learning. Students also acknowledged group work as a valuable exercise that aided their learning through peer interaction and discussions. They also relied on and felt accountable to the group (social pressure). Furthermore, the focus group findings were corroborated by the comments in the feedback form.

Despite the benefits and positive outcomes expressed, some issues remained, namely time and logistic pressure. Attempts to minimise the activities and space the group activities at two- or three-week intervals with weekly knowledge checks, together with the allocation of class time

for group work, did little to influence the perceived workload and time pressure. Based on reports from the literature this is a common consequence of gamified environments (Barata, Gama, Jorge, & Gonçalves, 2011; Berkling & Thomas, 2013). The only recourse to remedy this issue could be to provide students with deadlines in advance in order for them to plan their time accordingly. The comments in the feedback form revealed that students desired even more class time for group work, a consideration for future implementation.

The feedback received from students in the focus group as well as comments submitted in the course feedback evaluation were combined to identify refinements for future applications of OT Tycoon. The suggested refinements are as follows:

- Provide a memorandum to the quizzes after they have been completed to facilitate learning and preparation for the assessments.
- Ensure that the group leaderboard is working correctly to enable comparison between groups.
- Make progress through the game visible by ensuring that the progress bar and completion tracker work correctly and visually display points on the SUNLearn platform.
- Make the game more exciting by the addition of more game elements to the SUNLearn platform and incorporating some group activities into the lectures.
- Include competitive elements or activities that enable the individual to compete with him/herself.
- Incorporate a capstone assignment combining various chapters or themes.
- Give students advanced notice of when learning activities are due so they can plan ahead.

The findings and refinements from case 1 and 2 informed the development of a new intervention that was developed, implemented and evaluated in case 3. The rationale for the decision to create a new intervention as well as an explanation of each micro cycle follows in the subsequent case.

5.3 CASE 3: MESO-CYCLE 3

The purpose of Case 3 was to test the transferability of the design principles developed through reflection and refinement of the OT Tycoon intervention in Cases 1 and 2. As mentioned in section 4.3.3, Case 3 served as a theoretical replication. Even though the design implications derived from the preceding cases were applied, a new intervention was created with various alterations and improvements. Moreover, the intervention was implemented to a different module with a more heterogeneous student profile. The context and subjects as well the micro-cycles executed in Case 3 are described and discussed in the subsequent sections.

5.3.1 Context and subjects: IP 152, 2017 cohort

Industrial Psychology 152 (IP 152) is a 6-credit elective offered by the Department of Industrial Psychology to various BCom, BA and BSc degree programmes. The objective of the module is to orientate students to career psychology with particular emphasis on application in the South African work environment. The focus is to provide a theoretical basis for career development and management at an individual and organisational level of application. The module is considered "content heavy" and signs of disengagement amongst student registered for this module have been observed in the past (e.g. low class attendance, poor performance on the assessments).

In 2017, 340 students enrolled for the IP 152 module. The demographic breakdown of the group was; black African (8%), coloured (15%), Indian (2%) and white (75%). In terms of gender, 55% were female and 45% male. Their ages ranged between 18 and 28 years with an average age of 20 (*SD* = 1.32). Most students were in their first year of study (73%) from 13 different degree programmes. The majority were registered for BCom (Management Sciences) (39%) followed by BCom (16%) and BCom (Industrial Psychology) (14%). The module is offered in English and Afrikaans (separate classes; same timeslot) and 75% of students indicated English as their preferred educational language.

The lectures are presented in the second semester on a weekly basis. In the third term two lectures are presented per week on a Wednesday at 12:00 and Thursday at 8:00. After the recess (fourth term) one lecture is presented on a Thursday at 8:00. Historically, Thursday lectures are poorly attended even when it is the only lecture opportunity available.

5.3.2 Micro-cycle 7: Analysis and exploration

The development of the new intervention was the result of extensive collaborative brain storming and planning with a number of lecturers and blended learning coordinators from various departments. The primary aim was to apply the design principles from the previous two iterations in new contexts, being IP 152 and including students enrolled for a variety of programmes and inclusive of students that that chose the module as an elective. Furthermore, some students enrol for the module purely to "make up credits" while others envisage industrial psychology as a major, providing for a very different context compared to IP 132. The intervention was designed according to the same process discussed in Chapter 3 to develop OT Tycoon.

The challenges previously encountered in this module were discussed with the course coordinator to understand the target audience. The primary objective of the new intervention was to overcome disengagement amongst students and increase student engagement (Kapp, 2012). The development of the activities in the intervention sought to achieve the following learning objectives:

- to help students understand key concepts;
- to encourage the completion of formative learning activities;
- to promote class attendance ; and
- to increase engagement with the content.

The content of each chapter, broad objectives and learning outcomes of the module guided the formative learning activities assigned to each chapter. Once the structure of the game and the activities were developed, the appropriate game elements were selected.

5.3.3 Micro-cycle 8: Design and construction

The design of the Career Hero intervention was guided by the findings derived from Case 1 and 2 (both positive and negative). The game elements were altered slightly to improve the intervention and two additional components were added namely, an avatar and boss fights.

Design principle 1: ***Provide focused goals that establish and convey the purpose of the learning activities.***

As in Case 1 and 2 the rules and instructions were conveyed through an introductory presentation. In addition to the presentation, a video was create and a scheduled plan, referred to as the *Master plan*, was set out for the activities students needed to complete each week (Figure 5.4). This ensured clear upfront communication of deadlines for all the learning activities (both formative and summative) so student could plan ahead. A description of each icon on the master plan was provided along with a description of the nature of the activity.

Introduction. The researcher conducted a short presentation on the intervention (to both the English and Afrikaans classes) before Career Hero commenced. A short video conveyed the storyline, rules and point system together with a brief overview of the layout of the LMS. A question and answer session followed.

Rules. Career Hero was based on the premise that the player assisted (through the completion of activities and challenges) the main character, Chuck Choice, to conquer the changing world of work and become a career superhero. The video, masterplan and additional supporting documentation was available on SUNLearn for ease of access and referral.

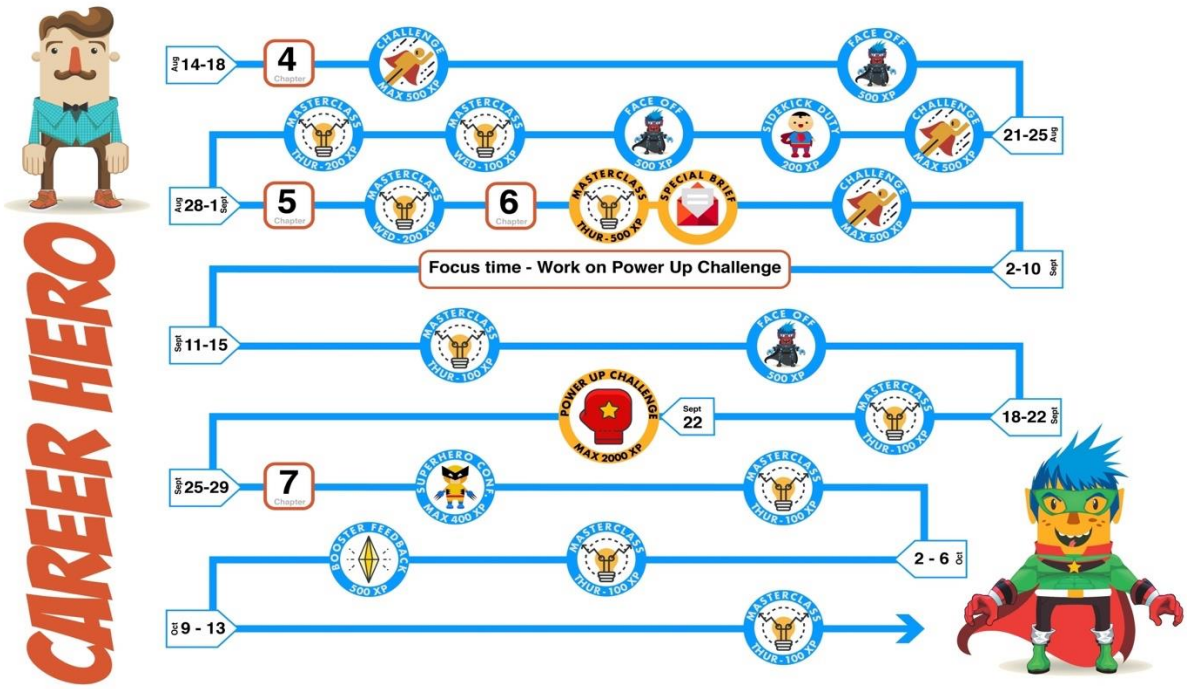

Figure 5.4. The Masterplan − Career Hero activities scheduled for each week

Design principle 2: Provide challenging tasks that are aligned with a student's skill level.

The improvements made to the challenges in Career Hero ensured higher levels of interactivity and catered to different learning styles and introduced more challenging tasks (which were optional). As suggested in the previous cases a capstone assignment, incorporating a number of chapters, was developed. In this assignment students could choose from three formats to present their work including a written report, infographic or video. In addition, an expert challenge (Face off challenge) was designed as "boss fight" at the end of each week. This task was made more challenging by requiring students to answer all questions correctly.

Challenges. The learning activities included two individual activities (*challenges* and *expert challenges*) and two group work activities (*sidekick duty* and *power up challenge*) (Refer to Figure 5.5).

- Weekly challenges: Short interactive presentation/ video (created using iSpring) explaining key concepts and followed by multiple-choice questions.
- Expert / face-off challenge: A series of multiple-choice questions pertaining to all the work covered in a chapter. Points were only awarded for correctly answering ALL the questions.
- Sidekick duty: A case study required students to work as a group to complete the questions. After submission, the memorandum allowed groups to grade each other's submissions.
- Power up challenge: This assignment required students to conduct an interview and report on questions (content covered in Chapters 4, 5 and 6). The preceding activities linked to each of these chapters, thus scaffolding the requirements of the assignment. The students could submit the report as a video presentation (2000XP), infographic (1000XP) or a written report (500XP).

Additional activities (for the period following the experiment) were created to ensure continuity in the educational experience (not discussed here).

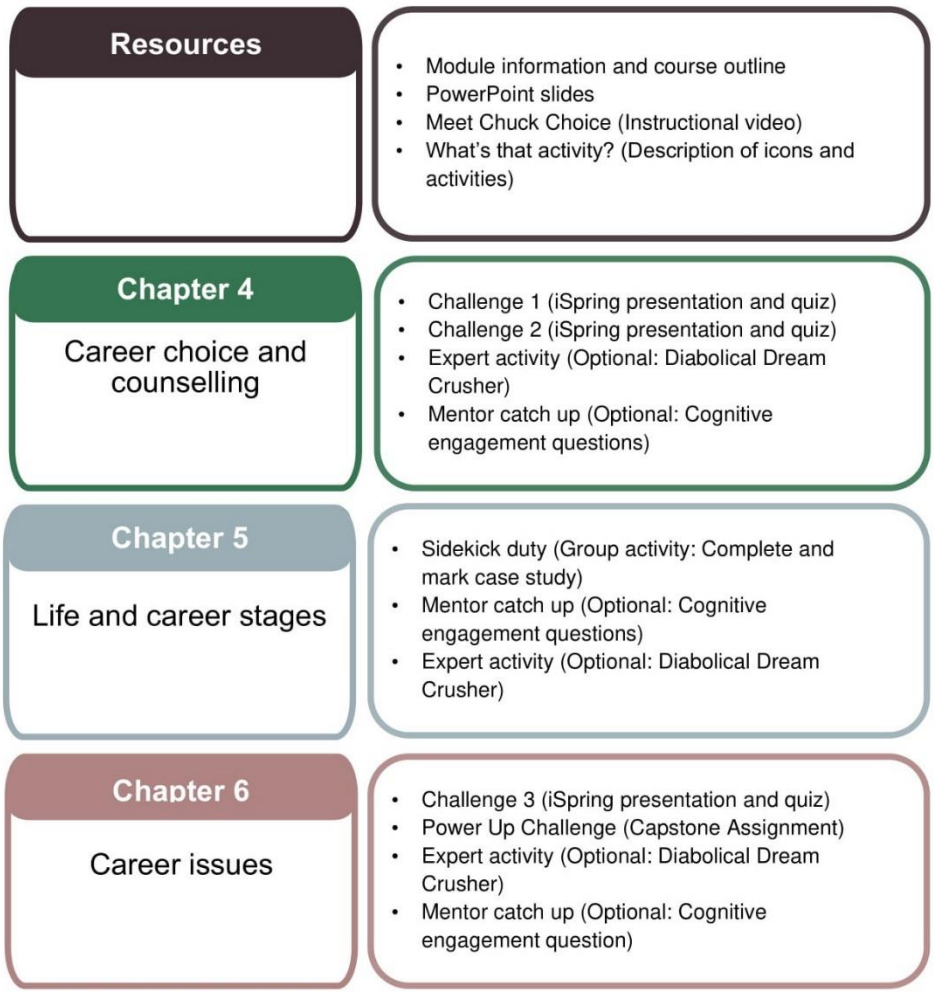

Figure 5.5. Learning activities and tasks assigned to each chapter covered in the intervention

Design principle 3: Provide rapid feedback regarding progress through the learning activities.

Feedback was conveyed through grades and points. Students were explicitly informed of the allocation of points for each activity (in the masterplan and additional resources on SUNLearn) and automatic grading was used to grade the majority of activities.

Feedback. The students received immediate feedback on the majority of tasks. The power up challenge however required manual grading. The lecturers therefore recruited 12 Honours students to assist with grading the activity and ensure the provision of prompt feedback.

Points. The point system in Career Hero was specifically carefully considered. The players earned points (XP) for the completion of activities to the maximum of 10 000 XP. For each increment of 1000 XP attained, the player earned 1% towards their class mark. Bonus points

('Easter eggs') were allocated intermittently to stimulate excitement. Refer to Appendix E for a detailed account of the allocation of points.

Design principle 4: ***Affirm performance by recognising achievements and providing indicators of progression.***

As with the previous interventions in Case 1 and 2, the content structure on SUNLearn was grouped according to the chapter it related to (e.g. Chapter 4, Chapter 5 etc.). However, in Career Hero the levels were linked to the point system and the avatar (figure 5.6).

Levels. The game consisted of six levels and linked to the points students were required to accumulate:

- Level 1 – 1700 XP
- Level 2 – 3950 XP
- Level 3 – 7700 XP
- Level 4 – 8000 XP
- Level 5 – 9250 XP
- Level 6 – 10000 XP

When a student earned the required points to move to the next level, he/she would "level up", causing a change in the appearance of the avatar (see Figure 5.6).

Avatar. A graphic designer designed the central character and the icons that appeared on SUNLearn. The point system and levels dictated the changes to the avatar.

Figure 5.6. Evolution of the Chuck Choice avatar (character upgrade)

Design principle 5: ***Create opportunities for social interaction through competitive or collaborative engagements.***

As in Case 1 and 2 team/group work was employed to encourage collaboration amongst students. In an attempt to pre-empt and minimise the logistical frustrations of finding group members, an online discussion group was created to allow students to communicate with their peers to join or find a group. In contrast to Case 2, group work was completed in the students own time. The inclusion of the leaderboard introduced a competitive element to the game. Taking into consideration the feedback from Case 1, students were encouraged to compete with themselves (by helping the avatar character evolve) but could compare their performance to their peers if they so desired.

Teams. Group work (3 members) was compulsory for two activities. Students could select their own group members and indicate membership on the SUNLearn platform.

Leaderboard. Each student's leaderboard only displayed the two scores above and below the students' score.

Design principle 6: ***Create an imagined environment that inspires curiosity and novelty and allows for creative thinking and authentic problem solving.***

A new storyline/narrative was created to frame the activities and move players through the content. In contrast to the previous intervention, the activities were formative and not summative. Hence, students were rewarded for participation through the point system.

Storyline. The title of the story was Career Hero and the central character was Chuck Choice. The aim was to help the character complete challenges, earn points and evolve into a Career superhero.

Reward. Participation in the Career Hero activities carried a weighting of 10% towards the final class mark and the percentage was linked to the number of points accumulated e.g. 5000 XP = 5% (Appendix E).

Figure 5.7. Example of the layout of the Career Hero SUNLearn platform

The blended learning coordinator was responsible for placing the content on SUNLearn and organising the layout of the platform: that is, the activities for each chapter (Figure 5.7). She also agreed to serve as the primary administrator and thus uploaded the content for the activities, allocated points and dealt with complaints and technical issues that were reported

5.3.4 Micro-cycle 9: Evaluation and reflection

The module began on 17 July 2017 at the outset of the second semester at Stellenbosch University. As mentioned in Chapter 4, two conditions were created. *Condition 1* represented the state of the LMS prior to the start of the intervention. The SUNLearn layout was displayed as it was in previous years. The lecturers used the platform to provide general information related to the course as well the power point slides and learning activities. The learning activities constituted two non-compulsory (formative) online activities and one compulsory online test.

The introduction of the intervention constituted Condition 2 and commenced on 16 August 2017 (5 weeks after the start of the module). The gamified intervention was integrated into the module and formed part of the assessments in the module. The intervention was therefore visible to all students enrolled for the module. The learning activities were formative assessments except for the capstone assignment (power up challenge) which was a summative assessment. Participation in the Career Hero activities was encouraged for all students enrolled for the module but they did not necessarily have to participate in the study (i.e. complete the questionnaires). Refer to Appendix F for a detailed outline of the module and the planning for the experiment,

The evaluation of the intervention included both qualitative and quantitative methods and measures. The qualitative evaluation included a focus group interview and responses obtain from open-ended questions in the e-survey, gathered at the end of the course. In addition, the execution and evaluation of the intervention was carried out as a within-subject experiment. This involved the collection of pre- and post-test quantitative data: that is, respondents from the IP 152 class who volunteered to complete the SEQ on two occasions (at the start of the intervention and after the intervention). A discussion of the outcome and findings garnered from the evaluation of the intervention follows next.

5.3.4.1 Qualitative evaluation of the intervention: IP 152 cohort

The researcher and the blended learning coordinator conducted and facilitated the focus group interview and followed the interview protocol applied in Case 1 and 2. This decision was justified as the researcher did not the lecturer in the module and therefore not in a position of power. An electronic invitation was sent via SUNLearn and points were offered as an incentive. Initially, 23 students signed up to participate but only 10 students participated (7 female and 3 male participants; white (70%) coloured (10%), black African (10%), Indian (10%).

In addition, open-ended responses from an e-Survey were collected to extend the qualitative insights into the intervention (n = 139). The question was stated as follows: *Please describe your experience with the Career Hero activities. What worked best and what needs to be changed/improved*? Firstly, the answers were grouped according to positively phrased statements (77); negatively phrased statements (63) and suggestions for improvements (43). Secondly, the researcher deductively analysed the data using the themes generated from the focus group interview (Case 3). The findings from this analysis served to triangulate and

elaborate on the themes highlighted in the focus group results. The description of each theme to follow is a combination of the descriptive codes extracted from the conversations in the focus groups and the qualitative comments collected in the e-survey.

Table 5.4 provides a list of the primary themes elicited through the focus group interview and e-Survey responses, with a description of each theme. A discussion of each follows in the subsequent paragraphs.

Table 5.4

Salient Themes and Descriptions Derived from the Focus Group Discussions and e-Survey Responses (IP 152, 2017 Cohort)

Theme	Description
Time limitations	The perceived pressure and demands caused by deadlines and time restrictions in the learning activities.
Point (XP) allocation	The positive (advantageous) and negative (disadvantageous) influences that the point system had on the student's perception of the activities and their behaviour.
Technical problems	The negative effects resulting from technical issues experienced on the SUNLearn platform.
Motivation to engage	The elements in the game that encouraged participation and completion of the tasks.
Various learning activities	The different types of activities included in Career hero and how the participants experienced them.
Interaction with peers	Group work and the challenges of group dynamics.
Communication and feedback	The communication of the availability of the assignments, allocation of points and opportunities to review the work.
Alternative layout encourages participation	The layout of the SUNLearn page and the nature of the activities that encouraged them to participate.

Time limitations: In the face off (expert) challenge students had one attempt to complete the activity within a 24-hour period. The feedback on this particular challenge was predominantly negative as the students reported that it caused them stress or did not assist them to learn ("I did not like that we sometimes had only "one day" to complete the online test and had to get "full marks" to receive points. We had only one attempt for that specific online test and it was not very helpful."). In addition, they were frustrated by the requirement that they needed to correctly answer all the questions and that one error would result in the points not being awarded. Even though the aim of the activity was to test mastery of the content, students were not given the freedom to fail. This could explain the negative reaction to this activity.

The time limits in the challenges referred to the number of attempts and the time limits placed on some of the activities. Students were awarded maximum points for completing the activity correctly after 1 attempt with decreasing amount of points for every additional attempt (1 Attempt = 500 XP; 2 Attempts = 300 XP; 3 Attempts = 200 XP). Some students reported that the time limits detracted from learning as the focus shifted to completing the activity in order to receive the points. One student commented that the time limit was not the problem, but rather the number of attempts allowed. She felt that all the allotted attempts should have been permissible to foster deeper learning and understanding, without being penalised by losing points. Similarly, Schöbel and Söllner's (2016) findings ranked time pressure and loss aversion as the least favoured game elements. They argued that the inclusion of these elements on an LMS could have an adverse effect as they detract from the students focus on the learning activity. In addition, the learning activities provided a number of attempts but did not encourage or facilitate freedom to fail. Dicheva, Irwin, Dichev, and Talasila (2014) stated that freedom to fail is an important feature in educational gamification as it provides the opportunity for the student to experiment, thereby increasing and testing their performance. Based on the participant's comments, students did not perceive that the activities afforded them this opportunity. Instead of facilitating learning the challenges and time limits detracted from the learning and placed the emphasis on the final result or the incentive being offered. In addition, students who may have been interested in the learning and practicing, rather than attaining points likely perceived awarding fewer attempts at the challenges as punishment. This outcome was not anticipated and highlights the importance of giving careful thought to the structure and purpose of incentives or rewards for formative activities.

As in Case 1 and 2, perceived time pressure was highlighted as a negative outcome of a continuous stream of learning activities. Despite the Masterplan schedule provided, a number of students claimed that they did not know about the activities because they did not check their emails regularly or did not receive the notifications. These findings were corroborated by the open-ended comments in the e-Survey. The general perception was that the activities added to the workload and were time consuming. For example, one comment read: "There was a constant stream of challenges which were all unexpected and hence often conflicted with my schedule and plan for completing other work. This led to me dreading even checking regular announcements from lecturers". Another comment stated: "I felt like the career Hero activities added additional workload and stress to the module which was a bit time demanding. The

shorter activities were fine but some of the activities were a bit excessive and I was unable to find the time to complete them."

In case 3, concerted attempts were made to minimise the workload pressure by creating shorter activities and a master plan to communicate when activities would appear and the deadlines for each. These efforts however remain fruitless if students are not aware of, or do not consult the schedule. The findings in Case 3 on time pressures are aligned with those reported by Barata et al. (2011) who proposed that workload was perceived as a detrimental factor, even though the workload and effort required was not dissimilar to other courses. Nevertheless, the continuous tasks they were required to complete made students feel they were "always working for this course" (p. 7). As in case 1 and 2, the timing and intervals between tasks should be carefully managed to ensure that students do not perceive the workload as unduly time consuming. This workload perception should be acknowledged as one of the most difficult to address in educational gamification, as it by nature requires the completion and regular engagement with activities.

Point allocation: The act of accumulating points created a sense of excitement and enjoyment for some students. They reported feeling driven to earn more points and enjoyed the sense of accomplishment from accumulating points and moving up the points ladder ("I liked that I wanted to earn more XP points every time"; "Made me feel like I was winning"; "I liked to see how I moved up the ladder and gain more points"). The points also encouraged the completion of the activities and class attendance as students appreciated being rewarded for desired behaviour. On the other hand, the point system also seemed to cause some frustration and annoyance. This was primarily attributed to the allocation of points in the face off challenge ("I felt that there could have been more opportunities to earn points on the face off challenges") and that some of the points were not loaded immediately ("I did not like the fact I was not given my XP points immediately"). Despite automatic grading on the LMS, the points for some activities and class attendance were loaded manually which resulted in some delays.

The positive perception of the points could be related to the feedback loop created by obtaining points. Alabbasi (2017) posited that gaining points provides instant feedback on accomplishment and assures the learner of their performance and competence. In addition, the learner is motivated to be cognisant of their actions and a sense of excitement is created (Bajko, Seaborn, Livingstone, & Fels, 2015; Cheong et al., 2014). This line of reasoning could also explain the frustration created by not receiving points on time. The students likely perceived

that they were not receiving the necessary feedback to guide their efforts and assess their performance. Alternatively, students may expect that a gamified context should operate in the same way a fully-fledged game or serious game does. When these expectations are not met the student may become frustrated (Berkling & Thomas, 2013).

The comments in the e-Survey corroborated these sentiments. Some comments provided insight into the effect of the points, for example, "The XP was not awarded immediately, thus taking away from the experience and limiting the dopamine released with completion". It was also evident that the game-like nature of Career Hero created expectations similar to what would be expected in a fully-fledged game, for example, "The lecturer should load the XP faster, because in a real game you see progress immediately when completing something, whereas in Career Hero, the lecturer takes too long to load the XP."

It was apparent that a number of students lacked clarity on how the points were allocated and/or calculated, despite the introductory resources provided (i.e. the master plan, video and description of each activity). Students also reported that they did not know which activities they had completed and which they had missed, as the activities were hidden after the due date. A few suggested that completion or continuous progress be displayed (i.e. indicate which activities had been attempted and how many points were allocated) to encourage people to do the activity, for example: "Sometimes I felt like the XP points system progress was difficult to follow and I'm still unsure when and whether I got certain points for some activities or questionnaires. I would have liked to see when and for what my XP points were submitted and achieved on a timeline type of format."

Lastly, some students requested more opportunities to obtain points whereas others suggested that the point system be removed in future.

Technical problems: The technical issues or "bugs" (especially the point system and layout) in the learning environment caused much frustration and also lead to stress. Comments from the e-survey corroborated these findings and highlighted that the layout was perplexing and not easy to navigate. One student described his frustration as follows:

> "The problem I had with this is that Career Hero did not resemble a fair game in the sense that it felt almost impossible to 'win' the game. Suppose you're playing Mario Kart but your car isn't working. You would try figure out why your car isn't working so that you can get back into the race and win. The problem is that you don't know who to inquire about your faulty car and, overall, the game feels rigged

> against you. Or maybe no matter how fast you drive your car and how perfect your run is you just can't beat the game. This would easily discourage you from playing Mario cart. I feel like that's what happened with Career Hero. It felt difficult to keep up with the admin, it was also very confusing and therefore did not seem worthwhile to stress yourself over about" (Comment in e-survey).

In a review of gamified online learning platforms Hansch and Newman (2015) posit that effective gamification is linked to user experience design, for instance, "The gamification elements should improve users' overall experience and help guide them through the content in a coherent, intuitive and engaging fashion … gamified features should be largely invisible and blend in with the platform's design and functionality" (p. 21). In case 1 and 2 the feedback suggested that the coherence and functionality of the LMS was optimally executed and effective. However, the comments discussed above suggest that aspects of the layout evoked negative emotions in the users in case three, and thus resulted in an unsatisfactory user experience for some students.

Motivation to engage was stimulated by elements in the game that encouraged participation and completion of the tasks. Some focus group participants noted that the mere presence of the game (i.e. Career Hero) motivated them to participate and return to the LMS regularly, for example, "I liked that the game added more purpose to doing IP 152. It kept me coming back to SUNLearn most of the time"). Respondents in the e-survey also shared this sentiment ("It motivated me to work during the semester"; "The idea of engaging the students in the module by conducting regular tests on the various themes is good and it helped with encouraging one to learn frequently for the module in order to not be left behind"). These findings are aligned with Franco-Mariscal et al.'s (2015) proposition that game elements drive students participation in learning activities and motivates interactions that may enhance learning. Comparably, in Bajko et al.'s (2015) study, students also reported feeling engaged with the content and encouraged to participate that was attributed to the "communication element" (p. 5). Examples in this study could include; feedback provided by the points and leader boards that show progression and performance which may serve as a motivator for some students ("I enjoyed seeing how much XP I have and how it's progressing. It inspired me to want to do more activities") and the notification/reminder emails regarding the activities ("Receiving an email for each activity made me check SUNLearn each day").

The point/reward system may also aid students to set goals for their learning and performance, for example, "Working towards attaining the 10% for participating in the game kept me

motivated". This viewpoint is supported by De Byl, (2012) who contended that the application of game elements can create a playful dynamic that entices competition, offers goals for students to work towards and stimulates motivation by providing rapid feedback and a sense of progression.

Various learning activities: Participants expressed enjoyment and felt that the learning activities were fun, exciting and interactive. One participant stated that the challenges were short and therefore easy to comprehend which held their attention. The content was viewed as relevant and the SCORM package was an effective medium that encouraged engaged learning ("I liked the activities, it made me engage more actively with the content of this module"), transfer of knowledge ("I enjoyed applying the learnt knowledge in autonomous situations") and development of skills ("I used it to develop my skills and understand the module content more in depth"). The focus group participants also reported that the activities provided real-world scenarios that were helpful in understand the application of the content while providing "… learning opportunities aside from just memorising". Overall, the focus group participants agreed that the activities were a good approach to prepare for the tests. The questions were good examples of the types of questions they could expect, but more importantly, kept them up-to-date with the content that was being taught in the lectures.

Based on the responses, it could be argued that participants perceived the activities to be meaningful and supported their learning by fostering positive study behaviour (Alabbasi, 2017). The findings are aligned with student's perceptions about learning activities, from Case 1 and Case 2. The e-survey yielded similar positive evaluations of the learning activities. These findings thus support and corroborate the importance of meaningful, relevant content and learning material in gamified applications to ensure sustained student participation (De Schutter & Vanden Abeele, 2014; Ding et al., 2017; Šćepanović et al., 2015).

However, in the focus group the participants did discuss the pressure created by the number of activities and the deadlines to complete them. Similarly, the e-Survey responses also alluded to this. The activities were perceived as time demanding and time consuming leading some students to feeling stressed and overwhelmed by the workload. These negative perceptions of the workload were also mentioned and discussed in Case 1 and Case 2 and were attributed to the frequency of tasks to be completed (Barata et al., 2011; De Schutter & Vanden Abeele, 2014). Other comments about the learning activities, referred to them as "tedious and diminutive" and therefore not effective. Another stated that he/she preferred more traditional

means of being tested, for example, a simple quiz or online test. Similarly, Berkling and Thomas (2013) reported very critical views from the students in their study , for example, they did not see the benefit of a game environment, felt it was a waste of time and were annoyed by the use of gamification. They attributed this view to the engrained culture of traditional teaching and learning students are exposed to at school level, for instance, "The problem is the change in teaching style is not seen as a relief by the student but rather as very painful and frustrating and no longer perceived as teaching but rather as an effort to self-teach, which is not why they came to university" (p. 7). Moreover, they construed their findings as an indication that students were not ready for autonomous learning and that mastery was perceived as irrelevant.

Interaction with peers. As in Case 1 and 2, the focus group participants acknowledged the value of group work, but a number of frustrations were also highlighted. Some students enjoyed working with their peers as it encouraged teamwork, promoted learning through discussions with their peers and provided an opportunity to meet and interact with other students in the class that they might otherwise not have spoken to ("I learn better through other people and like discussing something; It was a good experience as it encourages teamwork; It was a way to interact with her the students").

In the focus group and the e-survey responses, students who reported a dislike for group work stated the following reasons; 1) they thought the activities could be completed individually ("The group work tasks are rather annoying, I would have preferred to work alone."), 2) they found it difficult to find group members and were therefore frustrated by this ("it was a struggle to find group members"), or 3) found the experience stressful as not all members contributed equally (e.g. "Group projects were not effective because some members contributed more than others and it would be easier to complete tasks alone or at least have the option to do so."). In some instances, students added themselves to a group and did not make an effort to meet the rest of the members or contribute towards the work. Another participant felt that compulsory group work was necessary and conducive to learning: that is, "Well, at least you were forced to do something. Like otherwise you would just not engage with it at all. Like, even if it's just for points, you're still reading the sentences and getting something in your head."

From the focus group and e-Survey responses, the primary issues and frustrations can be attributed to the group dynamics amongst participants and how these relationships are managed. Another contributing factor may also be that some students are more committed to the group and completing the work, but these expectations and responsibilities are not shared by other

group members ("Like the problems in the groups that you might have has nothing to do with the whole Sidekick Duty and all the work that you have to... It's just your relationship problems. Like your friends just, they're leaving you alone, responsible for the things that you guys all have to do").

These findings highlight the fact that students are social beings and value opportunities to work together (Cheong et al., 2014). Peer evaluation could also assist to ensure equal contribution by group members (as suggested by a focus group participant) by rating each member's contribution to the work.

Communication and feedback are the announcement of the availability of the assignments, allocation of points and opportunities to review the work. At least four of the focus group participants reported that they lacked information or did not know when the activities were available. This led to last minute attempts or not completing the activities altogether (e.g. "I would have loved to do all the assignments, but it required commitment and assignments dates were not well communicated."). The point allocation was also unclear to many. One participant felt that the ladder was vague, as she could not see which activities she had completed and what was were still required to do. This may have been a consequence of the activities that were hidden after the due date.

In the e-Survey, the communication regarding assignments (i.e. when they were open or available online) and deadlines was a significant point of contention. Even though a detailed plan and regularly emailed notifications of the activities were provided, many students felt uninformed, for example, "I never knew when things had to be done by, so it was often a last-minute activity to do. Maybe there should be a list of everything and the due dates and how much each activity counts before we start the programme". Similar complaints were noted in Case 1 under the Communication: Instruction and feedback theme. Likewise, De Schutter and Vanden Abeele (2014) also reports that some students did not read the rule book and were therefore not aware of the quests, evaluations and expectations of them. They, therefore, suggested that one should evaluate or incorporate a quest that compels students to study the rulebook.

Furthermore, a number of students stated that they wished to review the activities for test/exam preparation. They were however, deprived of this opportunity as the activities on the LMS were

removed after the deadline. This was a considerable oversight on the part of the researcher and should be corrected in future.

Alternative layout encourages participation: The participants highlighted particular elements of the layout of the SUNLearn page (e.g. novel presentation) and the nature of the activities that encouraged them to participate ("The way it was presented was something different, new and fun for me"; "I liked that it was different compared to all other modules, interesting and know what is going on.").

The students also enjoyed the alternative format of the activities such as watching a video and answering questions, searching for and sharing articles etc. The activities encouraged participation as it allowed them to engage with the content through a challenging, fun and interactive medium. Some also enjoyed the opportunity to interact with other students and acquire knowledge through these interactions ("Watching videos about the content made it much easier to learn than just sitting with the thick textbook."; "I liked the video presentation. It really challenged me but also taught me new exciting skills"). One student commented that he/she enjoyed the addition of a storyline and observing the evolution of the avatar (e.g. "I liked seeing Chuck level up and change and get stronger."). The focus group and the e-Survey both yielded a number of suggestions for changes and refinements that that are discussed in section 5.3.5.

5.3.4.2 Quantitative evaluation of the intervention

The quantitative data collection included keeping attendance records and exporting the website analytics (activity logs). In addition, pre- and post-intervention responses gathered via the SEQ were analysed and contributed to the evaluation of the intervention in Case 3.

Attendance. A card reader was used to capture attendance records, for all enrolled students (n = 344), for the duration of the intervention. Analysis of the records indicated that the 21% of the students only attended one class of the nine where attendance was recorded. In contrast, 22% of enrolled students attended more than 80% of classes during this period.

Website analytics. The website analytics for each learning activity for all students enrolled in the module (n = 344) were exported and examined (Figure 5.8). The activities included the formative assessments (challenges, face-off challenges and sidekick duty) and a summative

assessment (power-up challenge). As previously mentioned the formative activities were not compulsory, but students received points for participation and completion of these activities.

In the first week of the intervention, only 21% of enrolled students completed Challenge 1, which increased to 65% for Challenge 2 and dropped to 46% for Challenge 3. This may be attributed to students not being familiar with the expectations or rules of the game. For example, one focus group participant reported that she did not know that the challenges were time restricted and therefore missed the opportunity to complete it. This may indicate that students expected flexibility from the learning environment: that is, the activities to be available to complete at their convenience.

The face-off challenge was an "Easter egg" activity through which students could earn additional points. Only 17% of enrolled student participated in face-off challenge 1 and only 8% completed the second. The sidekick challenge was an activity created to familiarise students with answering case study style questions: that is, the format used in tests and exams. A memorandum was posted and students were required to grade another group's submission. Only 37% completed the sidekick challenge and only 14% marked another group's submission.

The only activity completed by the majority of enrolled students (75%) was the power-up challenge. In comparison to the aforementioned activities, the power-up challenge was a compulsory summative assessment (i.e. contributed directly to the class mark) which was assigned the most XP. As one student stated in the e-survey: "The activities that counted for marks were the ones that helped me best because those were the ones I studied for and learned most from".

The analytics on the LMS indicated that 4% of enrolled students did not complete any of the activities. The reasons for this lack of participation are not clear. However, the qualitative feedback suggests that some students may have overlooked the learning opportunity ("Activities are tedious and diminutive'), preferred traditional methods of assessment ("I prefer being tested in other methods") or were not willing to invest time on the activities ("The activities were too time consuming").

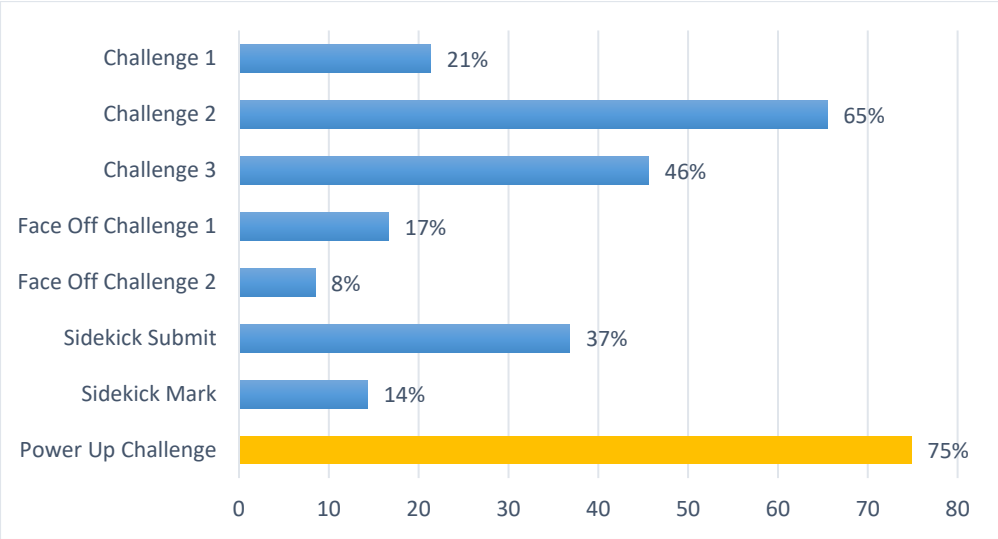

Figure 5.8. Percentage of students that completed the Career Hero activities

Game elements. In the e- survey, respondents (*n*=139) were asked to rate which game elements and activities influenced their engagement the most. The respondents selected points (21%) and the quests/challenges (18%) as most effective at stimulating their engagement in the game. When asked which game elements or activities were the least effective 17% selected the storyline and 16% the avatar. Correspondingly, Sillaots (2014) also reported that there was a lack of enthusiasm for the avatars included in his application. Perhaps, despite the fun element the avatars added, their perceived utility or purpose may not be evident. Kapp (2012) also argues that every game element included should contribute to learning and avatars in this instance may have been an unnecessary aesthetic add on or distraction.

5.3.4.2.1 Analysis of the Student Engagement Questionnaire

The data set extracted from the Checkbox platform (*n* = 442) included responses from Time 1 (T1) and Time 2 (T2). Prior to the analyses incomplete cases containing missing data were excluded where after 336 complete cases remained (T1 = 189 and T2 = 147). Data cleaning involved the removal of duplicates as some students had completed the questionnaire more than once at T1 or T2 (these ranged from 2 to 10 duplications, in some instances). The duplications are attributable to attempts made by students to cheat the system and accumulate additional points. The completion of the questionnaire carried a small incentive of 250 XP and some students attempted to gain additional points by starting the questionnaire and not completing it or completing it a number of times. Therefore, for consistency, the first attempt of the

questionnaire was retained and subsequent duplicates deleted. The final data set contained 285 responses, 168 prior to the intervention (T1) and 117 after the intervention (T2).

5.3.4.2.2 Descriptive statistics

The descriptive statistics for the pre-test and post-test groups are presented in Table 5.5. Respondents' ages ranged between 18 and 27 years. In terms of gender, 58.1% were female and 41.9% male. The majority of the sample in both groups registered for the module for the first time (91%) with the remainder repeating the module for the second or third time. The majority of the respondents in both groups indicated English, followed by Afrikaans, as their home language. English was also the preferred language of instruction.

Table 5.5

Descriptive Statistics for Pre-Test (n = 168) and Post-Test (n = 117) Group

		Pre-test group (*n*=168)	Post-test group (*n*=117)
		%	%
Gender	Female	58.1	58.1
	Male	41.9	41.9
Race	Black African	9.0	12.0
	Coloured	11.4	9.4
	White	74.9	76.1
	Indian	2.4	1.7
	Asian	1.2	0.9
	Multiracial	1.2	12.0
Home language	English	53.9	49.6
	Afrikaans	39.5	37.6
	isiXhosa	0.6	0.9
	isiZulu	1.8	2.6
	North Sotho	1.2	0.9
	Sesotho	0	0.9
	SiSwati	0	0.9
	Other	3.0	6.8
Language of instruction	I attend the English lectures	75.4	73.5
	I attend the Afrikaans lectures	24.0	24.8
	I sometimes attend the English lectures and sometimes the Afrikaans lectures	0.6	1.7

5.3.4.2.3 Reliability analysis of the Student engagement questionnaire

The reliability analysis procedures described in section 4.3.5.2 assessed the internal consistency and inter-item correlations of the measure. The Cronbach alpha coefficients for each scale

reflected satisfactory internal consistency when assessed against the set criteria. The obtained coefficients ranged from .73 to .95 for each of the scales (Table 5.6). The majority of the inter-item correlations were satisfactory and performed above the .3 benchmark (Appendix G). However, two items on the metacognitive self-regulation scale (2 of 12 items) performed below the criteria benchmark. The items were negatively phrased and reversed scored which could reflect miscomprehension or misunderstanding of the statements (Swain, Weathers, & Niedrich, 2008).

Table 5.6

Reliability: Summary of the Student Engagement Questionnaire Analysis

			Pre-test	Post-test
Dimensions	Scales	No. of Items	α	α
Behavioural Engagement	Online engagement	4	.82	.92
	Online active learning	5	.77	.89
	Online collaboration	4	.80	.85
	Online teaching	6	.87	.91
	Online academic relevance	3	.83	.89
Emotional Engagement	Interest	7	.90	.95
	Perceived competence	6	.88	.89
	Value	7	.92	.96
Cognitive Engagement	Effort/importance	5	.81	.87
	Effort regulation	4	.73	.73
	Metacognitive self-regulation	12	.77	.77
	Task value	6	.90	.90
	Intrinsic goal orientation	4	.65	.73
	Extrinsic goal orientation	4	.75	.75

Notes. Likert type response scale 1-7

5.3.4.2.4 Analysis of changes in student engagement over time

A mixed model one-way repeated measures ANOVA compared the scores on the scales in the SEQ at Time 1 (prior to the intervention) and Time 2 (after the intervention). The results revealed a significant effect for time in six of the 13 indicators (Table 5.7) with unexpected decreases between the pre-test and post-test scores on these six indicators.

Significant changes on the behavioural engagement indicators of student engagement over time: On the behavioural engagement scale significant decreases were observed in Online

Engagement (F (1, 79) = 47.52, p < .01, d = .78), online active learning (F (1, 79) = 29.04, p < .01, d = .57) and online academic relevance (F (1, 79) = 25.18, p < 0.01, d = .49). The effect size for online engagement was large and online learning and online academic relevance was medium. Nevertheless, the mean values are still indicative of a moderate level of online engagement, online learning and online academic relevance at T2, despite the significant decrease (M = 4.35, M = 4.28, M = 3.97).

Table 5.7

Descriptive Statistics and Repeated-Measures ANOVA at Time 1 and Time 2 for Student Engagement

		T1		T2		*df*	*F*	*d*
		M	*SD*	*M*	*SD*			
Behavioural engagement	Online engagement	5.39	1.19	4.35	1.52	79	47.52*	0.78
	Online active learning	5.02	1.12	4.28	1.48	79	29.04*	0.57
	Online collaboration	3.02	1.34	3.28	1.55	79	2.53	0.02
	Online teaching	4.3	1.27	4.24	1.41	79	0.60	0.05
	Online academic relevance	4.74	1.45	3.97	1.7	79	25.18*	0.49
Emotional engagement	Interest	3.67	1.21	3.81	1.58	79	0.33	0.10
	Perceived competence	4.52	0.94	4.3	1.31	79	3.49	0.20
	Value/usefulness	5.2	1.2	4.33	1.61	79	41.96*	0.63
Cognitive engagement	Effort regulation	5.2	1.14	5.04	1.14	79	2.61	0.15
	Metacognitive self-regulation	4.31	0.89	4.39	0.88	79	0.39	0.09
	Effort/importance	4.97	1.29	4.54	1.52	79	10.86*	0.31
	Intrinsic goal orientation	4.43	1.04	4.37	1.14	79	1.68	0.05
	Extrinsic goal orientation	5.45	1.16	5.08	1.25	79	11.42*	0.31

M, mean; *SD*, standard deviation; *df*, degrees of freedom ; *F*, F-ration; *d*, Cohen's d (small (0.2), medium (0.5) or large (0.8));

* p < 0.05

According to the literature, behavioural engagement encompasses participation and active immersion in academic activities (Fredricks et al., 2011). Involvement in active and challenging activities is thus essential part of student engagement (Coates, 2006; Kuh et al., 2007). As mentioned, the three scales that exhibited significant decreases included; online engagement; online active learning; and online academic relevance. Coates (2006) defined online engagement as the use of the LMS to enrich educational interactions; online active learning as the use of the LMS to actively seek challenging learning opportunities; and online academic

relevance as the use of the LMS to enhance the relevance and context of study in a module. The initial ratings on all the behavioural engagement scales were moderate to high indicating that the LMS platform was used to access activities that enhanced the respondent's educational experience. This is supported by the qualitative findings, particularly the *various learning activities* themes derived from the focus group. Those who participated in the online activities perceived them as effective, relevant activities that enabled engaged learning, for example, "I felt the career hero activities did help me learn more efficiently for the module"; "It encouraged me to go through my work when I was not planning to do so"; "Decent real world application, the case studies helped understand the slides relating to the activity". The criticism against the activities was that they were too frequent and time consuming, for example, "I did not enjoy it, as it required too many things to be done which took up valuable time that could have been used to do more constructive work. I felt nothing worked for me".

Despite the criticisms the activity logs, a proxy for behavioural engagement, showed a significant increase in activity (i.e. participation) on the LMS during the intervention. A statistically significant increase in activity on the activity logs from Time 1 (M = 91.2 SD = 37.95) to Time 2 (M = 354.44; SD = 159.49), F (1, 71) = 425.92, p <.001) was evident. The mean increase in activity scores had an effect size of d = 2.49 which is interpreted as large. This finding (i.e. the increase in LMS activity) is in contrast to the decreases in three behavioural engagement indicators of the Student Engagement Questionnaire.

To reconcile and investigate this discrepancy, the level of activity was added as a covariate to the mixed model ANOVA to determine statistically significant differences between the Time 1 and Time 2, when controlling for the participants level of activity on the LMS (activity logs). The ANCOVA [within-subjects factor: time; covariate: activity logs] revealed significant effects of time on online engagement (F (1, 70) = 48.89, p < .05); online active learning (F (1, 70) = 39.58, p < .05); and online academic relevance (F (1, 70) = 30.03, p < .05) when controlling for level of activity on the LMS. This indicates that the decreases observed over time on these three indicators remained significant even when controlling for participants activity on the LMS.

Therefore, this could indicate that regularly accessing or partaking in the online activities does not necessarily denote effective and engaged use of the LMS. This is supported by Newmann et al.'s (1992) assertion that participation may be misleading as it may denote compliant behaviour (i.e. doing what is required) rather than an investment in behaviours that contribute

to learning. Moreover, Coates (2006) proposes that students may differ in their use of and interaction with online learning environments. For instance, even though the online learning environment may be perceived as important and integrated with learning, the use thereof may not influence the perceived relevance of online learning. For some, the interaction with the learning environment may be superficial, as they may perceive the online environment as an add-on or merely an access point for gathering information while failing to engage with the intricacies of the content they are required to learn (Coates, 2006). Students may therefore use the LMS as an administrative tool rather than a learning tool. In light of the findings, the hypothesised increase in behavioural engagement was not supported.

Significant changes on the emotional engagement indicators of student engagement over time: On the emotional engagement scale the results revealed a significant decrease for value/usefulness (F (1, 79) = 41.96, $p < 0.01$, d = .63). The effect size was medium. Once again, at T2 the mean level of value/usefulness remained moderate despite the decrease (M = 4.33).

Value is an evaluation of the importance, appeal or benefit of an activity or tasks. Pintrich et al. (2015) proposed that a high evaluation of a task's value can precipitate more participation in learning. For example, one student stated "I enjoyed doing quizzes that we had to prepare for in advance because it was a good way to test my knowledge"; implying that there was a positive affective response together with a perceived utility or value in participating in these activities. Therefore, if an activity is perceived as valuable/useful the likelihood of a student participating and investing time and effort in it is higher. Likewise, if the perceived value/usefulness is low it may lead to less participation. Following this rationale, the significant decrease observed on the value/usefulness scale could possibly account for the decrease in the three indicators of behavioural engagement. If a student's evaluation of the usefulness of the activities on the LMS is low, the extent to which he/she uses the LMS to enrich their learning, access challenging activities or use of the LMS to seek relevance in their studies could decline (see Figure 5.9). Similarly, by not engaging with the activities on the LMS one cannot evaluate whether or not an activity is valuable or useful. Hence, if a student uses the LMS less the value of the activities decrease as they are opting out of the learning experience (even prior to engaging with the activity).

The observed decrease on the value/usefulness indicator and the lack of significant change on the interest and perceived competence indicators offered insufficient support for the hypothesised increase in emotional engagement.

Significant changes on the cognitive indicators of student engagement over time: The effort/importance (F (1, 79) = 10.86, $p < 0.001$, d = .31) and extrinsic goal orientation F (1, 77) = 11.42, $p < 0.01$, d = .31) indicators on the cognitive engagement scale revealed significant decreases with a small to medium effect size (i.e. between 0.2 and 0.5). The mean level of effort/importance and extrinsic goal orientation was moderate to high (M = 4.54; M = 5.08) at (T2).

Gibbs and Poskitt (2010) contend that an individual's cognitive engagement is dependent on both their behavioural and emotional engagement. If this holds true then the student's evaluation of the usefulness of the activities could account for the decrease in effort/importance. For example, a low evaluation of value or usefulness of the Career Hero activities may result in the student being less likely to invest cognitive effort in online learning. This could further translate to decreased engagement with the activities. Comments from the e-Survey also provided evidence of this; "I don't like anything about it. It's time consuming and that time I would rather invest in studying from my slides. My marks are good, but this counts 10 marks and I got 0. I don't like it. Just remove it from the module".

Extrinsic goal orientation refers to the perceived reasons for participating in an activity, particularly if those reasons are grades, rewards or performance (Pintrich et al., 2015). Task completion therefore becomes a means to an end, if extrinsic goal orientation is high. The mean extrinsic goal orientation ratings remained moderately high (>5) despite the observed significant decrease. This may imply that the points or grades the students could earn within the game motivated the respondents, for example, "*I think the online quizzes to get more points forced me to read my notes before tests which in return helped me, unknowingly, in preparation for them*". However, the motivational pull or effect of the points and grades awarded could have steadily diminished, through the course of the intervention, as the reward received for the effort required may no longer have been perceived to be sufficient as evidenced in the statement; "XP points should count more towards our Predicate as a lot of time and effort is put into doing the activities. After doing the quizzes, activities and going to almost ALL the classes, I feel as though it was pointless as it counted so little towards our Predicate." Nevertheless, the results

provided insufficient evidence to support the hypothesis that the intervention would lead to an increase in cognitive engagement.

Finally, the mean values for online engagement, online active learning, effort/importance, value and extrinsic goal orientation were moderate to high at T1 and remained so to T2 despite the significant decreases observed. A further explanation for this result could be that the differences observed are attributable to a regression towards the mean, defined as a "statistical phenomenon that can make natural variation in repeated data look like real change. It happens when unusually large or small measurements tend to be followed by measurements that are closer to the mean" (Barnett, Van der Pols, & Dobson, 2005, p. 215). In addition, social desirability bias may also explain this result as respondents may provide responses deemed to be acceptable or expected to place themselves in a favourable light. The accuracy of responses could also have been limited by respondent's memory or perceptual errors of their own behaviour and misinterpretation of the questions.

5.3.4.2.5 Analysis of the influence of enjoyment on student engagement indicators

The feedback from the qualitative evaluation highlighted student frustrations caused by the layout and the technical problems experienced with *Career Hero*. As mentioned, these factors may contribute to the overall user experience and perceptions of the gamified application (Hansch & Newman, 2015). The researcher was also interested in whether gamification of the content and the creation of the Career Hero game fostered an enjoyable learning environment. Schöbel and Söllner (2016) argued that an enjoyable experience is intrinsically motivating and may therefore be a dominant indicator of better learning outcomes. Correspondingly, enjoyment is a key motive for why people play games. It is also a dimension of user experience that is frequently assessed and determines the core subjective, positive experiences and reactions individuals may have towards media technology and its content (Mekler et al., 2014). Enjoyment is conceptualised as either the subjective moment to moment experiences (Boyle, Connolly, Hainey, & Boyle, 2012) or a motive that explains the more persistent objective or reason for game play (Mekler et al., 2014). Boyle et al. (2012) argued that engagement in gaming is a process constituted of different stages, at the heart of which is the subjective experience of enjoyment. In addition, the results from Mekler et al.'s (2014) systematic review of the enjoyment literature proposed that game enjoyment is the "valence of the player experience" and that it "describes the positive cognitive and affective appraisal of the game experience, and may in part be associated with the support of player needs and values" (p. 927).

Furthermore, enjoyment is linked to feelings of control, competence and psychological need satisfaction, while need satisfaction and values are associated with meaningful gamification (Nicholson, 2012).

According to the rationale presented above, an enjoyable experience or perception of the Career hero activities might influence the various engagement indicators. The effect may differ across different levels of enjoyment: that is, low, medium, and high enjoyment of the Career Hero activities. Students responded to "*Did you enjoy the gamified activities you had to complete on SUNLearn?*" on a five-point Likert-type scale. Responses were grouped as low (1-2) medium (3) or high (4-5) enjoyment.

A two-way mixed model analysis of variance assessed the impact of the level of enjoyment on student engagement measures over time. The inclusion of enjoyment of the Career Hero activities as an additional independent variable revealed a significant interaction effect between time and enjoyment on the majority of the indicators (Table 5.8).

The effect of the interaction suggests that the pre- and post-test scores were different for low, medium and high levels of enjoyment of the activities in Career Hero. The null hypothesis of no differences between the means is rejected. To evaluate the nature of the differences between the three means, across all significant student engagement scales, a Fishers LSD post hoc test followed the ANOVA analysis (Appendix H).

Table 5.8

Two-Way Analysis of Variance for Time and Enjoyment across all Indicators of Student Engagement

		df		Effect	*F*	*p*
Behavioural Engagement	Online engagement	1	75	Time	42.71	.000**
		2	75	Enjoyment	38.98	.000**
		2	75	T x E	10.75	.000**
	Online active learning	1	75	Time	25.31	.000**
		2	75	Enjoyment	49.72	.000**
		2	75	T x E	12.3	.000**
	Online collaboration	1	75	Time	2.65	.11
		2	75	Enjoyment	3.83	.03*
		2	75	T x E	5.34	.01*
	Online teaching	1	75	Time	0.07	.79
		2	75	Enjoyment	14.78	.000**
		2	75	T x E	3.34	.04*
	Online academic relevance	1	75	Time	23.32	.000**
		2	75	Enjoyment	54.95	.000**
		2	75	T x E	8.61	.000**
Emotional engagement	Interest	1	75	Time	1.48	.23
		2	75	Enjoyment	100.84	.000**
		2	75	T x E	5.31	.01*
	Perceived competence	1	75	Time	1.99	.16
		2	75	Enjoyment	35.26	.000**
		2	75	T x E	9.99	.000**
	Value	1	75	Time	36.8	.000**
		2	75	Enjoyment	56.88	.000**
		2	75	T x E	10.55	.000**
Cognitive engagement	Effort/importance	1	75	Time	12.14	.000**
		2	75	Enjoyment	18.78	.000**
		2	75	T x E	4.69	.01*
	Effort regulation	1	75	Time	2.18	.14
		2	75	Enjoyment	2.7	.07
		2	75	T x E	0.65	.53
	Metacognitive	1	75	Time	0.85	.02*
		2	75	Enjoyment	4.35	.36
		2	75	T x E	0.71	.49
	Intrinsic	1	75	Time	0.94	.33
		2	75	Enjoyment	7.68	.000**
		2	75	T x E		.97
	Extrinsic	1	75	Time	7.46	.01*
		2	75	Enjoyment	5.15	.01*
		2	75	T x E	1.67	.2

Notes. F, F-ration; *df*, degrees of freedom; *p <.05; ** p <.01

The post hoc LSD test indicated the following mean differences:

1. For the Online engagement scale (Figure 5.9), the low enjoyment group showed a significant initial difference in means scores from the intermediate and high enjoyment group at T1. In addition, the decrease in means scores over time, for the low and intermediate enjoyment group were also significantly different ($p < 0.001$) at T2.

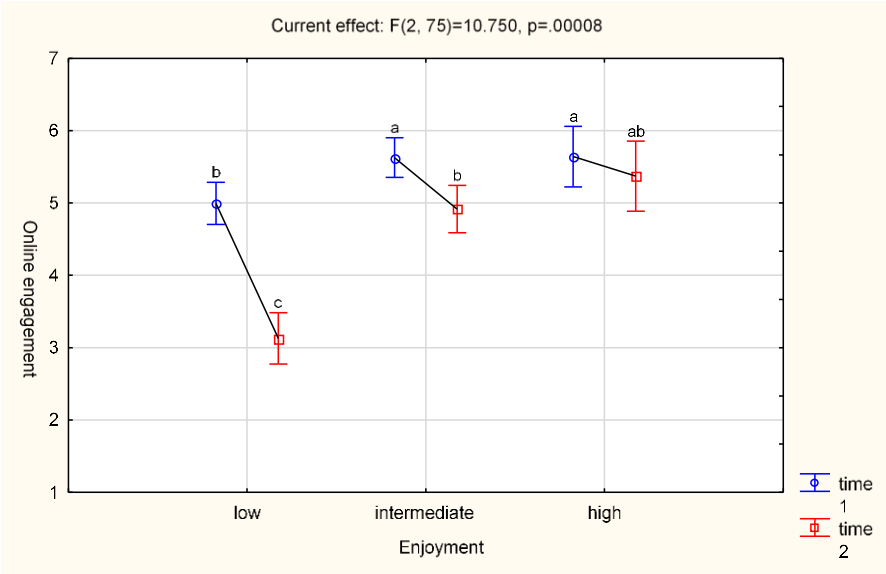

Figure 5.9. Mean differences for low, intermediate and high levels of enjoyment across time on the Online engagement scale

2. The online active learning scale (Figure 5.10) mean scores for the intermediate and high enjoyment groups were similar at T1, with a significantly lower score for the low enjoyment group. Over time the means scores of the low ($p < .001$) and intermediate ($p < .05$) enjoyment groups show a significant decrease, while the high enjoyment group remained relatively stable.

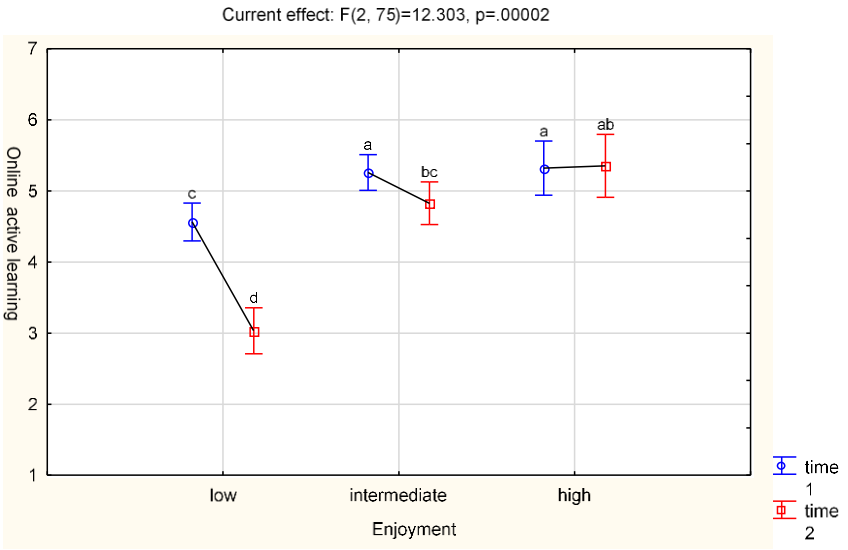

Figure 5.10. Mean differences for low, intermediate and high levels of enjoyment across time on the Online active learning scale

3. On the online collaboration scale (Figure 5.11), the mean scores for the intermediate and high enjoyment groups increased over time (T1 to T2), however only the intermediate enjoyment mean scores were significantly higher at T2 (p <.05). A non-significant decrease in the mean scores of the low enjoyment group is noted, together with a non-significant increase for the high enjoyment group.

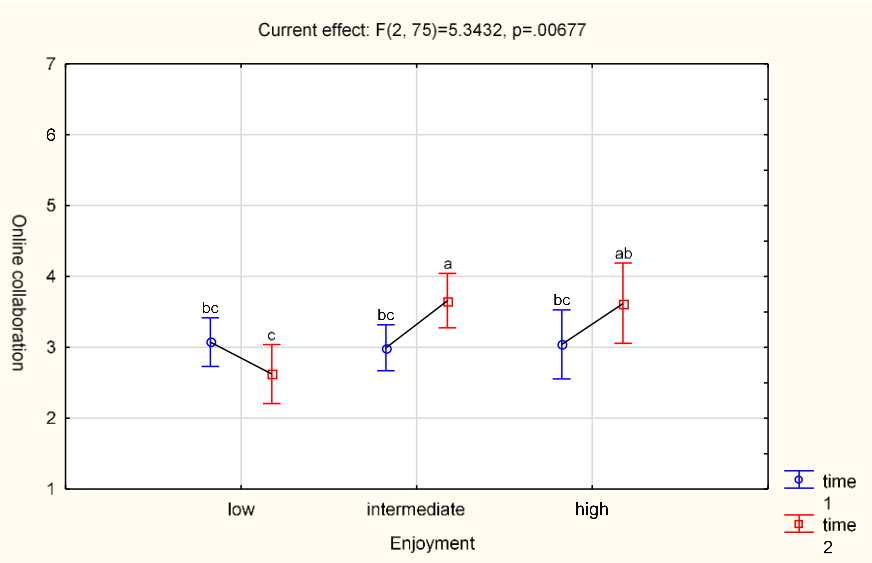

Figure 5.11. Mean differences for low, intermediate and high levels of enjoyment across time on the Online Collaboration scale

4. The online teaching scale (Figure 5.12) mean scores of the low enjoyment group showed a significant decrease between T1 and T2. Slight increase were observed in the means

scores for the intermediate and high enjoyment groups but the scores did not differ significantly over time.

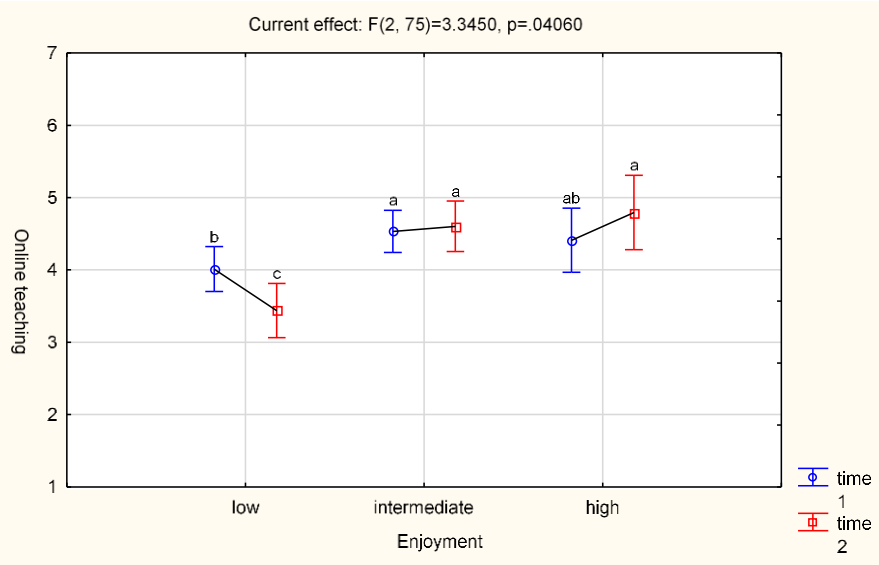

Figure 5.12. Mean differences for low, intermediate and high levels of enjoyment across time on the Online teaching scale

5. For the online academic relevance scale (Figure 5.13) the initial mean scores at T1 were significantly different for each group. In addition, the decrease in the low enjoyment group mean scores from T1 to T2 was significantly lower than the other two groups ($p < .001$).

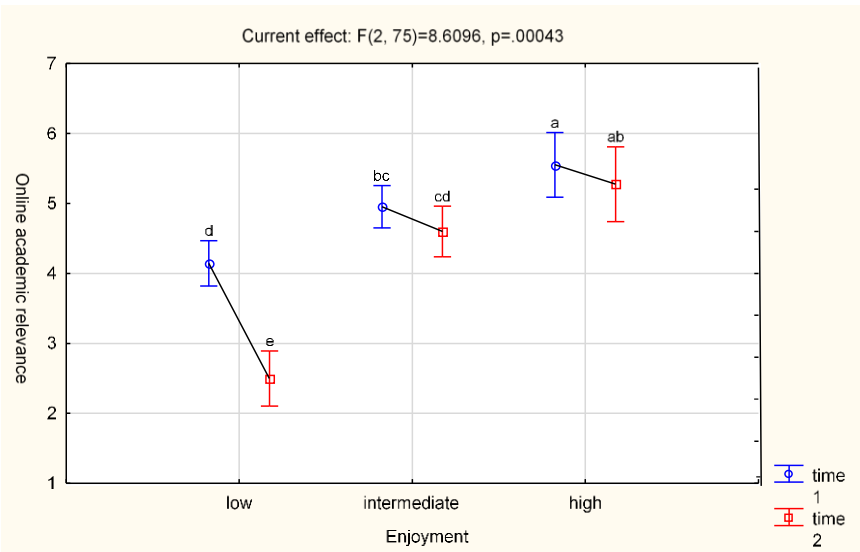

Figure 5.13. Mean differences for low, intermediate and high levels of enjoyment across time on the Online academic relevance scale

6. On the interest scale (Figure 5.14), the mean scores of the intermediate and high enjoyment groups differed significantly ($p < .05$) from each other and from the low enjoyment group (at T1). The increases observed for the intermediate and high enjoyment groups over time (T2) were however not significant. In comparison, the mean scores on the low enjoyment group differed significantly from the other two groups and reflected a significant decrease over time (T1 to T2) ($p < .001$).

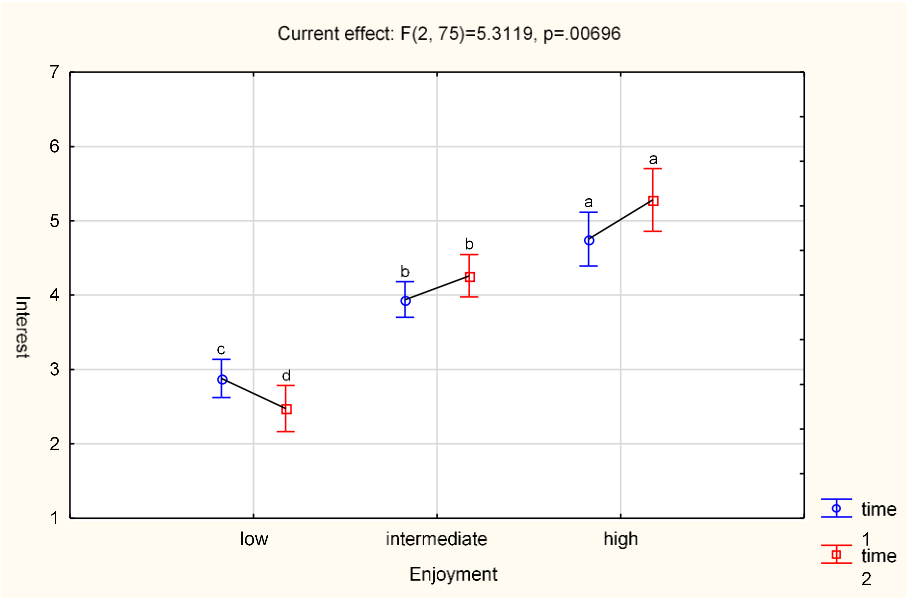

Figure 5.14. Mean differences for low, intermediate and high levels of enjoyment across time on the Interest scale

7. The mean level of perceived competence (Figure 5.15) for the low enjoyment group was significantly different from the intermediate and high enjoyment group at T1 ($p < .05$) and also reflected a significant decrease over time from T1 to T2 ($p < .001$). Even though slight increases were noted in the mean scores of the intermediate and high enjoyment group over time, these were not statistically significant.

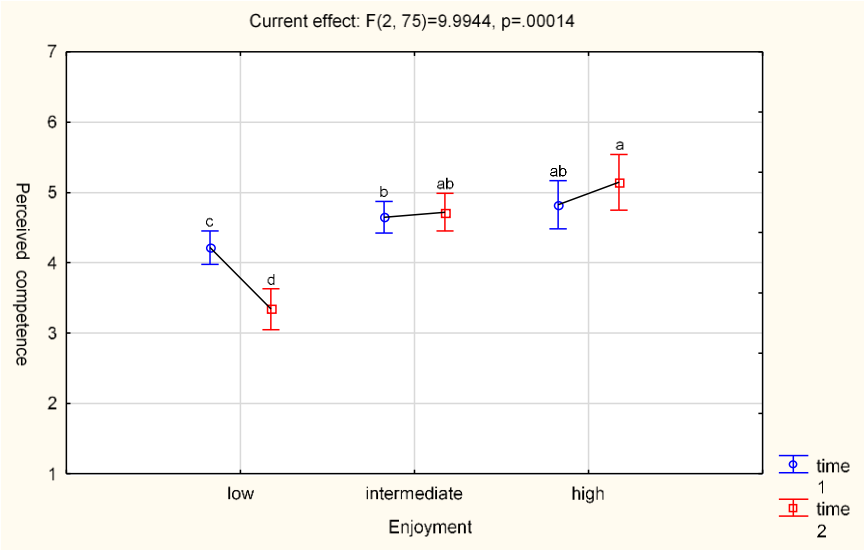

Figure 5.15. Mean differences for low, intermediate and high levels of enjoyment across time on the Perceived competence scale

8. The initial means scores for the intermediate and high enjoyment group on the value/usefulness scale (Figure 5.16) were the same at T1, however, the intermediate and low groups mean scores decreased significantly from T1 to T2 ($p < .001$). No significant changes are observed for the high enjoyment group on the value/usefulness scale.

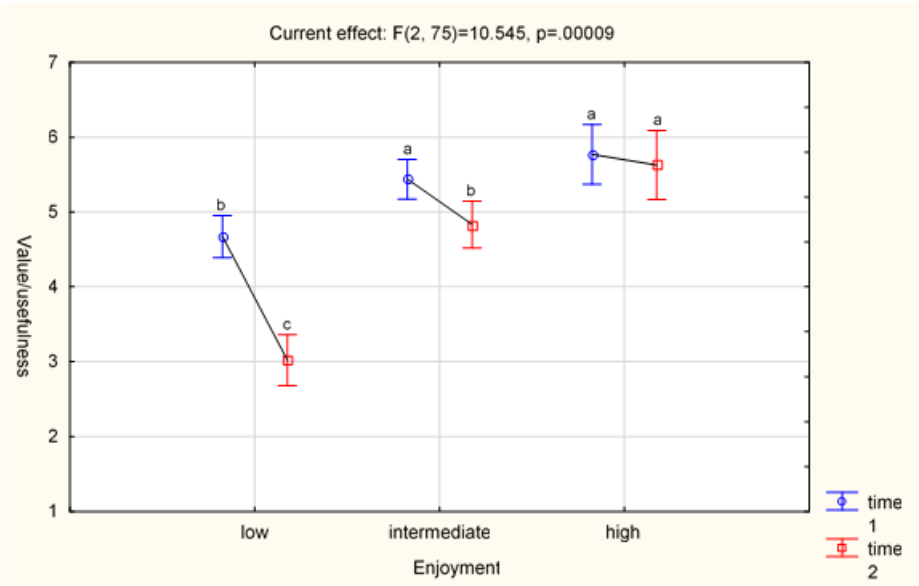

Figure 5.16. Mean differences for low, intermediate and high levels of enjoyment across time on the Value/usefulness scale

9. The effort/importance scale (Figure 5.17) was the only indicator influenced by enjoyment on the cognitive engagement dimension. In line with the previously observed trends, the low enjoyment group's mean scores decreased significantly from T1 to T2 ($p < .001$). While the changes observed in the intermediate and high groups were not statistically significant.

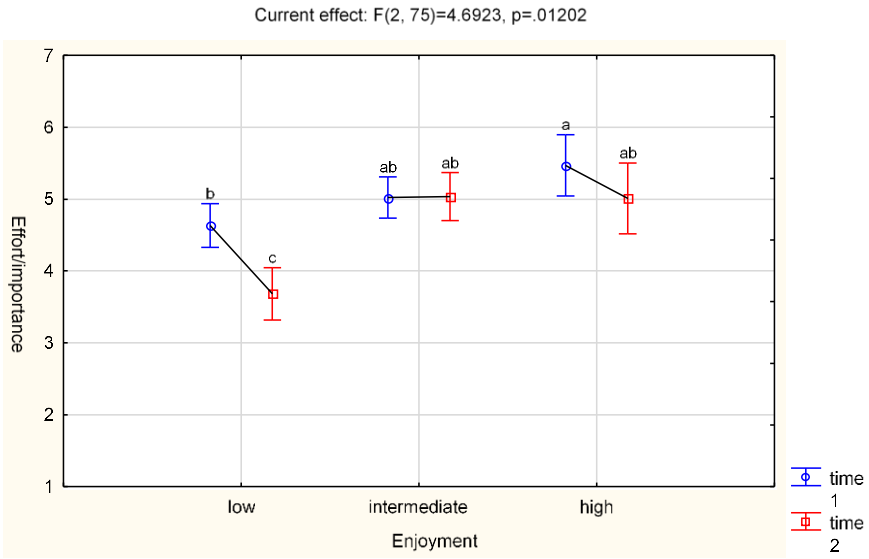

Figure 5.17. Mean differences for low, intermediate and high levels of enjoyment across time on the Effort/importance scale

The results suggest that enjoyment of the gamified intervention may play a significant role in indicators of behavioural and emotional engagement. It may also influence the effort put into activities, particularly for students that do not enjoy the learning activities in the gamified learning environment. Therefore, if a student does not enjoy a gamified learning environment the likelihood that their engagement will increase, in spite of attempts to increase it is low. The results suggest that engagement may actually decrease even further when students perceive to be "forced" to participate in an intervention designed to improve engagement.

5.3.5 Reflection on meso-cycle 3 and refinement of the gamification intervention

The quantitative evaluation of the gamified intervention in case 3 implemented a pre and post examination of the student engagement construct. The initiation of the *Career hero* intervention only took place five weeks into the module to create two clear treatment conditions (without the intervention vs. with the intervention). Student engagement was measure at the start of the intervention and at the end of the intervention. The analysis of the responses on the SEQ yielded

surprising and somewhat disappointing results. Nevertheless, a number of factors within the classroom and online context may account for, and shed light on, these findings.

Initial scores on the SEQ, were mostly moderate to high. Prior to the intervention SUNLearn in the IP 152 module was utilised for administrative purposes and students had to complete a compulsory online test (a week prior to the start of the *Career hero* intervention). The initial engagement scores may therefore reflect satisfaction with the familiar use and purpose of the LMS in the module (prior to the intervention, the online interaction was rather minimal and very much in line with "standard" SUNLearn practices in other modules where SUNLearn is used primarily for administration, some online quiz tests, depository for notes and announcements). Moreover, one student noted the majority of students attend the first lecture of the course to get an overview and may not even return to class after the first lecture. However, these students would still interact with SUNLearn to access the content, view notices and perhaps complete assessments. Despite the prior notification to attend the class in which Career Hero was introduced, a number of enrolled students may have been absent and therefore not aware of the intervention or entered the "game" at a later stage. Late comers to the game would have been able to orientate themselves with the resources documents and videos provided, but may have lost the opportunity to participate in the first few activities as strict deadlines were imposed. As a result, some students may have opted out of engaging with Career Hero from the start or withdrawn when they perceived that they could not catch up which may have impacted the findings.

With regard to the activities, students expected direct communication regarding when activities would be available. They did not want to make the effort to continuously check on SUNLearn or on the planner provided. Initially, a number of students emailed the SUNLearn Advisor asking for announcements to be sent out (especially with activities that are only available for a limited amount of time). This request was granted and students were therefore notified of all activities via email notifications and on SUNLearn. Nonetheless, there were still complaints from some students who claimed they did not know when the activities took place. This may suggest that some students may not be willing or ready to take responsibility for their learning or only willing to do the minimum required of them.

The quantitative results highlighted immense frustration caused by the points allocated. The frustration might have had a particular influence on their behavioural and emotional engagement. Class attendance was recorded using a card reader as it offered a reliable means

of monitoring attendance. This was however, not without issues. In some instances, the reader did not read/record some student cards. In other cases, students did not bring their student cards to class and wrote their information on a piece of paper. This information was therefore recorded manually which delayed the allocation of points. In addition, it also became apparent that some students were "cheating the system" by repeatedly clicking on the survey link which automatically awarded points even though the survey was not completed. This also required manual resetting, correction and re-allocation of points for each student. Even though the circumstances that caused delays were explained to students, they still expected that points should be awarded immediately and were disgruntled when this expectation was not met. A number of comments in the feedback form stated that the points system was ineffective, unfairly allocated and that the speed of allocation needed to improve. This also links to the preceding discussion of extrinsic goal orientation and highlights the concerning fact that the gamified intervention may have inadvertently emphasised external rewards which may overshadow more desirable intrinsically motivated behaviour such as learning and mastery. Even though incentives may promote desired study behaviour the risks are; that either an expectation will be created; they will not take ownership of their learning or may not want to participate and learn if the activity does not contribute towards their grade. However, if students have a well-developed sense of responsibility for their learning and are intrinsically motivated then gamified interventions may be more positively received.

Students also seemed to be demotivated by the face off challenge and they perceived it as being too difficult (e.g. required to achieve full marks to get XP). The activity was designed to challenge top performing students, but also ensured that points for high and low performers could be differentiated. Only 17% of students attempted the first face off challenge and half that number attempted the second challenge. This suggests that students may avoid activities they perceive as too difficult or unattainable and only those who have confidence in their ability would be willing to attempt a challenge of this nature.

Lastly, the instructions for the assignments were provided in English and Afrikaans and separate submission links for the assignments were created. At first glance, the amount of information on the page may have cluttered the page overwhelming the students. To minimise the clutter, completed activities were closed and hidden after the deadline. Students could, therefore, not go back to the activity for practice or revision at a later stage. These actions could have adversely affected behavioural engagement and may account for the decreases in online

engagement, online active learning and online academic relevance observed in the analyses (as the activities were no longer available to engage in) by the time data at T2 was gathered.

The feedback from participants in the focus group and the respondents to the e-survey highlighted a number of refinements to improve the Career Hero game. The primary areas that require attention are: communication of information, the layout of the SUNLearn page, the learning activities and the point system. The suggested changes to each area are briefly noted in Table 5.9.

Table 5.9

Proposed Refinements for Career Hero

Communication	Clear communication of the assignment dates at the start of the course
	Provide clearer explanation of point allocation and contribution of points to the grade.
Layout	Improve the layout of the activities on SUNLearn by decluttering the content and keeping notifications and additional information separate from the learning activities.
	Keep all learning activities on the page for revision.
	Change the theme of the game and make it less “childish”.
	Clearly display progress through the game.
Learning activities	Consider the spacing of activities and deadlines for completion
	Extend the time allotted for the completion of the activities.
	Make the activities available for revision and test preparation.
	Remove the face off challenge (boss fight) or provide more time or attempts to complete the activity.
Points	Provide a visual display of progress through the game and the points obtained for each activity that was completed.
	Provide points immediately after completion of the activities
	Separate the points accumulated in the game from the grade.

5.4 SUMMARY: CHAPTER 5

Chapter 5 presented three instrumental cases studies detailing the outcome of three meso-cycles and the accompanying micro-cycles of DBR research. A detailed report of each micro cycle iteration was put forth that included the data analysis and in-depth discussions of the findings. Considered links were drawn to the literature to explain, weigh and consider the findings. Each iteration enhanced the understanding of the proposed set of design principles that culminated from the literature review. The application and evaluation of these principles in three real world online contexts improved the design principles for an educational gamification intervention.

The implications of these findings, derived from cross case comparisons, are presented next. Chapter 6 will also include an outline of the limitations and recommendations for future research as well concluding remarks.

CHAPTER 6

IMPLICATIONS, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

The findings presented in Chapter 5 offered new insights pertaining to the impact educational gamification has on dimensions of student engagement (i.e. behavioural, emotional and cognitive engagement) and offered practitioners practical design principles and guidelines based on the lessons learnt in this study.

This final chapter serves to provide an overview of the foregoing study followed by the various contributions emanating from this endeavour. In this section, a discussion of the key learnings and implications (for theory and practice) that emanated from the research process follows. An outline of the limitations of the study and recommendations for future research are put forth.

6.2 OVERVIEW OF THE RESEARCH

The study developed from the present drive by the Department for Higher Education DHET) and training to improve teaching and learning in the South African higher education context with the particular focus on using technological enhanced avenues to foster and support student engagement. The enhancement of student engagement through the application of gamification was thus the central focus of the study. The envisaged outcome and contribution were to propose a framework of educational gamification design principles for the facilitation of student engagement. To this end, each chapter contributed to achieving the set objectives and outcome of the study. This study articulated the development of a gamified online learning environment and empirically examined student engagement through student perceptions and experiences. Furthermore, important guidelines for practitioners considering the use of educational gamification to promote student engagement were derived.

The design-based research approach selected provided a systematic framework for the iterative design, construction and evaluation of two gamified interventions over three cases. Each phase constituted three micro cycles of research guided by the literature and informed by practice and the researcher's personal experiences. The topic under investigation as well as the research

approach necessitated collaborative interaction with, and exposure to, a number of disciplines including psychology and education, amongst others.

The selected data collection strategy ensured that varied forms of data were included in the evaluation of the gamified interventions. The qualitative data provided rich descriptions that helped to uncover and develop salient themes by probing and analysing the experiences and perspectives of the participants. This data not only illuminated an understanding of the impact the game elements had, but also informed valuable insights into the dimensions of student engagement that are not as easily identifiable in the analyses of survey data. The quantitative data provided quantifiable indicators of the level of engagement per dimension. Both the qualitative and quantitative data sources supported an exploratory investigation of the influence a gamified intervention may have on the dimensions of student engagement over time. The integration of the findings emanating from these data collection strategies thus underpins the theoretical and practical implications that follow.

6.3 THEORETICAL IMPLICATIONS

The theoretical implications and contributions are presented according to the behavioural, emotional and cognitive dimensions of student engagement.

6.3.1 Behavioural engagement

The definition of behavioural engagement encompasses elements of engagement that reflect actual behaviour such as participation and involvement (Fredricks & McColskey, 2012), positive conduct and immersion in learning activities (Reading, 2008), amongst others (See section 2.4.2.1). Various studies suggest that game elements stimulate participation and desired behaviour within a gamified system (Franco-Mariscal et al., 2015; Kapp, 2012; Lee & Hammer, 2011). Similarly, evidence of participation and involvement was present in all three cases as students completed activities and interacted with the gamified learning platform. For some students the presence of the game was motivation enough to participate. The novel format in which the learning activities were presented differed from other modules offered at the university (i.e. very few courses have implemented gamification or game elements). Therefore, for some students the drive to participate may be explained by the “novelty effect” proposed by Hamari et al. (2014) as the initial curiosity stimulates and draws students to the online platform. Alternatively the increased participation may have been a legitimate increase related to

gamification (Landers & Armstrong, 2015). The salient themes that emerged from the qualitative data across the three cases emphasised specific game elements that influenced involvement and participation. These motivating game elements included the reward system, competition and levels as the most pertinent drivers of behavioural engagement.

The results suggest that a reward system (i.e. marks or grades and points) can drive participation, but this is contingent on the valence that is attributed to the reward and the informational value thereof. To illustrate, across the three cases the accumulation of points (that were not directly linked to the class mark) was only a secondary objective as students were more inclined to complete tasks that contributed directly to the class mark. Çakıroğlu et al. (2017) contend that points might not be strong reinforcements for some students if they are not linked to internal motivators such as doing better than their peers or passing their course with a good grade. Therefore, in order to encourage participation in activities the reward (i.e. points) needs to be of value or linked to an outcome that is valued by the individual − thus the reward should have valence. In this setting, the final grade (class mark) holds immense value to most students as it determines whether they pass or fail the module. In addition, grades or points serve as feedback whereby students assess if their level of performance is sufficient or if more work is required, (e.g. “It motivates you to either work harder or not. So you’re motivated because you’re doing well.”). Hence, the findings support previous propositions that points or reward systems provide students with feedback mechanisms and therefore potentially advance their motivation to participate, if the outcome is valued (Bajko et al., 2015; Cheong et al., 2014). Nonetheless, feedback should not only motivate participation but reinforce and support mastery of the content thus ensuring deep learning rather surface learning is taking place.

Competitive elements also have the ability to influence participation. This was most evident in Case 1 where students reported that competition had a positive effect on their behaviour and encouraged collaboration amongst group members. This corresponds with Bajko et al.’s (2015) findings where students reported that competitive elements compelled them to push themselves harder. However, the results also supported previous findings that suggest that direct peer-to-peer competition may elicit mixed responses and may therefore have a positive (desired) or negative (undesired) effect on participation (Burguillo, 2010; De Schutter & Vanden Abeele, 2014; Sillaots, 2014). Competition is a necessary requirement of a game (Nah et al., 2013) but requires careful consideration. Based on the findings in this study, collaborative team based competition and limited leader boards (i.e. only two above and two below are displayed) are

viable options for consideration. Alternatively, learning activities or the narrative could encourage students to compete with themselves by providing a visual display of their progress.

Providing a sense of progression using levels furthermore reinforces participation. The results suggest that the most effective application of game levels resulted when levels created structure in the layout of the gamified platform and facilitated a linear progression through the content (learning activities). Moreover, providing focused goals at each level encouraged engagement with the learning activities at each level. If the student perceived the activities to be helpful, relevant or meaningful for their own learning they were more likely to continuously participate and progress to the next level once the goal was achieved. Thus, the embedded principles derived from goal setting theory effectively created a sense of progression and encouraged participation. For example, by setting challenging but obtainable goals at each level reinforced goal commitment and attainment as completion of each level stimulated progression to the next level/s (Grund, 2015; Locke & Latham, 2002). Student reports suggested that this approach also served to build their self-efficacy and sense of competence as proposed by the Self Determination Theory (Ryan & Deci, 2002; Ryan et al., 2006).

An alternative approach to generate goal commitment and a sense of progression is to integrate the levels with the point system and link each level to visual changes or evolution of an avatar (see Case 3). However, in the present study, this approach was not very effective because even though some students were motivated to complete the activities and enjoyed seeing the avatar evolve, it did not create the same sense of progression required to motivate participation. A further unexpected outcome was that the change in levels emphasised the accumulation of points − which may have promoted extrinsically motivated participation rather than intrinsically driven engagement with the content. Thus, even though participation is a prerequisite for learning, more immersive learning or deeper behavioural engagement is the desired goal. To this end, the findings suggested that students were more motivated or likely to put effort into a task if the relevance of the learning activity to their studies was clear. Moreover, if the application of the learning material is demonstrated or provides an opportunity for the student to apply the content it may lead to more meaningful interaction with the content (e.g. “You understand things easier by physically doing something you study about”). This suggests that intrinsic motivators (e.g. deriving meaning, a need to attain knowledge or developing competence) are a prerequisite for immersive behaviour and learning, factors that are also associated with cognitive and emotional engagement.

A further factor that also influenced behavioural engagement was the perceived pressure created by numerous and frequent learning activities. In all three cases, the frequency of activities was perceived as negative and the participants underscored the fact that the activities required consistent effort and additional time outside of the class. Even though students recognised that the activities helped them to keep up to date with the work, the perceived time pressure could have negatively influenced behaviour and learning as students completed activities driven by compliance behaviour (in other words completing the activity just to complete it with no or little intrinsic motivation, deep learning and engagement). Other students may completely disengage from the onset of the game and not participate because of the perceived lack of time. This outcome suggests that some students may have a performance avoidance goal orientation as they would be inclined to participate to avoid the negative consequence of failure. In addition, the choice to participate or not, may however be moderated by whether or not the activity is perceived to have value or aligns with the students personal values or goals. Hence, students that are extrinsically motivated may continue to participate and engage on a superficial level in order to earn a reward. The converse would be participation for the sake of learning or mastery of the activity, as is evident when students are intrinsically motivated (Gasiewski, Eagan, Garcia, Hurtado, & Chang, 2012). To this end, Hansch and Newman (2015) warn against the potentially detrimental effect of rewarding behaviour that should be intrinsically motivated with external rewards, as explained by the over justification effect (Groh, 2012) (refer to section 3.3).

The current research thus suggests that game elements such as points, completion and levels combined with thoughtfully designed learning activities can encourage and facilitate behavioural engagement in that students participate and complete the activities set out. Participation may however be a consequence of the extrinsic reward on offer or motivated by a performance goal orientation. Hence, it is important to keep in mind that participation may not always translate to better learning (Cheong et al., 2014). In addition, when the gamified learning environment is perceived to be causing undue pressure by frequently requiring the completion of tasks or applying short deadlines, a student's propensity to apply effort and cognitively engage with the content over time may be diminished and eventually lead to disengagement (decreased or no participation). This could possibly be attributed to a student's perception of the difficulty of the goal (i.e. it is unrealistic or unattainable) and in order avoid the possibility of failure (avoidance goal orientation) will therefore withdraw. Similarly, these factors may also influence motivation, enjoyment and interest (i.e. emotional engagement).

6.3.2 Emotional engagement

Throughout this study, the emotive response elicited by gamification was evident in the responses, descriptions and discussions that took place. In all three cases, students expressed both positive and negative emotions toward the game itself and specific game elements and activities.

As previously stated, emotional engagement is characterised by affective reactions: that is, immediate emotions such as happiness and anger or emotional reactions to a person or object (Fredricks et al., 2004; Reading, 2008). From the evaluation of the qualitative data positive emotive descriptors such as “creative”, “fun”, “appealing” and “interesting”, emerged when describing the game, which finds support in other studies for example Franco-Mariscal et al. (2015) and Landers and Callan (2011).

The positive emotional reactions speak to the motivational affordance and drive created by the structure (levels), activities (quests or challenges), incentives (points or grades) and competitive elements (leader boards). These elements also evoked excitement and created anticipation for what was coming next. Initially this may be merely a consequence of the novelty effect, which can be short-lived and may result in diminishing participation and performance over time. However, if the positive motivational push provided by various game elements is strong enough students should continue to participate even after they become more familiar with the system.

The link between emotion and behaviour suggests a strong interaction between emotional engagement and behavioural engagement and the completion of activities evoked feelings of achievement, excitement and motivation. Furthermore, positive emotional experiences and appraisals of the activities seemed to influence positive behaviours such as continued participation in the activities. This interaction is supported by the game element termed the social engagement loop, whereby participation leads to feedback which in turn creates motivation to participate again (De Byl & Hooper, 2013). If feedback is not provided, informative or valued, the motivation to participate will decrease thus potentially disrupting the social engagement loop. This is further explained by Vroom’s expectancy theory, whereby an individual will act or behave in a certain way depending on the expected outcome and whether it is valued. Therefore, in order to stimulate engagement the “feedback” component is essential and should evoke positive emotions in order to sustain behaviour.

Across the three cases, the learning activities were particularly effective at evoking positive feelings or emotions. Positive appraisals were evident when students recognised the educational benefit derived from completing the activities and practicing the work, for example:

> "It made the work feel more interesting and achievable. Each time I moved on to a new level or completed another quiz or group activity, I felt a deep sense of motivation and enrichment. I never realised how much time I spent on the subject every week, because of the nature of the activities. It was truly a very fun experience and enhanced my understanding and reinforced my knowledge of concepts" (2016 Focus group participant).

In addition, the perceived meaning and relevance that students attribute to the learning activities also encouraged completion of activities. This was particularly true when students perceived learning activities as relevant to their context or subject and could see the value added to their learning and preparation for other assessments. Hence, it can be argued that the relevance of the content included in a gamified learning environment is both an important prerequisite and outcome of behavioural and cognitive engagement. For example, if it was immediately clear that an activity was relevant (i.e. contributed to learning) students would be more likely to engage and complete it. This is supported by Deci et al.'s (2001) conceptualisation of intrinsic motivation: that is, the student internalises the importance or value of the activity (cognitive engagement) and perceives that is beneficial (for their own good) which regulates their self-motivated drive (emotional engagement) to perform the behaviour and engage in it repeatedly (behavioural engagement). Moreover, this self-regulated drive also alludes to how participating in a task may align with or support student's personal goals (e.g. mastering the content, learning, doing well in the module or just completing it) which would be perceived as rewarding and thus create positive emotional responses which drive future behaviour.

On the opposite end of the emotional spectrum are negative emotions or reactions. In this study, many of the negative emotions expressed could be attributed to frustrations with technical issues (e.g. delayed allocation of points), requirements imposed on the student (e.g. group work), subjective preferences for certain elements (e.g. competition) and perceived pressure imposed by the frequency of learning activities. To illustrate, in Case 1, students that did not like competition felt demotivated by competitive elements. They also highlighted the negative influence that restrictions and delayed feedback (e.g. slow point allocation) had on their perception of the game. The pressure created in a game can be perceived as being both positive and negative. As with competition, it is highly subjective and dependant on how much pressure

an individual is prepared to endure (Cheong et al., 2014; Vermeulen, Gain, Marais, & Odonovan, 2016). Some students admitted that they stopped participating in the game all together because the deadlines were too tight or they did not have the time to complete the activities. Moreover, students were also frustrated by having to accumulate points (of which the allocation could have been delayed) and the perception of the relatively low number of points earned in comparison to the effort required. Drawing on Expectancy theory, the students' frustration was possibly influenced by a lack of perceived instrumentality (good performance will lead to a desired outcome) and valence attached to the incentive provided: that is, they may not have valued the points and were therefore not willing to exert the required effort. In addition, Nicholson (2012) warns that use of external rewards can potentially create negative feelings especially if perceived to be an attempt to control behaviour , for example only offering one avenue (the game) to obtain the 10% grade contribution.

Raymer (2011) postulates that engagement (which he defines as "occupying the attention or efforts of a person" p. 1) is determined by how rewarding a task or activity is perceived to be and the positive emotions that are triggered. Moreover, the perception of whether a task is rewarding or not is dependent on both 'wanting' and 'liking' which need to be activated. It can therefore be argued that the 'wanting' component can be associated with intrinsic motivation and the drive to achieve the goals of the game or one's personal goals, as discussed earlier. In addition, 'liking' can be associated with the experience or enjoyment of either the game, the content or the activity.

Based on the findings, if a student wanted to complete the activities and enjoyed them while doing so, they were more likely to report positive emotions (i.e. positive emotional engagement) and engage in the game (positive behavioural engagement). However, if the student wanted to complete the activities, but experienced the interface as cluttered and difficult to navigate, or felt overwhelmed by deadlines, they were more likely to be frustrated (negative emotional engagement) and less driven to complete the activities (negative behavioural engagement). Finally, if the student did not want to complete the activities (possibly due to feeling "forced" to participate due to the grade implication) and experienced the game as unenjoyable, he/she would be more likely to disengage or not participate at all. Hence, educational gamification influences emotional and behavioural engagement through the perceived motivational or rewarding influences of the game elements, relevance of the activities and enjoyment of the

experience. When these factors are absent or cause frustration or anxiety, they are likely to have a negative influence on both emotional and behavioural engagement.

Lastly, the lecturer's involvement and efforts that has the potential to foster positive emotions towards the gamified learning environment, influences emotional engagement of students. As one participant in the 2016 cohort stated, "the lecturer is the actual person who's carrying out this whole thing and that did make a very big difference". This demonstrates the significant role that the lecturer plays in promoting the concept of gamification and providing support. The influence of the student-lecturer relationship on student engagement is strongly supported in the literature (Crombie, Pyle, Silverthorn, Jones, & Piccinin, 2013; Umbach & Wawrzynski, 2005). Crombie et al. (2013) proposed that students who sensed that their instructors cared about them, encouraged and valued their participation, exhibited increased levels of engagement. These effects may also extend to online environments but requires deliberate effort to create and facilitate a teaching online presence (Ma et al., 2015). Moreover, Dixson (2010) proposes that combining active learning with meaningful and varied forms of interacting will lead to higher student engagement with a module. The current research therefore solidifies the theory that positive staff interactions and learning experiences, when integrated, can positively enhance student engagement.

6.3.3 Cognitive engagement

Cognitive engagement encompasses a number of characteristics that convey the psychological thought processes involved in learning (Fredricks & McColskey, 2012). These include: investment in learning, effort, self-regulation and meta-cognitive evaluation of learning (Fredricks et al., 2011). Cognitive engagement has also been linked to an internal desire to overcome challenges, learn and master content (Rotgans & Schmidt, 2011). The internal and subjective nature of cognitive engagement makes the observation or identification of this dimension less distinguishable than emotional and behavioural engagement. However, the discussion and descriptions pertaining to the learning activities and learning experiences did yield some important theoretical insights.

The findings support the notion that a key facilitator of cognitive engagement is the type of learning activities included in the gamified intervention (Des Armier et al., 2016; Kapp, 2012). Learning activities are the primary aides for learning as they may support revision of the content and consolidation of the students' learning. These activities should therefore stimulate the

various cognitive processes suggested in Blooms taxonomy for example remember, understand and apply. Student feedback confirms that the activities influenced psychological investment in the content as the purpose and relevance of the subject matter and the module were emphasised. Moreover, the students highlighted the value and benefit they derived from the formulation of the activities, as the formal module assessments were framed in a similar manner that required an application of the theory. This is consistent with other studies where students reported feeling better prepared for assessments and ascribed this to the gamified activities they we engaged in (Des Armier et al., 2016).

As previously discussed, gamified activities were perceived as relevant to what students were learning in the module content and allowed them to envisage a possible future in which they would make use of the knowledge. This is aligned with previous findings that have established the role of having a sense of purpose and emphasising vocational relevance has on students likelihood to remain committed and engaged (Appleton et al., 2006; Hu & Kuh, 2003). The results also contribute to the application of the self-determination theory as a guiding theory whereby competence, in particular, can be fostered by developing activities that support the cognitive processes involved in learning, but are also relevant and applicable to the subject in question. Hence, learning activities that provide opportunities for authentic and experiential learning are important components of a gamified intervention that seeks to facilitate student engagement (Meyer, 2014; Payne, 2017).

The two game elements that could directly attribute to enhanced cognitive engagement are levels and teams. The results of this study suggest that the use of levels can influence cognitive engagement by providing structure to the layout of the LMS, which facilitates an even distribution of the workload and streamlines the content, making it more manageable. By chunking the content into manageable pockets of micro learning, a clear and transparent learning pathway is created that assists students to direct their efforts and progress towards achieving specific learning goals (Davis & Singh, 2015). As previously mentioned, levels can promote goal setting and support students' attainment of their own goals and those presented by the game. Furthermore, students receive a psychological reward for engaging in the activity as well as more tangible incentives and feedback (e.g. points) to motivate further participation. This supports Franco-Mariscal et al.'s (2015) proposition that game elements drive students participation in learning activities and motivates interactions that enhance learning as well as Alabassi's (2017) assertion that gamified learning activities have the potential to stimulate

efforts towards deeper understanding of concepts and content. Thus, the provision of goals and incentives can stimulate both behavioural and cognitive engagement if the learning activity provides an opportunity for deeper engagement with the content.

Teams or group work also provides valuable opportunities to facilitate cognitive engagement. The self-determination theory proposes that people have a need for relatedness and thus desire opportunities to engage with others, which is supported by the tenets of collaborative learning (Ryan & Deci, 2002). In the present study, group assignments required students to work collaboratively with their peers to complete learning activities. Despite the logistical and time pressures associated with group work, the students were nonetheless able to draw value from these interactions. For some students, group work offered a valuable opportunity to discuss the learning material, debate differing perspectives and develop a deeper conceptualisation of the content. The findings thus support the influential role various types of learning activities and collaborative interaction between students can have on influencing cognitive engagement in a gamified environment.

In sum, the research findings support Fredricks et al.'s (2004) assertion that student engagement is a dynamic and complex interaction between the dimensions of student engagement (behavioural, emotional and cognitive) and that the process of student engagement does not operate in isolation. This study attempted a novel approach in the study of educational gamification with the linkage of the specific game elements to dimensions of student engagement and thereby demonstrating the varied motivational affordances game elements hold. Moreover, both the positive and negative influences game elements may have in different contexts, and with different student groups, were revealed and reported. The findings also emphasise the importance of carefully considering the purpose and potential effect game elements may have on student's behaviour, cognitions and emotions prior to implementation of educational gamification.

In addition, the importance of acknowledging and remaining cognisant of the influence other factors such as student context, group size, programme structure, target audience and whether a module is an elective or not, will have on the success of the design and implementation of gamified technologies was highlighted. For example, large heterogeneous groups add complexity as it becomes more challenging to cater to varied student preferences and engage the majority of students. In addition, when a module is not compulsory (i.e. it is an elective)

student engagement may be rigged negatively from the start if interest in the subject is low and the purpose of selecting the module is only to amass credits.

Throughout this research process, the critical importance and value of having a solid understanding of the motivation and learning theory that can guide the design process, the creation of educationally purposive activities and the seamless integration with classroom and online learning, was emphasised. Hence, educational gamification should not be a haphazard exercise, but a deliberate and conscious effort to harness the potential of game elements and available technologies to support engagement that leads to effective and deep learning. More importantly, learning should always be the primary reason for incorporating game elements, not entertainment. The theoretical contributions thus inform the practical implications of this study that follow next.

6.4 DESIGN PRINCIPLES AND DESIGN GUIDELINES

A primary contribution of the design-based research approach is a set of design principles that emanate from the conceptualisation and development of the intervention over numerous iterations. Plomp and Nieveen (2007, p. 89) propose that design principles essentially convey the

- "purpose/function of the intervention;
- key characteristics of the intervention (substantive emphasis);
- guidelines for designing the intervention (procedural emphasis);
- implementation conditions; and
- theoretical and empirical arguments (evidence) for the characteristics and procedural guidelines"

The purpose of the intervention(s) were to develop an online, gamified learning environment to facilitate student engagement among industrial psychology students enrolled in two Industrial Psychology modules to facilitate student engagement. The design principles stated below thus represent an amalgamation of theory, practice and conclusions drawn from the findings in this study.

6.4.1 Design principles

Design principle 1: Provide focused goals that establish and convey the purpose of the learning activities.

A core principle of gamification is the creation of a goal orientation (Nah et al., 2013). By dissecting the learning content into manageable themes or topics, sub goals are created that can assist a student to achieve the greater goal of mastering the content and passing the module. This begins with the articulation and communication of guidelines and rules that govern the gamified learning environment. In all three cases, participants stressed the need for clarity and understanding of the rules and requirements of the game. This included, but was not limited to, clarity on the allocation of points and grades, clear instructions for activities, well communicated deadlines etc. A lack of clarity or understanding of the gamified learning environment results in uncertainty and can potentially perpetuate feelings of anxiety, frustration and pressure leading to possible premature disengagement (i.e. the student disengages prior to any participation/engagement). It is therefore imperative that instructions and guidelines are clearly conveyed, understood, easily accessible or displayed for easy reference. The goal and value of the activity should be clearly communicated through rich descriptions of the tasks and requirements. This will also ensure that the valence of the activity is explicit.

Each gamified learning environment is unique, and the students are therefore novices with limited experience in this new environment, notwithstanding that they bring their own expectations and prior experiences from playing traditional games. It is thus important to incorporate a process of familiarising and orientation into the gamified platform (e.g. clear explanations of the purpose and function of the game; technical guidance). This will support involvement and facilitate engagement.

Time is a further essential factor to consider. Gamified applications by nature require students to complete tasks more frequently than would “normally” be expected in a module. This includes providing enough time to complete the activity as well as setting deadlines and communicating them in advance in order for students to plan effectively. Attention to time elements acknowledges the lecturer’s awareness of the constraints imposed by other subjects and requirements within the student’s degree programme, which students may appreciate. One may also provide choice between different activities to cater to different learning styles and allow students to complete activities in their own time and not dictate when these activities

should be completed. This will ensure that students have autonomy over their learning but also develop a sense of responsibility for their own learning. Fostering and supporting self-directed learning behaviour at an undergraduate level is important for progression to post graduate studies and more importantly to succeed as an employee and lifelong learner, once students leave formal education.

Design principle 2: Provide challenging tasks that convey meaning and relevance.

Design learning activities that are meaningful and relevant. Learning activities are most effective when they are meaningfully derived from the content and aligned with the learning outcomes or objectives of the module. They should thus successfully impart knowledge and encourage practical application or engagement with the content. The activities can serve various purposes, for example transferring knowledge, testing knowledge or reinforcing learning as suggested by Bloom's taxonomy. They should also promote, guide and support positive study behaviours such as revision, self-directed learning and on task behaviour (Alabbasi, 2017). Where possible these activities should also prepare students for other forms of assessments (e.g. summative or formative). The activities should therefore be perceived as relevant, beneficial, worthwhile and convey the purpose and relevance of the module to the students' broader educational training.

Design principle 3: Provide rapid feedback regarding progress through the learning activities.

Feedback is vital to encourage and sustain participation. Within in a gamified learning environment the inclusion of game elements that offer motivational affordances such as competitive elements (i.e. leaderboards) or a reward system (i.e. incentives and grade or points) can serve as form of feedback. The nature of activities included in the gamified learning environment will determine what type of feedback is required and can be provided. Game elements may provide information such as a student's position in the game, their level of performance in a given task as well as when and where to invest their time and effort. However, some tasks may require higher levels of feedback that articulates exactly how performance can be improved. It is important that provision of feedback is immediate or provided as soon as possible. To this end, rubrics offer an informative and descriptive means of providing feedback.

Design principle 4: ***Affirm performance by recognising achievements and providing indicators of progression.***

The use of levels creates a sense of progression from one topic to the next. What worked best in this study was the placement of activities at each level. This not only creates structure, but also organises the learning content into logical, meaningful chunks that align with lecture content. The restriction of access to a new level prior to meeting the requirements of the preceding level can create a sense of excitement, curiosity and accomplishment; stimulate consistent participation and ensure that students stay up to date with the work. The structure should also offer flexibility and support autonomous learning and the freedom to fail. Students should therefore be able to return to activities to practice or revise the content. The inclusion of a progress bar can also be a useful means that indicate progression through a level visually (if there are a number of activities per level). Points can be used to reinforce participation and create rewarding experiences that may stimulate progression through the activities (if the points hold valence to the student). Ideally points should also reinforce learning and mastery by rewarding repetition or correct answers.

Design principle 5: ***Create opportunities for social interaction through competitive or collaborative engagements.***

Competition and collaboration both have a place in a gamified learning environment. The collaborative interaction between group members can lead to various positive social and learning outcomes (e.g. relationship building, accountability to group members, and discussion of the content) which advances collaborative peer learning and the associated positive outcomes. However, group work may also create frustrations, for example, group formation or logistical issues. Online forums could be used to facilitate interaction amongst students to find and form groups or the lecturer could assign individuals to groups. Logistical issue may be minimised by assigning designated time for group work, for example during a tutorial or practical time slot.

Competition is a necessary part of any game but it is also important to keep in mind that it may elicit mixed reactions, for example, competitive elements may be favoured by some and not by others. Therefore, if competitive elements are included their purpose should be carefully considered to ensure that the desired behaviour, that is conducive to learning, is encouraged and reinforced.

Design principle 6: ***Create an imagined environment that inspires curiosity and novelty and allows for creative thinking and authentic problem solving.***

The gamification of learning activities on an LMS provides a novel and alternative format for presenting content. The functionality of the LMS will dictate whether changes can be made to the platform to create a game-like environment (but this is not a prerequisite for inspiring curiosity and novelty). A well thought through narrative that articulates the intricacies of the imagined environment can form the foundation of an enjoyable and interesting experience as it creates a sense of excitement and curiosity. The narrative can also support a sense of progression, thereby, encourage participation and reinforce positive behaviours that support learning.

It is important to choose the correct narrative that either aligns with the interests of target audience or supports vocational relevance. Narratives or characters perceived to be childish or incongruent with what is being taught can have a detrimental effect on student participation and engagement with the gamified learning environment. In addition, the use of avatars may be a fun addition, but has little utility in the learning process.

6.4.2 Design guidelines for lecturers

Where the design principles offered a general approach to applying gamification, the guidelines presented below are specific to lecturers that may consider implementing gamification in their modules. These are derived from the researcher's personal experiences and learnings during the research process.

- **Carefully consider each game element selected.** Gamification and the game elements selected are unique to each context and the objectives you set out to achieve through your learning activities. When selecting game elements, thoroughly research their intended purpose and their use in similar contexts, particularly the resultant outcome in those contexts.
- **Prepare for additional work.** The design and planning of an intervention takes time and the administrative load, once implemented, can be overwhelming. It is advisable to recruit assistants to assist with administrative tasks and back end support. Students expect rapid feedback from a gamified system, which is not always supported by the

LMS. This may require an individual to respond manually when the technology is not able to do so.

- **Collaborate with support staff.** Gamified applications should be well designed and implemented (Lee & Hammer, 2011), but this requires specialised ICT training and knowledge that is not a specific requirement for being a lecturer. Lecturers, therefore need to draw on support within the university environment and enlist the assistance of the technical and support staff employed at your institution. These individuals often have a wealth of valuable information about the capabilities and affordances of the LMS and the process involved in effective learning and instructional design. They offer a helpful sounding board for your ideas.
- **Consider the affordances of the technology at your disposal.** Every LMS is distinct and will have different levels of functionality, tools and user interfaces. Identifying and maximising the potential of the affordances offered by an LMS ensures that gamifying a learning platform does not become a costly exercise. A plethora of resources is available on the internet and can easily be integrated into the LMS or linked externally.
- **Content is key.** When gamifying a module for the first time activities that are currently in use may be adapted and included in the new system. However, for the gamified learning environment to meet various student needs, requires the development of additional learning activities. Offering a variety of tasks caters to students with different learning styles, different learning speeds, skill levels and preferences (e.g. more or less challenging activities). It must be emphasised that gamification does not enhance bad content. Content must be of a high standard and relevant to the subject.
- **Pilot test the prototype.** As evidenced across the three cases, a one-size-fits-all approach does not guarantee the same outcomes and may even lead to opposing effects (Šćepanović et al., 2015). There may also be a disparity between what student's expect from a gamified learning environment and how it actually operates. It is therefore important that any new intervention (prototype) should be pilot tested and refined according to feedback received. This may not always be feasible but room should be made for adaptation as new information or feedback is received.
- **Feedback.** The potential for gamification to facilitate engagement and influence motivation, is significantly diminished if technical difficulties or bugs frustrate students on the LMS platform. Even if an initial prototype is developed and tested, the context,

student group or type of game elements used may lead to different outcomes than what was expected. The provision of channels through which problems can be reported will ensure that general frustrations that may be hindering the learning process are dealt with timeously.

- **Continuously refine the intervention.** The iterative design, evaluation and refinement of a gamified learning environment are imperative to meeting the intended purpose of the intervention and the needs of the student. The designer, lecturer and/or practitioner should continuous strive to improve and find new ways to stimulate and facilitate engagement and most importantly meet intended module outcomes. Moreover, new student groups may have different needs or expectations and the gamified learning environment should accommodate these adaptations.
- **Lecturer involvement.** The lecturer's involvement creates a positive perception, strengthens confidence in the lecturer and facilitates the development of rapport and respect between the lecturer and students. This will foster open communication channels to improve not only the game but also strengthen learning.

6.5 LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Notwithstanding the strengths of this research project, namely the in-depth and integrated review of the relevant literature and methodological rigour afforded by the DBR approach, some limitations should be highlighted as these could pave the way for future research efforts.

In this study, the researcher was also the lecturer, designer, evaluator and implementer, which may lead to conflicts of interest or influence of researcher bias. According to McKenney, Nieveen, and Van den Akker (2006), this may raise a number of challenges for a researcher who takes on these various roles. To minimise these possible conflicts of interest, the researcher sought professional scrutiny and critique through presentations at local and international conferences and information sharing platforms at the university. In addition, collaborative interactions with various subject matter experts also informed the researcher's conceptualisation and development of the study's research design and the intervention. The research design also included various "methods and tactics" to gather and record data from various sources that were used to triangulate and interpret the findings (Plomp & Nieveen, 2007, p. 31)

The primary aim of the study was not generalisability of the outcomes. The methodology selected was applied to a local setting with relatively small sample sizes (in both the focus groups and pilot study). Even though this may limit the generalisability of the findings, attempts were made to establish transferability by applying the design principles to two different settings (i.e. different Industrial Psychology modules). This approach highlighted the risk of firstly, not prototyping or pilot testing a new system with each new group and secondly, the importance of continuously refining a gamified system to align with the needs and preferences of a particular student group. The shortcomings and lessons learnt from these attempts underscore the need for replication and dissemination of studies in similar and different contexts.

The design of the gamified intervention was customised for a Moodle-supported learning management system. The affordance of this particular LMS were taken into consideration when constructing the intervention, but the attractiveness or game-like feel of the interventions was limited by what was technically possible on the LMS. Other LMS's may offer more or less functionality such as themes/skins that create a more authentic game experience. This offers an avenue for future studies to examine whether gamified learning environments that look like actual, fully-fledged games influence student experiences and engagement more, than alternatives with a game layer or game-like feel.

As with most studies, the majority of participants in this study were already likely to be more engaged than those who did not participate. The sample size of the focus group interviews were small and the conclusions drawn may not have fully represented the views of the larger group. However, the focus groups offered the most practical and time saving means of gathering data, and were deemed appropriate as many activities were conducted in groups. The findings may have been enhanced by examining individual experiences through semi-structured one-on-one interviews or arranging more than one focus group interview. However, due to time constraints and the examination period that follows the conclusion of a module, this was not practical or feasible. Future studies should consider a combination of individual and group interviews to gain a richer understanding of the influence of game elements on student engagement.

In terms of the measure of student engagement, various instruments were used that were not initially developed to measure student engagement, but were aligned with the substantive descriptions of each dimension , for example cognitive engagement was measured with a learning strategies scales from the MSLQ. The researcher acknowledges that this approach may have limited the ability to capture the full scope of each dimension and may have influenced

the observed results of this study. A further limitation is that most instruments that measure student engagement focus on the classroom or institutional setting. Even though these have utility, the online environment is different and has its own unique influences and challenges. Reliable and valid measures of the dimensions of student engagement in the online environment would make a valuable contribution to understand the influence gamification and particularly game elements have on the specific dimensions of student engagement.

6.6 CONCLUSION

With the numerous challenges facing the South African higher education system, concerted efforts are required to support student success and enhance the quality of teaching and learning. A significant predictor of student success is student engagement that is underpinned by the provision of educationally purposive activities. Strategies for facilitating student engagement are well documented and with the increased use of ICT over the last few decades, these strategies have been extended to online environments. This has offered new avenues for creative and innovative approaches that support purposive educational practices. A recent addition to game-inspired interventions in education is educational gamification, which offers tools to design learning environments that stimulate motivation and foster engagement. The focus of this study was to uncover the features of a gamified intervention that facilitates student engagement.

Through systematic, iterative micro-cycles of research, proposed by the DBR approach, two online learning interventions were developed, applied and evaluated. Using qualitative and quantitative methods of data collection and analysis, three instrumental cases were presented to encapsulate the findings of this study. This endeavour provided insight into the influence game elements have on the dimensions of student engagement and demonstrated the complex and dynamic interaction of these dimensions in the process of engagement. The findings also highlighted the importance of integrating considered and well-designed reward and feedback mechanisms (game elements) with learning activities that are viewed as meaningful and relevant by the target audience. Despite the lack of support for the proposed influence of the gamified intervention on student engagement, the study demonstrated that gamification could be used to facilitate engagement but must be carefully tailored and used with consideration, paying particular attention to contextual and group influences.

The primary contribution of this study is the set of design principles and guidelines that are applicable for lecturers and practitioners alike. These outcomes offer key insights into the features required to design gamified learning environments that facilitate student engagement and will contribute to enhancing future pedagogical and educational use of this set of tools.

Despite the localised context and restricted samples of this study, that limit the generalisability of the findings, the transferability of key design principles of engagement and gamification was demonstrated. This study validates the need for further examination of educational gamification in varied contexts, courses, and target groups as well as improvement of measurement tools for the outcomes of gamification use. It is only through continued theoretically driven and rigorous investigations of gamification in education that robust, comprehensive methodological and practical guidelines will emerge. In closing, Lee and Hammer (2011, p. 3) succinctly conveyed the mind-set required to ensure that gamification assists universities to do education better:

> "It is not good enough to gamify school because it is the next fad, or because we believe students are motivated by points, or because we think badges will cause students to change their behaviors permanently. We must know what problems we are trying to fix, design systems that fix those specific problems, develop ways of evaluating whether those fixes work, and sustain those fixes over time. Gamification can only provide tools, and those tools must produce results that are worth the investment".

If heeded, this stance will support the continued improvement and proliferation of educational gamification pedagogy.

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APPENDIX A

Focus group: Informed consent and focus group protocol

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STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

Research title: The role of gamification in the facilitation of student engagement: An exploratory Industrial Psychology application

You are asked to participate in a research study conducted by Miss Samantha Adams, from the Industrial Psychology Department at Stellenbosch University. The results obtained will contribute to the completion of a PhD degree in Industrial Psychology. You were selected as a possible participant in this study because of the interaction you have had with a gamified learning management platform (SUNLearn).

1. PURPOSE OF THE STUDY

This study aims to theoretically and empirically investigate the effects or benefits that educational gamification may facilitate. More specifically, the study will focus on the potential role that educational gamification can play in fostering student engagement. The researcher therefore seeks to identify the properties of gamification that foster student engagement and test the effect thereof. The envisioned outcome of this study will be to propose design principles for the application of educational gamification for increased student engagement in university students.

2. PROCEDURES

If you volunteer to participate in this study, you would be required to do the following:

2.1. FOCUS GROUP INTERVIEW

You will be asked to reflect on and discuss your experiences in your interaction with the gamified learning platform on SUNLearn. A trained facilitator (Miss Nicola van der Westhuizen) will guide you through a semi-structured process of eliciting and discussing your experiences and the most salient thoughts related to your interaction. There are no right or wrong responses; we are merely interested in your personal opinions and thoughts. You will be asked to express and discuss the thoughts that come immediately to mind. Your responses will remain anonymous and your confidentiality protected. The focus group will take approximately 2 hours to complete.

3. POTENTIAL RISKS AND DISCOMFORTS

There are no potential risks or discomforts envisaged in this study.

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Participation in the study would provide the participant with an opportunity to reflect on the influential factors that play a role in their learning and engagement when interacting with a gamified learning platform.

5. PAYMENT FOR PARTICIPATION

No payment will be made to participants for partaking in this study.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a coding procedure. You will not be required to provide your names or particulars in the focus group. The focus group will be conducted by a facilitator (Nicola van der Westhuizen), appointed by the researcher, in person. The results of this study will be published in the form of a completed dissertation as well as in an accredited journal, but confidentiality will be maintained. No names will be published.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Samantha Adams (adamss@sun.ac.za / 021 808 2599 / 083 668 6527) or Prof Ronel du Preez (rdp@sun.ac.za / 021 808 9562)

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

CONSENT OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was explained to me by Nicola van der Westhuizen in English and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

Please tick the relevant box

I hereby consent voluntarily to participate in this study. I have also been given a copy of this form. ☐

I do not consent to participate in this study. ☐

FOCUS GROUP PROTOCOL

The following focus group protocol has been developed as a guide for the facilitator. Due to the semi-structured nature of this exercise the facilitator may probe and ask additional questions that are not included below.

Purpose:

The purpose of the focus group is to identify the most accessible beliefs, thoughts and experiences associated with the participant's interaction with the gamified SUNLearn platform.

Participants:

The focus group will be made up of individuals who share a common experience. A purposive sample will be drawn from a group of students that have been directly exposed to and involved in a gamified learning environment. Participation is voluntary and the group will be made up of approximately 8-12 participants.

Procedure:

The participants will be required to reflect on and brainstorm their experiences related to their gamified learning context. Each thought will be written on a separate piece of paper and randomly placed on a wall once everyone has completed the task. The following questions will be posed to initiate this process of reflection and brainstorming :

- Describe what you liked most about the use of gamification in your course. Why?
- Describe what you liked least about the use of gamification in your course. Why?

An analysis of the generated comments/ thoughts will be conducted after the brainstorming session. The researcher will engage the participants to clarify meaning and understanding of each idea. The participants will be encouraged to discuss and describe their comments/ thoughts in order to draw out and construct the shared reality of the group members. Once this discussion has concluded and all comments/ thoughts are displayed the group will then be asked to arrange their ideas into groupings that share a common meaning. This process of grouping is referred to as inductive coding or clustering. This is then followed by axial coding which is a process of reviewing the themes and groupings and giving each a name. These themes will guide the development of the design framework.

Lastly, the participants will be asked to briefly discuss and evaluate their overall experience as a participant in a gamified learning environment. The questions will be phrased as follows:

- If you could change one thing about the way gamification was used in your course, what would it be and why?
- Do you believe you are able to learn better through the use of gamification in your course? Why or why not?

APPENDIX B

Pilot questionnaire: Informed consent and questionnaire (Case 2)

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STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

Research title: The role of gamification in the facilitation of student engagement: An exploratory Industrial Psychology application

You are asked to participate in a research study conducted by Miss Samantha Adams, from the Industrial Psychology Department at Stellenbosch University. The results obtained will contribute to the completion of a PhD degree in Industrial Psychology. You were selected as a possible participant in this study because of the interaction you have had with a gamified learning management platform (SUNLearn).

1. PURPOSE OF THE STUDY

This study aims to theoretically and empirically investigate the effects or benefits that educational gamification may facilitate. More specifically, the study will focus on the potential role that educational gamification can play in fostering student engagement. Educational gamification is conceptualised as the application of game elements to non-game contexts as a means to encourage motivation and engagement with educational content. The researcher therefore seeks to identify the properties of gamification that foster student engagement and test the effect thereof. The envisioned outcome of this study will be to propose design principles for the application of educational gamification for increased student engagement in university students.

2. PROCEDURES

If you volunteer to participate in this study, you would be required to do the following:

2.1. QUESTIONNAIRE

You will be asked to complete a questionnaire to determine how interaction with the gamified SUNLearn page has influenced your student engagement, specifically your behavioural, cognitive, emotional and general engagement. You will be required to rate each question on the relevant scales e.g. 1 to 4. There are no right or wrong responses; we are merely interested in your personal opinions. Your responses will remain anonymous and your confidentiality protected. You will require approximately 20-30 minutes when completing this questionnaire.

You will also be requested to provide consent for the researcher to access your activity logs on SUNLearn. Your student number will thus also be requested in order to access this information. Your activity log will allow the researcher to check how often you accessed the learning platform and how long you spent on the activities. This information will be gathered by the instructional designer in the faculty, Magda Barnard, and will only be made available to the researcher once it has been coded and all identifying information removed.

3. POTENTIAL RISKS AND DISCOMFORTS

There are no potential risks envisaged in this study. However, you may experience some discomfort as a result of the nature of the some of the questions and providing your student number in order to access your activity log. Please be assured that the researcher will not have direct access to your student number or activity logs, and will not be able to link your student number to your responses. Please see the section on "Confidentiality" for the coding procedure that will be employed to ensure your anonymity and the confidentiality of your responses.

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Participation in the study would provide the participant with an opportunity to reflect on the influential factors (i.e. the behavioural, cognitive, emotional and general dimensions of student engagement) that play a role in their learning and engagement when interacting with a gamified learning platform. He/she will also be able to ascertain whether this interaction has an effect on their engagement and learning.

5. PAYMENT FOR PARTICIPATION

No payment will be made to participants for partaking in this study.

6. CONFIDENTIALITY

The questionnaire will be completed online on Stellenbosch University's survey system, Checkbox. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a coding procedure. You will not be required to provide your names on the questionnaire but you will however be required to provide your student number in order to link your SUNLearn activity to your responses on the questionnaire.

In order to protect your anonymity and confidentiality a list of student numbers and responses to the questionnaire will be sent to the instructional designer in the faculty of Economic management Sciences (Magda Barnard) once the questionnaire has closed. Ms Barnard will then draw the activity logs for each student number. She will then change the student number to a new number and recode the list of student numbers e.g. Student number: 12345678 will be changed to a 1,2 or 3 etc. The updated list (excluding the student numbers) will then be sent to the researcher who will analyse the data further. The list containing the original student numbers and recoded numbers will only be in the possession of the instructional designer, and not the researcher.

The results of this study will be published in the form of a completed dissertation as well as in an accredited journal, but confidentiality will be maintained. No names will be published.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Samantha Adams (adamss@sun.ac.za / 021 808 2599 / 083 668 6527) or Prof Ronel du Preez (rdp@sun.ac.za / 021 808 9562)

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development, Stellenbosch University.

CONSENT OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

If you are willing to voluntarily participate in this study please tick the relevant box:

I hereby consent voluntarily to participate in this study. ☐

I do not consent to participate in this study. ☐

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DEMOGRAPHIC INFORMATION SHEET

The following information is solely for research purposes
Please tick the appropriate box

How many times have you registered for this module?
This is the first time,
This is the second time,
I have registered 3 or more times for this module
Indicate your race. (Mark only one.)
- Black African,
- Coloured,
- White
- Indian,
- Asian,
- Multiracial,
What is the language of instruction in the classes that you attend for Industrial Psychology 132?
- I attend the English lectures,
- I attend the Afrikaans lectures,
- I sometimes attend the English lectures and sometimes the Afrikaans lectures,
- My lectures are in English and Afrikaans.
- My lectures are in English with an Afrikaans interpretation service.
What is your home language? (Mark only one.)
- English,
- Afrikaans,
- IsiXhosa,
- IsiZulu,
- IsiNdebele,
- North Sotho,
- Sesotho,
- Setswana,
- Tshivenda,
- SiSwati,
- Xitsonga,
- Other
Indicate your gender
- Female
- Male
Indicate your age.

How would you rate your computer skills? **Scale 1 – 5 (Very poor – Average – Very good)**
Do you play games in your free time e.g. cell phone games, computer games, console games etc.? **Scale 1 – 5 (Never, Sometimes, Very often)**
Did you enjoy the gamified activities you had to complete on SUNLearn? **Scale 1 – 5 (Not at at all – Very much)**
Did you know about the concept of gamification before participating in the module?
Yes
No
Do you consent to the researcher accessing your SUNLearn activity log to view how many times you have logged on and interacted with the learning activities?
Yes
No
If response is YES then… **Please indicate your student number.** *Open response*

SECTION A
BEHAVIOURAL ENGAGEMENT

For each of the following statements, please indicate how frequently you engaged in the following activities in Industrial Psychology 132 using 1=never, 2=rarely, 3=sometimes, 4=often

Online Engagement (OE): the extent to which students use online learning systems(i.e. SUNLearn) to enrich their study

- I used SUNLearn to improve how I learn in the module
- SUNLearn helped me to interact better with the module content
- I used SUNLearn to manage my studies in the module
- SUNLearn is a major part of Industrial Psychology 132

Online Active Learning (OAL): key ways in which students use online systems (i.e. SUNLearn) to enhance learning in the module

- I used online materials on SUNLearn to improve my learning
- I used online materials on SUNLearn to make lectures more meaningful
- I identified expected work standards using SUNLearn
- I found that online materials on SUNLearn challenged me to learn
- I used online feedback to improve my understanding of a topic

Online Contact with Staff (OCS): the level and quality of students' online contact with staff

- I used SUNLearn to contact my lecturer
- I found it easy to communicate with my lecturer online
- I had individual contact with my lecturer online

Online Collaboration (OC): students' use of online systems(i.e. SUNLearn) to work collaboratively with peers in this module

- I used SUNLearn with other students around campus
- I used SUNLearn to do academic work with other students
- I used SUNLearn to work with other students outside of class
- I used SUNLearn to communicate with other students

Online Teaching (OT): whether teachers use online learning systems (i.e. SUNLearn) to promote effective learning in this module

- My lecturer used SUNLearn to clarify what was required to do well
- My lecturer used SUNLearn in ways that improved the overall teaching
- My lecturer made an effort to communicate with students online
- My lecturer used SUNLearn to provide students with extra assistance
- My lecturer used SUNLearn to tailor activities for students
- My lecturer used SUNLearn to discuss interesting issues

Online Academic Relevance (OAR): use of online systems (i.e. SUNLearn) to enhance the relevance and context of study in this module

- Using SUNLearn made my studies seem more relevant
- Using SUNLearn made me feel part of the university
- Using online materials on SUNLearn helped me put my studies in real-world contexts

SECTION B
EMOTIONAL ENGAGEMENT

Think of the OT Tycoon activities and for each of the following statements, please indicate how true it is for you, using the following scale:
Response options: 1= not at all true, 2, 3, 4= somewhat true, 5, 6, 7=very true
Mark only one

Interest/Enjoyment

- I enjoyed doing the OT Tycoon activities very much
- The OT Tycoon activities activity were fun to do.
- I thought the OT Tycoon activities were boring.(R)
- The OT Tycoon activities did not hold my attention at all.(R)
- I would describe the OT Tycoon activities as very interesting.
- I thought the OT Tycoon activities were quite enjoyable.
- While I was doing the OT Tycoon activities, I was thinking about how much I enjoyed it.

Perceived Competence

- I think I am pretty good at the OT Tycoon activities.
- I think I did pretty well at the OT Tycoon activities, compared to other students.
- After working at the OT Tycoon activities for a while, I felt pretty competent.
- I am satisfied with my performance in the OT Tycoon activities.
- I was pretty skilled at the OT Tycoon activities.
- The OT Tycoon activities were activities that I couldn't do very well. (R)

Value/Usefulness

- I believe the OT Tycoon activities could be of some value to me.
- I think that doing the OT Tycoon activities is useful for my learning in this module
- I think the OT Tycoon activities are important to do because it can help me to learn effectively in this module
- I would be willing to do the OT Tycoon activities again because they have some value to me.
- I think doing the OT Tycoon activities could help me to be successful in this module
- I believe doing the OT Tycoon activities could be beneficial to me.
- I think the OT Tycoon activities are important activities.

SECTION C
COGNITIVE ENGAGEMENT

Please rate the following items based on your study behaviour in Industrial Psychology 132. Your rating should be on a 7- point scale where **1= not at all true of me** to **7=very true of me**

Effort/Importance

- I put a lot of effort into the OT Tycoon activities.
- I didn't try very hard to do well at the OT Tycoon activities. (R)
- I tried very hard on the OT Tycoon activities.
- It was important to me to do well at the OT Tycoon activities.
- I didn't put much energy into the OT Tycoon activities.(R)

Resource Management Strategies: Effort Regulation

- I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do. (REVERSED)
- I work hard to do well in this class even if I don't like what we are doing.
- When course work or SUNLearn activities are difficult, I give up or only study the easy parts. (REVERSED)
- Even when course materials are dull and uninteresting, I manage to keep working until I finish.

Cognitive and Metacognitive Strategies: Rehearsal

- When I study for this class, I practice saying the material to myself over and over.
- When studying for this class, I read my class notes and the course readings over and over again.
- I memorize key words to remind me of important concepts in this class.
- I make lists of important terms for this course and memorize the lists.

Cognitive and Metacognitive Strategies: Elaboration

- When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.
- I try to relate ideas in this subject to those in other courses whenever possible.
- When reading for this class, I try to relate the material to what I already know.
- When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.

- I try to understand the material in this class by making connections between the readings and the concepts from the lectures.
- I try to apply ideas from course readings in other class activities such as lecture and discussion.

Cognitive and Metacognitive Strategies: Organization

- When I study the readings for this course, I outline the material to help me organize my thoughts.
- When I study for this course, I go through the readings and my class notes and try to find the most important ideas.
- I make simple charts, diagrams, or tables to help me organize course material.
- When I study for this course, I go over my class notes and make an outline of important concepts.

Cognitive and Metacognitive Strategies: Critical Thinking

- I often find myself questioning things I hear or read in this course to decide if I find them convincing.
- When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.
- I treat the course material as a starting point and try to develop my own ideas about it.
- I try to play around with ideas of my own related to what I am learning in this course.
- Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.

Cognitive and Metacognitive Strategies: Metacognitive Self-Regulation

- During class time I often miss important points because I'm thinking of other things. (REVERSED)
- When reading for this course, I make up questions to help focus my reading.
- When I become confused about something I'm reading for this class, I go back and try to figure it out.
- If course materials are difficult to understand, I change the way I read the material.
- Before I study new course material thoroughly, I often skim it to see how it is organized.
- I ask myself questions to make sure I understand the material I have been studying in this class.
- I try to change the way I study in order to fit the course requirements and instructor's teaching style.
- I often find that I have been reading for class but don't know what it was all about. (REVERSED)
- I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
- When studying for this course I try to determine which concepts I don't understand well.
- When I study for this class, I set goals for myself in order to direct my activities in each study period.
- If I get confused taking notes in class, I make sure I sort it out afterwards.

SECTION D
GENERAL ENGAGEMENT

Constructive Teaching (CT): whether staff inspired and supported active learning

- Materials were presented in a way that I could understand
- My lecturer valued students' ideas and questions
- My lecturer encouraged students to question what was being taught
- My lecturer used teaching approaches that suited students' needs
- I felt encouraged to creatively explore ideas
- My lecturer talked about her field in ways that inspired me to learn

Collaborative Work (CW): students' involvement in collaborative activities

- I have worked on group projects with other students
- I worked with other students on difficult tasks
- I thought about the best way to work collaboratively
- I used spaces around campus to study with other students
- I helped other students when they were having academic problems

Teacher Approachability (TA): the broad interest of staff in students and student needs

- My lecturer seemed interested in helping students
- My lecturer were generally approachable
- My lecturer was accessible
- My lecturer made a real effort to interact with students

Student and Staff Interaction (SSI): the level and nature of student-initiated contact with teaching staff

- I had one-to-one conversations with my lecturer
- I initiated individual contact with my lecturer
- I sought advice from my lecturer on how to improve my performance
- I developed a valuable rapport with my lecturer
- I met with academic my lecturer outside of class

Active Learning (AL): students' efforts to actively construct knowledge

- I set high performance standards for myself
- I tried to make connections between things that I was learning
- I pushed myself to understand things I found puzzling
- I sought out my own resources to help me understand topics
- I thought about the practical applications of material that I studied
- I thought about ethical issues related to the material that I studied

Academic Challenge (AC): extent to which expectations and assessments challenge students to learn

- Assessment tasks challenged me to learn
- I was given enough material to keep up my interest
- I was encouraged by teachers to go beyond set materials
- My lecturer gave me comments on my work that helped me learn
- I received feedback quickly enough to improve subsequent work

Beyond Class Collaboration (BCC): collaborative work with others outside formal instructional environments

- I talked with students outside of class about the module
- Students were required to work together outside of class

- I used spaces around campus to study with my peers
- I studied with my peers outside of class

Supportive Learning Environment (SLE): students' feelings of legitimation within the university community

- My lecturer respected students' backgrounds, perspectives and needs
- The classroom felt like a supportive place to learn
- My lecturer seemed responsive to feedback from students
- I felt part of an academic community in this module

SECTION E
OT TYCOON EVALUATION
How can we improve the OT Tycoon game and learning activities for future students?

APPENDIX C

Ethics approval letter from Research and Ethics Committee (REC)

Approval Notice
New Application

16-May-2017
Adams, Samantha SP

Proposal #: SU-HSD-004270

Title: The role of gamification in the facilitation of student engagement: An exploratory Industrial Psychology application

Dear Miss Samantha Adams,

Your **New Application** received on **03-May-2017**, was reviewed
Please note the following information about your approved research proposal:

Proposal Approval Period: **16-May-2017 -15-May-2020**

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number** (**SU-HSD-004270**) on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 218089183.

Included Documents:

DESC Report
DESC Report 1
DESC Report 1
REC: Humanities New Application

Sincerely,

Clarissa Graham
REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1. Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.
2. Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use. If you need to recruit more participants than was noted in your REC approval letter, you must submit an amendment requesting an increase in the number of participants.
3. Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the
signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.
4. Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period.** Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit**
the continuing review report in a timely fashion to ensure a lapse in REC approval does not occur. If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.
5. Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, number of participants, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You **may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.
6. Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouch within **five**
(5) days of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch Universtiy Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.
7. Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research

proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

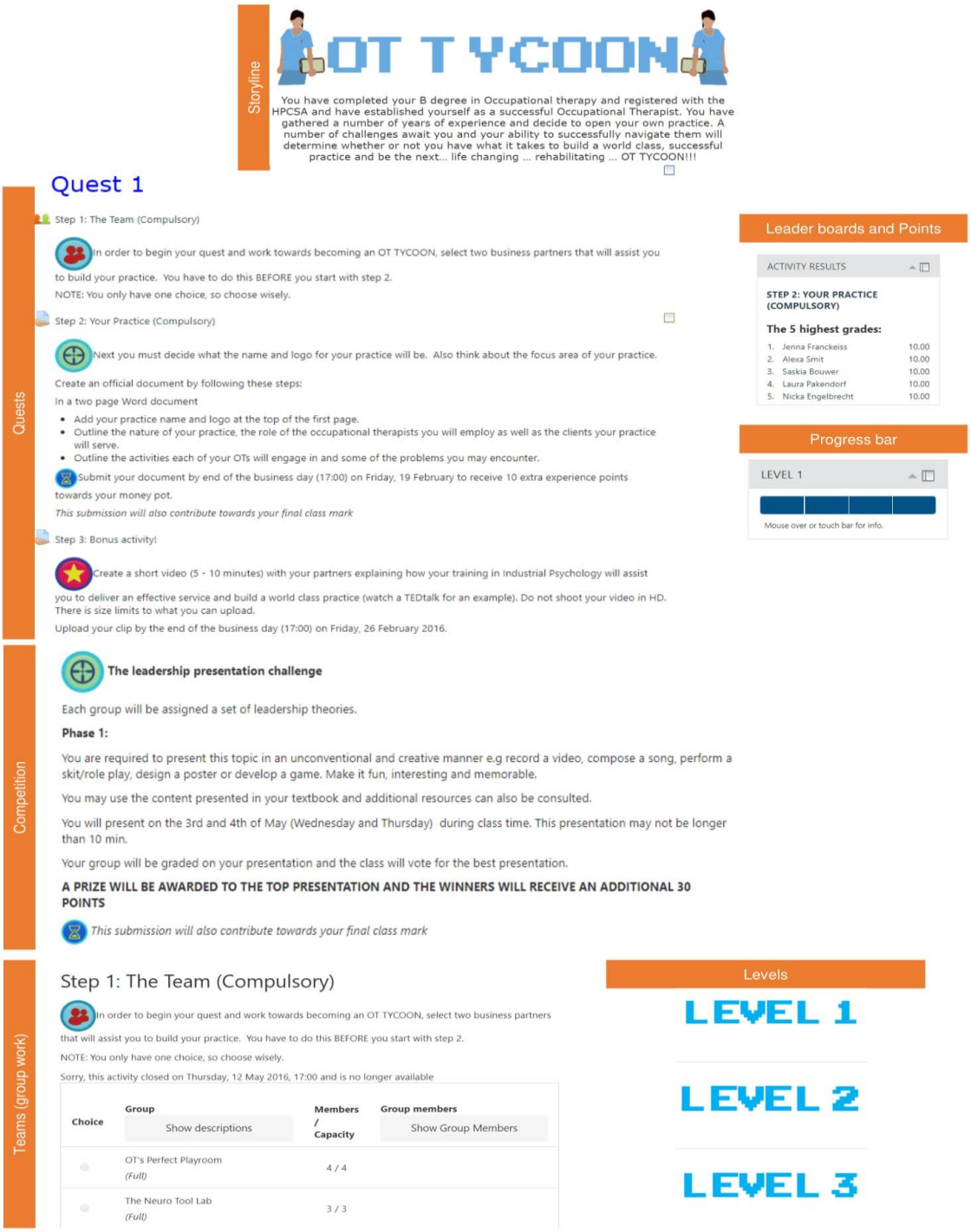
8. Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9. Final reports. When you have completed (no further participant enrollment, interactions, interventions or data analysis) or stopped work on your research, you must submit a Final Report to the REC.

10. On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

APPENDIX D

Game elements incorporated into the OT Tycoon game



APPENDIX E

Point and mark allocation in Career Hero

Table E1

Points (XP) Allocation for Activities in Career Hero

Activities	**Point allocation**
Challenges (Formative learning activities)	1 Attempt = 500 XP 2 Attempts = 300 XP 3 Attempts = 200 XP
Power-up challenge (Capstone assignment)	Video submission = 2000 XP or Infographic submission = 1000XP or Report submission = 500XP
Face off challenges (Boss fight)	500 XP
Sidekick duty (Case study assignment)	200 XP for submission 200 XP for providing a peer with feedback
Superhero conference (forum discussion)	200XP for posting on forum 200 XP for commenting on a peer's contribution
Master classes (Lecturers)	Wednesday class − 100 XP Thursday class − 200 XP
Booster feedback (e-Survey)	500 XP
Mentor catch up	150 XP
Bonus points for reaching Levels 4 and 6	500 XP each

Table E2

Points and Marks Obtained for Completion of Career Hero Activities

Points obtained	**Mark allocated**
9 501 – 10 000	10%
9 000 – 9 500	9%
8 000	8%
7 000	7%
6 000	6%
5 000	5%
4 000	4%
3 000	3%
2 000	2%
1 000	1%
0 – 999	0%

Table E3

Weighted Contribution of Assessments in IP152

Assessment	**Weighted contribution to class mark**
Semester Test	50%
Online Test 1	10%
Online Test 2	10%
Capstone Assignment (Power up challenge)	20%
Points	10%

APPENDIX F

Module outline and planning for Career Hero (IP152, Case 3)

Table F1

Module Outline and Planning for IP152 Career Hero Intervention and Experiment

INDUSTRIAL PSYCHOLOGY – 152 – CAREER PSYCHOLOGY MODULE OUTLINE PER WEEK – 2ND SEMESTER 2017						
Weeks	**Content**	**Lecture**	**Formative Assessments**	**Summative Assessments**	**Research**	**Cumulative Points**
17-21 July	Course framework					
	1) The Meaning of Work	Thursday	Quiz (20 July - 25 July): Seven values match			
24-28 July	1) The Meaning of work	Wednesday				
	2) Changes in Organizations	Thursday				
31 July - 04 Aug	2) Changes in Organizations	Wednesday	Knowledge check (3 August - 8 August): Match concepts to definition			

	3) Career Concepts and Career Management Models	Thursday				
07 - 11Aug	3) Career Concepts and Career Management Models	Wednesday (Public Holiday)				
		Thursday		Online Test 1 (Ch1 – 3)	Brief class on study and gain consent Engagement Questionnaire (250XP)	
GAMIFIED TREATMENT BEGINS						
14 - 18 Aug	4) Career Choice and Counselling	Wednesday (100XP)				
		Thursday (200XP)	iSpring (18 August – 22 August) (1-500XP, 2-300XP, 3-100XP)		CE Questions (Restrict access iSpring) (150XP)	
			Expert Activity (18 August) (500XP)			
21 -25 Aug	5) Life and Career stages	Wednesday (100XP) | Briefing for Workshop	iSpring (24 August – 29 August) (1-500XP, 2-300XP, 3-100XP)	23 Aug: Semester Test		

		Thursday (200XP)	Workshop (Hand-in 23 – 27 August, Mark 28 – 29 August) (200XP for marking, 200XP for their mark – mark + 0)		CE Questions (Restrict access Workshop) 150XP	
			Expert Activity (25 August) (500XP)			
28 Aug - 1 Sept	5) Life and Career Stages	Wednesday (100XP)				
	6) Career issues	Thursday (500XP) | Brief on Capstone Assignment	iSpring (31 August – 14 September) (1-500XP, 2-300XP, 3-100XP)			
02 -10 Sept						
11- 15 Sept	6) Career issues	Thursday (50XP)				
18 -22 Sept	6) Career issues	Thursday (50XP)		Capstone Assignment (22 September) (Written 500XP, Infographic 1000XP, Video presentation 2000XP)	CE Questions (Restrict access Capstone Assignment) 150XP	
			Expert Activity (22 August) (500XP)			
Bonus 250XP for reaching LEVEL 4						
GAMIFIED TREATMENT ENDS						

25 Sep – 29 Sept	7) Career well-being	Thursday (50XP) | Brief on discussion	Discussion (28 September – 5 October) (Post 300XP, Comment 100XP)		Engagement Questionnaire (250XP)	
02 -06 Oct	7) Career well-being	Thursday (50XP)	Expert Activity (6 October) (500XP)	Online Test 2		
Bonus 250XP for reaching LEVEL 6						
09- 13 Oct	8) Organisational choice	Thursday (50XP)		14 October(?): Sick / Alternative test	Feedback (500XP)	
16 – 20 Oct	Questions / Exam Overview	Thursday			Classes end	
05 November						
29 November						

APPENDIX G

Inter-item correlations for the Student Engagement Questionnaire

Table G1

Inter-Item Correlations for Student Engagement Questionnaire

Dimension	Scale	Items	Inter-Item Correlation	Cronbach's α if Item Deleted
Behavioural engagement	Online engagement	1	.75	.87
		2	.83	.84
		3	.79	.85
		4	.69	.89
	Online active learning	1	.65	.82
		2	.73	.80
		3	.71	.81
		4	.62	.83
		5	.59	.84
	Online collaboration	1	.70	.81
		2	.79	.77
		3	.73	.80
		4	.55	.87
	Online teaching	1	.65	.89
		2	.75	.88
		3	.71	.88
		4	.78	.87
		5	.74	.88
		6	.73	.88
	Online academic relevance	1	.77	.79
		2	.72	.83
		3	.75	.81
Emotional engagement	Interest	1	.85	.92
		2	.87	.91
		3	.69	.93
		4	.63	.94
		5	.85	.92
		6	.87	.91
		7	.74	.93
	Perceived competence	1	.78	.79
		2	.70	.81
		3	.55	.84
		4	.67	.82
		5	.80	.79
		6	.34	.88
	Value/usefulness	1	.84	.95
		2	.86	.95
		3	.84	.95

Dimension	Scale	Items	Inter-Item Correlation	Cronbach's α if Item Deleted
		4	.80	.95
		5	.91	.94
		6	.81	.95
		7	.84	.95
Cognitive engagement	Effort importance	1	.78	.86
		2	.71	.88
		3	.82	.85
		4	.70	.88
		5	.69	.88
	Metacognitive Self-regulation	1	.22	.78
		2	.43	.76
		3	.46	.75
		4	.56	.74
		5	.46	.75
		6	.55	.74
		7	.45	.75
		8	-.08	.81
		9	.55	.75
		10	.55	.75
		11	.43	.76
		12	.47	.75
	Task value	1	.68	.91
		2	.70	.91
		3	.82	.90
		4	.85	.89
		5	.81	.90
		6	.75	.91
	Effort regulation	1	.50	.68
		2	.44	.71
		3	.53	.66
		4	.61	.61
	Internal goal orientation	1	.52	.66
		2	.53	.66
		3	.52	.66
		4	.50	.67
	External goal orientation	1	.64	.70
		2	.61	.71
		3	.61	.71
		4	.49	.78

APPENDIX H

Post hoc Fishers Least Square Differences tables

Table H1

Fishers Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Online Engagement Scale

	LSD test; variable BOE (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	1,87	0,23	0
{1}-{3}	low*1	intermediate*1	-0,63	0,2	0
{1}-{4}	low*1	intermediate*2	0,08	0,22	0,72
{1}-{5}	low*1	high*1	-0,65	0,25	0,01
{1}-{6}	low*1	high*2	-0,38	0,28	0,19
{2}-{3}	low*2	intermediate*1	-2,5	0,22	0
{2}-{4}	low*2	intermediate*2	-1,79	0,24	0
{2}-{5}	low*2	high*1	-2,51	0,27	0
{2}-{6}	low*2	high*2	-2,24	0,3	0
{3}-{4}	intermediate*1	intermediate*2	0,71	0,21	0
{3}-{5}	intermediate*1	high*1	-0,01	0,25	0,95
{3}-{6}	intermediate*1	high*2	0,26	0,28	0,36
{4}-{5}	intermediate*2	high*1	-0,72	0,26	0,01
{4}-{6}	intermediate*2	high*2	-0,45	0,29	0,13
{5}-{6}	high*1	high*2	0,27	0,31	0,39

Table H2

Fishers Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Online Active Learning Scale

	LSD test; variable BOAL (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	1,53	0,21	0
{1}-{3}	low*1	intermediate*1	-0,7	0,18	0
{1}-{4}	low*1	intermediate*2	-0,26	0,2	0,18
{1}-{5}	low*1	high*1	-0,76	0,23	0
{1}-{6}	low*1	high*2	-0,79	0,26	0
{2}-{3}	low*2	intermediate*1	-2,23	0,2	0
{2}-{4}	low*2	intermediate*2	-1,79	0,22	0
{2}-{5}	low*2	high*1	-2,29	0,25	0
{2}-{6}	low*2	high*2	-2,32	0,28	0
{3}-{4}	intermediate*1	intermediate*2	0,44	0,19	0,02
{3}-{5}	intermediate*1	high*1	-0,06	0,23	0,79
{3}-{6}	intermediate*1	high*2	-0,09	0,25	0,72
{4}-{5}	intermediate*2	high*1	-0,5	0,24	0,04
{4}-{6}	intermediate*2	high*2	-0,53	0,27	0,05
{5}-{6}	high*1	high*2	-0,03	0,28	0,91

Table H3

Fishers Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Online Collaboration Scale

	LSD test; variable BOC (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	0,45	0,26	0,09
{1}-{3}	low*1	intermediate*1	0,08	0,24	0,73
{1}-{4}	low*1	intermediate*2	-0,59	0,25	0,02
{1}-{5}	low*1	high*1	0,03	0,3	0,92
{1}-{6}	low*1	high*2	-0,55	0,33	0,1
{2}-{3}	low*2	intermediate*1	-0,37	0,26	0,15
{2}-{4}	low*2	intermediate*2	-1,04	0,28	0
{2}-{5}	low*2	high*1	-0,42	0,32	0,19
{2}-{6}	low*2	high*2	-1	0,35	0,01
{3}-{4}	intermediate*1	intermediate*2	-0,67	0,24	0,01
{3}-{5}	intermediate*1	high*1	-0,05	0,29	0,87
{3}-{6}	intermediate*1	high*2	-0,63	0,32	0,05
{4}-{5}	intermediate*2	high*1	0,62	0,3	0,04
{4}-{6}	intermediate*2	high*2	0,04	0,34	0,91
{5}-{6}	high*1	high*2	-0,58	0,36	0,11

Table H4

Fishers Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups On the Online Teaching Scale

	LSD test; variable BOT (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	0,57	0,24	0,02
{1}-{3}	low*1	intermediate*1	-0,52	0,21	0,02
{1}-{4}	low*1	intermediate*2	-0,59	0,23	0,01
{1}-{5}	low*1	high*1	-0,4	0,27	0,15
{1}-{6}	low*1	high*2	-0,78	0,3	0,01
{2}-{3}	low*2	intermediate*1	-1,1	0,23	0
{2}-{4}	low*2	intermediate*2	-1,17	0,26	0
{2}-{5}	low*2	high*1	-0,97	0,29	0
{2}-{6}	low*2	high*2	-1,36	0,32	0
{3}-{4}	intermediate*1	intermediate*2	-0,07	0,22	0,75
{3}-{5}	intermediate*1	high*1	0,12	0,27	0,64
{3}-{6}	intermediate*1	high*2	-0,26	0,29	0,37
{4}-{5}	intermediate*2	high*1	0,19	0,27	0,48
{4}-{6}	intermediate*2	high*2	-0,19	0,31	0,54
{5}-{6}	high*1	high*2	-0,38	0,33	0,24

Table H5

Fisher's Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Online Academic Relevance Scale

	LSD test; variable BOAR (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	1,64	0,25	0
{1}-{3}	low*1	intermediate*1	-0,81	0,22	0
{1}-{4}	low*1	intermediate*2	-0,46	0,24	0,06
{1}-{5}	low*1	high*1	-1,41	0,28	0
{1}-{6}	low*1	high*2	-1,13	0,31	0
{2}-{3}	low*2	intermediate*1	-2,46	0,24	0
{2}-{4}	low*2	intermediate*2	-2,1	0,27	0
{2}-{5}	low*2	high*1	-3,05	0,3	0
{2}-{6}	low*2	high*2	-2,78	0,33	0
{3}-{4}	intermediate*1	intermediate*2	0,35	0,23	0,13
{3}-{5}	intermediate*1	high*1	-0,6	0,28	0,03
{3}-{6}	intermediate*1	high*2	-0,32	0,3	0,29
{4}-{5}	intermediate*2	high*1	-0,95	0,29	0
{4}-{6}	intermediate*2	high*2	-0,68	0,32	0,04
{5}-{6}	high*1	high*2	0,28	0,34	0,42

Table H6

Fisher's Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Interest Scale

	LSD test; variable EI (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	0,41	0,2	0,04
{1}-{3}	low*1	intermediate*1	-1,06	0,17	0
{1}-{4}	low*1	intermediate*2	-1,38	0,19	0
{1}-{5}	low*1	high*1	-1,88	0,22	0
{1}-{6}	low*1	high*2	-2,4	0,25	0
{2}-{3}	low*2	intermediate*1	-1,47	0,19	0
{2}-{4}	low*2	intermediate*2	-1,79	0,21	0
{2}-{5}	low*2	high*1	-2,28	0,24	0
{2}-{6}	low*2	high*2	-2,81	0,26	0
{3}-{4}	intermediate*1	intermediate*2	-0,32	0,18	0,08
{3}-{5}	intermediate*1	high*1	-0,81	0,22	0
{3}-{6}	intermediate*1	high*2	-1,34	0,24	0
{4}-{5}	intermediate*2	high*1	-0,49	0,22	0,03
{4}-{6}	intermediate*2	high*2	-1,02	0,25	0
{5}-{6}	high*1	high*2	-0,53	0,27	0,05

Table H7

Fisher's Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Perceived Competence Scale

	LSD test; variable EPC (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	0,88	0,18	0
{1}-{3}	low*1	intermediate*1	-0,43	0,16	0,01
{1}-{4}	low*1	intermediate*2	-0,5	0,18	0,01
{1}-{5}	low*1	high*1	-0,61	0,21	0
{1}-{6}	low*1	high*2	-0,93	0,23	0
{2}-{3}	low*2	intermediate*1	-1,31	0,18	0
{2}-{4}	low*2	intermediate*2	-1,38	0,2	0
{2}-{5}	low*2	high*1	-1,48	0,22	0
{2}-{6}	low*2	high*2	-1,81	0,25	0
{3}-{4}	intermediate*1	intermediate*2	-0,07	0,17	0,68
{3}-{5}	intermediate*1	high*1	-0,18	0,2	0,39
{3}-{6}	intermediate*1	high*2	-0,5	0,22	0,03
{4}-{5}	intermediate*2	high*1	-0,11	0,21	0,62
{4}-{6}	intermediate*2	high*2	-0,43	0,24	0,08
{5}-{6}	high*1	high*2	-0,32	0,25	0,21

Table H8

Fisher's Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Value/Usefulness Scale

	LSD test; variable EV (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy2"*time				
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error	p
{1}-{2}	low*1	low*2	1,65	0,21	0
{1}-{3}	low*1	intermediate*1	-0,77	0,19	0
{1}-{4}	low*1	intermediate*2	-0,16	0,2	0,44
{1}-{5}	low*1	high*1	-1,1	0,24	0
{1}-{6}	low*1	high*2	-0,96	0,27	0
{2}-{3}	low*2	intermediate*1	-2,42	0,21	0
{2}-{4}	low*2	intermediate*2	-1,81	0,23	0
{2}-{5}	low*2	high*1	-2,75	0,26	0
{2}-{6}	low*2	high*2	-2,61	0,29	0
{3}-{4}	intermediate*1	intermediate*2	0,61	0,2	0
{3}-{5}	intermediate*1	high*1	-0,33	0,24	0,17
{3}-{6}	intermediate*1	high*2	-0,19	0,26	0,47
{4}-{5}	intermediate*2	high*1	-0,94	0,25	0
{4}-{6}	intermediate*2	high*2	-0,8	0,28	0,01
{5}-{6}	high*1	high*2	0,14	0,29	0,63

Table H9

Fisher's Least Square Differences Pairwise Comparison of Low, Intermediate and High Groups on the Effort Scale

	LSD test; variable EE (no duplicates in ADAMS_SEQ 152 FINAL DATA SET.stw) Simultaneous confidence intervals Effect: "enjoy			
Comparisons Cell {#1}-{#2}	1st Mean	2nd Mean	Mean Differ.	Standard Error
{1}-{2}	low*1	low*2	0,95	0,22
{1}-{3}	low*1	intermediate*1	-0,39	0,21
{1}-{4}	low*1	intermediate*2	-0,4	0,21
{1}-{5}	low*1	high*1	-0,84	0,26
{1}-{6}	low*1	high*2	-0,38	0,29
{2}-{3}	low*2	intermediate*1	-1,34	0,22
{2}-{4}	low*2	intermediate*2	-1,35	0,24
{2}-{5}	low*2	high*1	-1,79	0,27
{2}-{6}	low*2	high*2	-1,33	0,3
{3}-{4}	intermediate*1	intermediate*2	-0,01	0,2
{3}-{5}	intermediate*1	high*1	-0,45	0,25
{3}-{6}	intermediate*1	high*2	0,01	0,27
{4}-{5}	intermediate*2	high*1	-0,44	0,26
{4}-{6}	intermediate*2	high*2	0,02	0,29
{5}-{6}	high*1	high*2	0,46	0,3