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An Examination of Influential Factors on Gamification in Higher Education: A Content Analysis

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by

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ABSTRACT

Student disengagement and disconnection post pandemic has become a prominent concern in higher education. As colleges and universities navigate the post-pandemic landscape, addressing student disengagement and reconnecting them to the learning community has become a priority. Gamification has been used in education since early 2010s, however, the empirical studies on the effectiveness of gamification have yielded inconsistent results. Without a clear understanding of how gamification works and which gamification design elements have a higher potential to influence learning outcomes, gamification intervention may not achieve the desired results.

Guided by Self-Determination Theory and Theory of Gamified Learning, this study aimed to examine the factors that contributed to the successful implementation of gamification in higher education, and to identify the design elements that had most influence on student learning outcomes. The study employed a correlational research design and quantitative content analysis method. Data was collected from the empirical studies conducted between 2014 and 2023. The literature search yielded 1038 publications. After a careful screening, 67 experiments were included in this study. Data analysis was conducted using logistic regression and Chi-Square tests. Two gamification design elements, *Social Interaction* and *Leaderboards*, were found to have significant influence on student learning outcomes.

The results showed that integrating social interaction and leaderboards in the gamification design facilitates the satisfaction of the needs for competence and relatedness, which helps improve student engagement and connection with the learning community and alleviates the issue facing higher education. This study provided insights

for college instructors and instructional designers in the design of gamification intervention in instruction. Implications for practice and future studies were presented.

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Chapter One

Introduction

This chapter presents an overview of the study. It starts with an introduction of the background information on the topic of gamification in education, and describes the issues of student disengagement and disconnection in higher education post COVID-19 pandemic, and the challenges current gamification research in higher education is facing. The purpose of the study is then presented, followed by the significance of the study. The chapter concludes with a description of the organization of this study.

Background of the Study

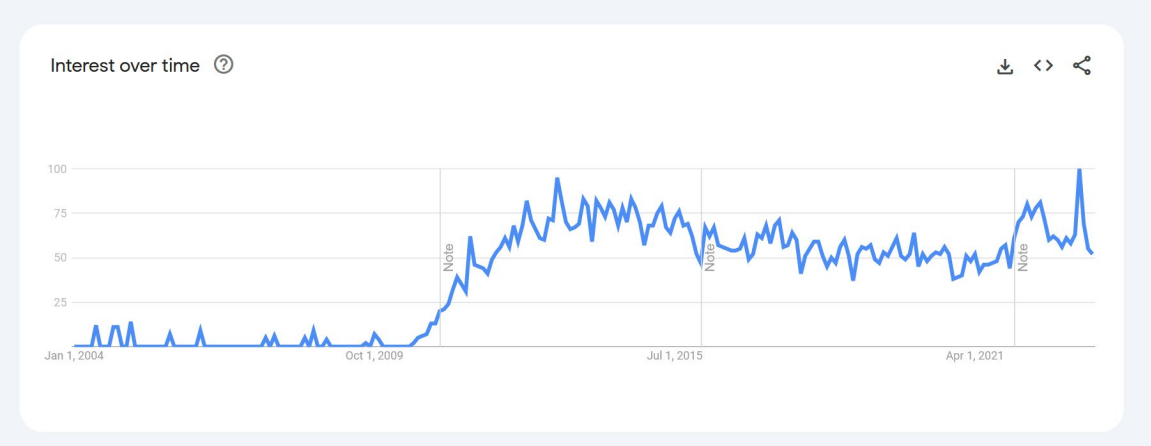
While games have been used in teaching since ancient times, gamification is a comparatively new phenomenon. Gamification, "the use of game design elements in non-game context" (Deterding et al., 2011, p. 10) to increase engagement and motivation, gained popularity in the early 2010s. It has been a growing trend ever since with practical applications in businesses and organizations for employee training (Vanduhe et al., 2020), in marketing and sales to increase brand loyalty (Xi & Hamari, 2019), in health and wellness to promote healthy behaviors (Miller et al., 2014), and recently, to combat disinformation and misinformation on social media (Almaliki, 2019; Sotirakou et al., 2022).

In recent years, there has been a growing interest in using gamification in education due to the advancement in digital technology and the availability of gamified learning systems (see Figure 1). The research in gamification has been steadily rising (Sailers & Homner, 2020). Studies have been conducted to better understand the application of gamification and its potential effects on students (for example, Brom et al.,

2019; Gupta & Goyal, 2022; Morris et al., 2019; Sailer & Sailer, 2021). By tapping into natural human desire for competition, achievement, and social interaction, gamification has the potential to boost student engagement, learning performance, and overall academic success (Dichev & Dicheva, 2017).

Figure 1

Gamification as the search term in Google Trends



The COVID-19 pandemic has increased the need for gamification to improve engagement and retention rates. The pandemic has had a significant impact on every aspect of society, including higher education. College students have faced numerous challenges and disruptions to their learning experience (Garcia-Morales, Garrido-Moreno, & Martin-Rojas, 2021). When the pandemic started, the sudden shift to remote learning disrupted the traditional classroom setting, leading to a loss of structure and face to face interaction. The absence of physical classroom environments hindered students' ability to actively participate in discussions and collaborate with peers. The lack of access to campus resources and support services further exacerbated the issue. This change made it challenging for students to stay engaged and motivated.

College is not just about academics; it is also a time (and place) for students, especially on-campus students, to socialize and build relationships. Social interaction is a key part of college experience. The lack of social interaction can contribute to feelings of disengagement and isolation. Studies on the impact of COVID-19 on higher education have highlighted the challenges with maintaining student motivation and engagement, and detrimental effects of anxiety and stress on student learning (Chiu et al., 2021; Copeland et al., 2021; Ghislieri et al., 2023; Wu & Teets, 2021).

While lack of motivation to learn on college campus has always been an issue, there is a sharp decline in student motivation during COVID-19 (Corpus et al., 2022). With the ease of the pandemic and the return of colleges and universities to the pre-pandemic norm, the issue of lack of motivation and disengagement continues. "A 'stunning' level of student disconnection," as Beth McMurtrie claimed in The Chronicle of Higher Education, "Professors are reporting record numbers of students checked out, stressed out, and unsure of their future", calling it "an epidemic of student disengagement" (McMurtrie, 2022).

College student disengagement and disconnection post Covid-19 pandemic has become a prominent concern in higher education. As colleges and universities navigate the post-pandemic landscape, addressing student disengagement and reconnecting them to the learning community has become a priority.

The primary goal of gamification in education is to increase motivation and engagement (Kapp, 2012). Research in various disciplines has explored the impact of gamification on student motivation, effort, and learning performance. Some of the key findings include enhanced engagement, improved motivation, social learning, and a fun

learning experience. Gamification has been found to enhance levels of student engagement. By incorporating game elements such as points, badges, levels, and leaderboards, gamification can make learning more interactive and enjoyable (Murillo-Zamorano et al., 2023; Smiderle et al., 2020). Gamification has been found to have positive effects on student motivation. By introducing badges, rewards, and levels, gamification encourages students to participate more actively and fosters a sense of achievement (Lehtonen et al., 2015; Makler et al, 2015). Gamification has also been shown to promote social learning, which can be a significant motivator in itself. By combining leaderboards with team or group work, gamification encourages competition and collaboration, motivating students to perform better (Sailer & Homner, 2020; Yildirim, 2017). Gamification has been found to provide a more enjoyable and fun experience as it introduces the element of play to learning (Chen & Liang, 2022; Murillo-Zamorano et al., 2023).

While research on gamification has shown positive effects on motivation and learning, the findings are inconsistent with mixed results (Dichev & Dicheva, 2017; Huang et al., 2020; Landers et al. 2018; Ritzhaupt et al., 2021; Sailers & Homner, 2020). Studies have shown no or negative effects of gamification on motivation (Balci et al., 2022; Hanus & Fox, 2015; Kyewski & Kramer, 2018). Hanus and Fox (2015) implemented gamification in their semester-long course to investigate the effects of gamification on student motivation, satisfaction, efforts, and empowerment. They found badges, leaderboards and competition negatively impact intrinsic motivation. Students in the gamified course showed decreased motivation, satisfaction, and empowerment when compared with those in the non-gamified course (Hanus & Fox, 2015). Balci and

colleagues (2022) conducted two experiments in their online physics course to evaluate the effectiveness of badges and leaderboards on academic performance and motivation. They found badges and leaderboards did not affect students' motivation or academic performance (Balci et al., 2022). Kyewski and Kramer's experimental study on the influences of badges on motivation, behavioral engagement and learning performance also yielded non-significant results (Kyewski & Kramer, 2018).

Nacke and Deterding (2017) presented an editorial discussing the growth in gamification research since the early 2010s. They postulated that early research in gamification focused on defining and categorizing game design elements, describing systems and designs, and studying the effects of gamified systems. The field has grown ever since and the research is more focused on how and when gamification works, and on using theories to drive studies, test hypotheses, and explore the effects, moderators, and mediators of game elements. In addition, the authors discussed the different application contexts for gamification, emphasizing that not all activities and contexts are suitable for gamification and systematic studies are needed on the moderating effects of different individual and situational contexts (Nacke & Deterding, 2017).

Statement of the Problem

Gamification research has made significant progress and is now moving towards more theoretical and methodological maturity (Nacke & Deterding, 2017; Rapp et al., 2019). However, there are still many challenges and open questions that need to be addressed in order to fully realize the potential of gamification in various fields. Recently there have been a few systematic reviews and meta-analyses on the effects of gamification on cognitive, behavioral, and motivational/affective learning outcomes, all

of which point out that while gamification has shown positive effects on the learning outcomes, the findings are inconclusive, and more research is needed to fully understand the effectiveness of gamification in educational settings (Dichev & Dicheva, 2017; Huang et al., 2020; Ritzhaupt et al., 2021; Sailer & Homner, 2020).

Dichev and Dicheva (2017) conducted a systematic review on 51 empirical studies in educational settings, 41 of which investigated the effects of gamification on affective, behavioral, and cognitive outcomes. The majority of the experimental studies included in the review were inconclusive, with 12 reporting positive results and 3 negative results, indicating a lack of methodological rigor in gamification research. The authors concluded there were insufficient evidence to support the benefits of gamification in educational settings, and that systematically designed studies with rigorous approaches were needed in order to better understand the long-term benefit of applying gamification in education (Dechev & Dicheva, 2017).

Huang, Ritzhaupt, and colleagues (2020 and 2021) conducted two meta-analyses to examine the effects of gamification on student learning outcomes (Huang et al., 2020; Ritzhaupt et al., 2021). Huang et al. (2020) focused on the cognitive learning outcome while Ritzhaupt et al. (2021) on the behavioral and affective outcomes, with the intention to identify gamification design elements with potential to have higher impact on learning. Thirty experiments were included in Huang et al.'s study (2020), and 32 in Ritzhaupt et al.'s research (2021). Fourteen gamification design elements were examined, such as quest/mission/modules, badges and award, points and experience, leaderboards, levels and advancement, responsive feedback, avatar and customization, narrative/storyline, competition, and collaboration, etc. Both studies found overall positive effects of

gamification on student learning outcomes based on the analysis on effect size. Upon closer investigation on the gamification design elements, they found that for cognitive learning outcome, collaboration and quests/missions/modules are the two elements that made the significant difference. Competition had a significant positive impact on the affective outcome. Although some elements such as non-linear navigation, narrative/storyline, and adaptivity/personalization, were found to have significant impact on behavioral outcomes, each element was only present in one study; the sample size was too small to draw any conclusions. No significant impacts were found in the most widely used elements—points, badges, and leaderboards—on any of the learning outcomes. The authors cautioned the use of the pointification approach (points, badges, and/or leaderboards). They also pointed out lack of empirical studies on other game design elements and suggested more exploratory studies be conducted beyond merely pointification.

Most meta-analyses on the effect of gamification focus on the game elements studied and the methodological rigor. Sailer and Homner (2020) took a different approach. In their meta-analysis of gamification on learning, Sailer and Homner (2020) focused on the moderating factors, including inclusion of game fiction, social interaction, learning arrangement of the comparison group, and situational, contextual, and methodological moderator such as period of time, research context, randomization, design, and instruments. They identified 40 experiments from 38 publications. The results showed that inclusion of game fiction and social interaction were significant moderators for behavioral outcomes, but not for cognitive and motivational outcomes. Competition combined with collaboration was most effective in supporting behavioral outcome when

game fiction was included. The authors concluded that gamification had the potential as an effective instructional approach (Sailer & Homner, 2020). However, from their analysis it was still unclear what factors contributed to successful gamification (as the authors did not investigate specific game design elements). More theory-guided high quality empirical research was needed to investigate the relationship between gamification and learning.

All these systematic reviews and meta-analyses have pointed out a consistent problem of inconclusive results within the gamification research in education: gamification research lacks theoretical foundation and methodological rigor (Dichev & Dicheva, 2017, Sailer & Homner, 2020, Seaborn & Fels, 2015). Simply adding game elements like points, badges and leaderboards to the instruction does not automatically increase student motivation and improve learning. Without the guidance of theories and design principles, gamification interventions may not effectively achieve desired learning outcomes.

Purpose of the study

Previous research has shown overall positive effect of gamification on student learning outcomes. However, the findings are mixed with regards to the effect of specific gamification design elements such as badges, levels, and leaderboards. There are no conclusive findings on what elements or combinations of elements have the most impact. The purpose of this study was to explore the latest trends in gamification research, examine the impact of gamification on student learning, and delve into the factors that influence the effectiveness of gamification in teaching and learning in higher education context. This study aimed to identify the influential factors in the design and

implementation of gamification in instruction and examine the extent to which these influential factors contribute to its success. Furthermore, this study intended to shed light on how gamification as a pedagogy could be used in course design by suggesting some implementation guidelines for instructors and instructional designers.

Significance of the Study

Gamification has been applied and researched in various contexts, especially in education (Dichev & Dicheva, 2017; Seaborn & Fels, 2015). Previous systematic reviews and meta-analyses have synthesized the findings of empirical studies on gamification in education. However, they did not distinguish the research settings of those studies and included the experiments in all educational contexts in the reviews, including elementary and secondary education settings (Dichev & Dicheva, 2017; Huang et al., 2020; Ritzhaupt et al., 2021; Sailer & Homner, 2020). Learning context is an important moderating factor in gamification (Sailer & Homner, 2020). What works in the elementary education setting may not work in higher education settings. This study focused on formal higher education settings and only included empirical studies with undergraduate or graduate students as participants. In addition, the interest in using gamification in education has been rising, especially since the COVID-19 pandemic (Zainuddin, 2023). Previous systematic reviews and meta-analyses covered studies published before the end of 2018. This study aimed to gain an understanding of the latest development of gamification research in higher education by including the most recent studies, focusing on the publications between 2014 and 2023—a decade of empirical research.

Furthermore, this study included theories and instructional design as one of the gamification design elements, highlighting the significant role theories and instructional design play in the intervention. Theories provide "explanations of a natural or social behavior, event, or phenomenon" (Bhattacherjee, 2012, p.5). They are essential to research as they provide frameworks for understanding how things work and how concepts are related to each other, for guiding the research process and for making sense of research findings and translating them to practice, and provide guidance for future research (Bhattacherjee, 2012). Instructional design incorporates learning theories and instructional theories to guide the design and development of effective learning experience. Previous reviews have pointed out lack of theoretical foundation in gamification research (Dichev & Dicheva, 2017; Landers et al., 2018; Seaborn & Fels. 2015). By including theories and instructional design as a gamification design element, this study amplified the need for theory-guided research and practice in the field.

This study also included social interaction as one of the gamification design elements. Social interaction has barely been studied in gamification research in education. At the time when student disengagement and disconnection in higher education is at an all-time high level and gamification applications are on the rise, it is critical to gain a better understanding on how gamification works before rushing to implement this pedagogy in instruction. This study contributed to the existing literature by identifying the gamification design elements that had a greater influence on student learning outcomes, and by providing the implementation guidelines that could be used by instructors and instructional designers in higher education.

Definition of Terms

The following terms are defined within the context of this study.

1. Gamification: the intentional use of game design elements in non-game contexts to increase motivation, engagement, and interaction (Deterding et al., 2011; Kapp, 2012; Seaborn & Fels, 2015).
2. Gamification design elements: the elements commonly used in the design of digital games such as avatars, levels, leaderboards, narratives, etc.
3. Gamified learning environment/system: a learning context or system with the integration of gamification.
4. Goals and challenges: goals are the outcomes students are expected to achieve within the gamified learning system. Goals provide purposes and directions for students to progress. Challenges are the tasks that students are expected to complete in order to achieve the goals. Goals and challenges are also referred to as missions and quests in gamification.
5. Points: numerical representation of progress or achievement. They can be in the form of coins.
6. Badges: visual representations of achievements. They are also referred to as trophies and are represented as icons or logos.
7. Leaderboards: visual displays of ranking of students or teams based on the individual or team performance using criteria such as points and/or badges.
8. Levels: different stages of progression that students choose to attain. Levels are also referred to as level-ups or power-ups in some gamification applications. They convey the status and/or achievements of students.

9. Rewards: incentives for completing specific tasks or achieving specific goals. In educational gamification context, rewards are often given in the form of extra points, dropping lowest scores, making up an assignment, more time for tasks, clues for specific challenges, etc.
10. Progress bars or progress: visual representation of the progress made towards a specific goal. Depending on the design, it is also referred to as performance graph. In this study, progress bars and progress are used interchangeably.
11. Fiction elements: the elements that are not real and are created for the purpose of providing an immersive experience for students. In this study, fiction elements include narratives or storylines and avatars. Narratives or storylines refer to the stories or plots within a gamified learning system. They provide students with fictional scenarios or contexts for the tasks they complete. Avatars are digital representations of students within a gamified learning system. Avatars can be personalized to reflect students' preferences.
12. Feedback: the response or reaction provided to students by the gamified learning system, the instructor, and/or peers.
13. Social interaction: in this study social interaction refers to competition, collaboration and cooperation between individual students and/or groups.

Organization of the Study

This study is organized into five chapters. Chapter one gives a brief introduction to gamification in educational settings, and an overview of gamification research in higher education and the problem this study hopes to address. It describes the purpose

and the significance of the study and provides the definitions of the key terms used in the study.

Chapter two provides a review of literature. It starts with the conceptualization of gamification, followed by the discussion of the theoretical frameworks this study was based on—Self-Determination Theory and Theory of Gamified Learning. It then presents the conceptual framework of the study, followed by the discussion of the gamification design elements and how they are related to the two theories.

Chapter three describes the methodology of this study in detail. It begins with the research questions, followed by the research design and data collection procedures. It explains the criteria for data inclusion and the coding methods. The chapter concludes with the results of interrater reliability analysis.

Chapter four presents the results of data analysis of this study. It describes the data analysis method used for each research question, and the results of the analysis are reported.

Chapter five provides a discussion of the results for each research question, and a conclusion with implications for future research in the field. It suggests some design guidelines for the implementation of gamification in instruction. Limitations of the study are addressed.

Summary

Student disengagement and disconnection post pandemic has become a prominent concern in higher education. As colleges and universities navigate the post-pandemic landscape, addressing student disengagement and reconnecting them to the learning community has become a priority. The empirical studies on the effectiveness of

gamification have yielded inconsistent results. Without a clear understanding of how gamification works and which gamification design elements have a higher potential to influence learning outcomes, gamification intervention may not achieve the desired results. The implementation of gamification in educational settings requires careful consideration of many factors. This study examined the factors that contributed to the successful implementation of gamification and provided insights for college instructors and instructional designers in the application of gamification design elements in instruction.

This chapter gave an overview of this study. It started with an introduction of the background information on the topic of gamification in education, and described the challenges current gamification research in higher education wass facing. The purpose of the study was then presented, followed by the significance of the study. The chapter concluded with a description of the organization of this study.

Chapter Two

Literature Review

Gamification has been explored extensively, especially in educational settings (Dichev & Dicheva, 2017; Seaborn & Fels, 2015). However, the findings of the research are inconclusive. Researchers have indicated that the effectiveness of gamification in education may vary depending on various factors, such as individual and situational factors, learning contexts, disciplinary factors, and methodology factors (Landers et al., 2018, Ritzhaupt et al., 2021, Sailer & Homner, 2010). To investigate how gamification works, it is necessary to understand what gamification is and its theoretical connection. This literature review provides the background information in the theory and practice in gamification in the field of education. It begins with the conceptualization of gamification, followed by the introduction of two theories which this study was based on—the Self-Determination Theory and the Theory of Gamified Learning. It then discusses how gamification design elements have been applied in the existing literature and summarizes their findings and implications. The chapter concludes with a summary of the literature review.

Conceptualizing Gamification

One of the controversies in gamification research is that there is no standard definition of the term (Seaborn & Fels, 2015). Researchers and scholars have proposed varying definitions and conceptualizations of gamification. Some focus on "the use of game design elements in non-game context" (Deterding et al., 2011, p. 10), while others emphasize the importance of creating a game-like experience (Werbach, 2014).

The term gamification originated in the digital game industry (Deterding et al., 2011). It emerged from leveraging the engaging and motivating aspects of games. The idea behind gamification is simple and basic. Digital games (especially video games) can motivate and engage players for an extended period of time. People of all ages are comfortable with playing a variety of games on smart phones, tablets, computers, and game consoles. By applying game elements such as points, badges, levels, rewards, and leaderboards in a non-gaming activity or task, students will be more engaged and motivated to complete the activity or task.

Marriam-Webster defines the word gamification as "the process of adding games or gamelike elements to something (such as a task) so as to encourage participation" (Merriam-Webster, 2023). There are a few definitions in the field of gamification research, arguably the most well-known and widely used being "the use of game design elements in non-game contexts" (Deterding et al., 2011, p.10). Kapp (2012) defined gamification as "the use of game-based mechanics, aesthetics, and game-thinking to engage people, motivate action, promote learning, and solve problems" (Kapp, 2012, p.125). Seaborn and Fels (2015) suggested adopting a "standard" definition of gamification, "the intentional use of game elements for gameful experience of non-game tasks and contexts" (Seaborn & Fels, 2015, p.17).

There is a common theme in these definitions: (1) gamification is intentional; (2) it focuses on people; and (3) it seeks to change behavior by motivating and engaging people. In other words, gamification is the *intentional* use of *game design elements* in non-game contexts to *increase motivation, engagement, and interaction* (Deterding et al., 2011; Kapp, 2012; Seaborn & Fels, 2015). Gamification is *not* simply adding game

elements to any contexts. When implementing gamification, instructors and instructional designers intentionally select specific game elements, such as points, badges, levels, challenges, leaderboards, and integrate them to a well-designed curriculum to create a *gamified learning experience*. These elements are carefully selected and intentionally designed to *motivate* students, provide a sense of progression, and increase engagement. The effectiveness of gamification depends on *how* it is designed and implemented (Landers, 2014; Landers et al., 2018; Sailer & Homner, 2020). Without careful consideration of the learning contexts, learner characteristics, and goals and objectives, gamification may not yield the desired outcomes.

There are several successful gamified learning systems in education, Duolingo, Code Academy, Khan Academy, Brilliant, to name just a few. Duolingo (https://www.duolingo.com/) is a language learning system that uses gamification to make learning engaging and fun. A variety of game elements are integrated into the system, such points, levels, streaks, and rewards to motivate learners. Feedback, challenges, and leaderboards are also used to enhance learner engagement and improve learning.

Brilliant (https://brilliant.org/) is a STEM learning system that uses gamification to make learning complex subjects fun and engaging. Elements such as points, levels, challenges, and rewards are integrated in the system. It also incorporates visuals and animations in its interactive lessons to create a game-like experience. More importantly, the gamified system provides simple explanations (for complex subjects) and real-time feedback. Well-designed instructional content plus purposefully selected and implemented elements make this gamified STEM learning platform successful.

Theoretical Frameworks

One consistent finding in previous reviews is that gamification research lacks theoretical foundation and methodological rigor (Dichev & Dicheva, 2017, Sailer & Homner, 2020, Seaborn & Fels, 2015). The application of gamification in education is a comparatively new phenomenon and the connections between theory and practice have not been well established (Seaborn & Fels, 2015). Nonetheless, several theories have been used to explain why and how gamification works, and to guide empirical practices in education. These include Goal-Setting Theory, Flow Theory, Self-Determination Theory, and more recently, Theory of Gamified Learning. *Goal-Setting Theory* proposes that setting specific and challenging goals can improve motivation and performance (Latham & Locke, 2007). Landers, Bauer, and Callan (2015) conducted an empirical study using goal-setting theory to investigate the effect of leaderboard on performance. They found that leaderboard was successful in motivating students to set goals to be at or near the top and reach higher performance levels (Landers et al., 2015).

Flow Theory focuses on *flow*—the state of mind of people when they are engaged in an activity with total involvement (Csikszentmihalyi, 1990). Flow theory makes suggestions on the conditions that lead people to experience *flow* (Csikszentmihalyi, 1990; Schmidt, 2010). These conditions include clear goals, a good balance of challenges and skill, immediate feedback, sense of control, and concentration on the task (Csikszentmihalyi, 1990; Schmidt, 2010). Empirical research has produced evidence supporting the mediating effect of flow on student learning (Thomas & Baral, 2023).

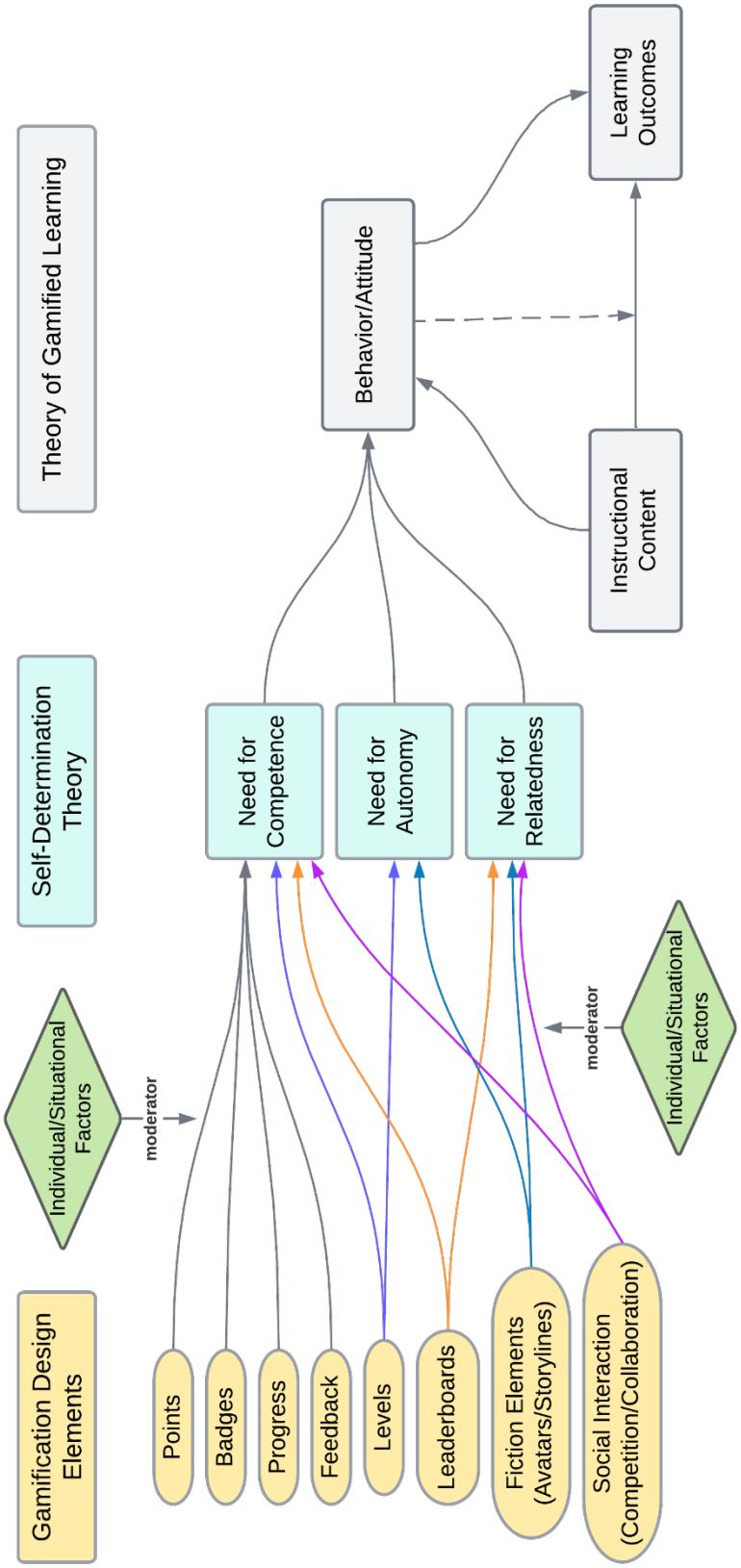
Self-Determination Theory suggests that people are more motivated when they feel that they have control over their actions and their actions are meaningful (Ryan &

Deci, 2000). *Theory of Gamified Learning*, the latest development in gamification research, describes gamification as a process that uses design principles to add game elements to an existing process to change how that process influence people (Landers, 2014).

In this study, *Self-Determination Theory* and *Theory of Gamified Learning* were applied in the examination and discussion of the influence gamification has on student learning outcomes. In Figure 2 the researcher presents the conceptual framework for this study. It illustrates the relationship between gamification design elements and Self-Determination Theory, and between Self-Determination Theory and Theory of Gamified Learning.

Figure 2

Conceptual framework: the relationship between gamification design elements, Self-Determination Theory, and Theory



Self-Determination Theory

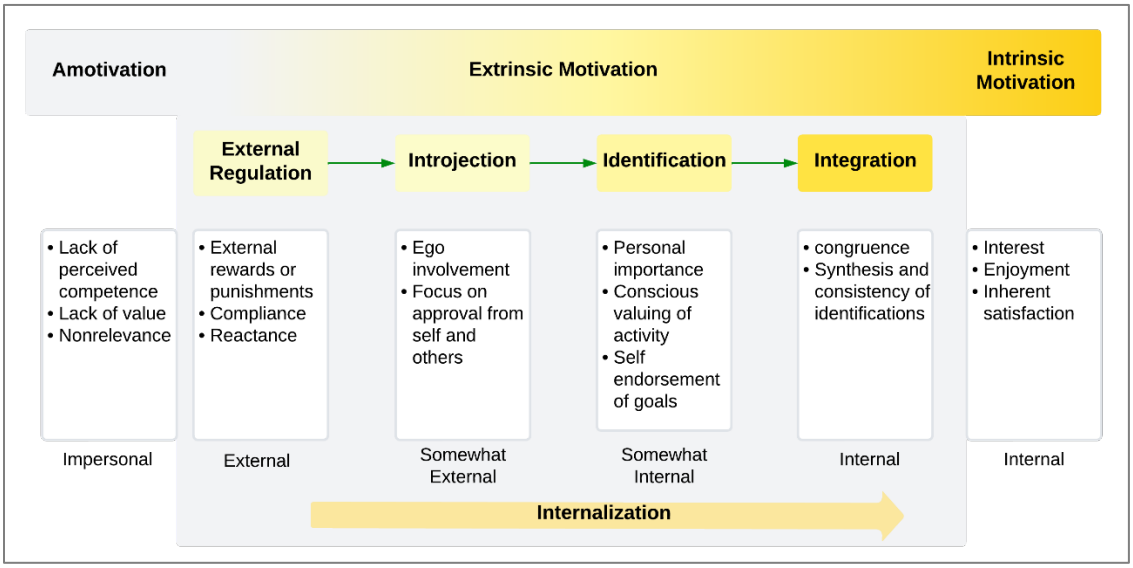
The most-frequently used psychological theory in gamification research, Self-Determination Theory focuses on motivation and psychological needs that drive human behavior. Developed by Ryan and Deci (Deci & Ryan, 1985; Ryan & Deci, 2000), Self-Determination Theory posits that individuals have three basic needs to meet—the needs for autonomy, competence, and relatedness. Autonomy is the sense of ownership one feels in the decision he/she makes and the direction he/she chooses. Competence refers to the feeling of being able to do well in a task. Relatedness is the sense of attachment to and a sense of belonging among other people. These needs are essential for individuals to experience intrinsic motivation. When these needs are satisfied, individuals are more likely to be intrinsically motivated to perform the required tasks and experience optimal learning outcomes (Ryan & Deci, 2000).

Intrinsic motivation is what drives people to perform an activity or task for the enjoyment of the activity or task itself (Ryan & Deci, 2000). However, not all tasks are intrinsically motivating, and people can be driven by various extrinsic motivational factors, for example, their values, their personal commitment to excel, rewards, and even fear of failure (Ryan & Deci, 2000). Self-Determination Theory views extrinsic motivation as a continuum ranging from amotivation to passive compliance to active personal commitment that can be regulated through internalization and integration (Ryan & Deci, 2000) (see Figure 3). Internalization occurs when an individual identifies with the value or regulation that is initially external to himself/herself. It helps turn motivation from extrinsic to intrinsic. Integration occurs when an individual has fully internalized the value or regulation and has made it part of their own identity. Self-Determination

Theory suggests that there are social and environmental conditions that facilitate intrinsic motivation and the internalization and integration of extrinsic motivation (Ryan & Deci, 2000, 2020). Note that it also suggests that social-contextual events such as feedback and rewards can facilitate or diminish competence and autonomy (Ryan & Deci, 2000). While events that allow for greater autonomy, for example, positive feedback, choice, and acknowledgement of feelings, increase intrinsic motivation, imposed goals, deadlines, and expected tangible rewards diminish it (Ryan & Deci, 2000; Deci, Koestner, & Ryan, 2001).

Figure 3

Self-Determination Theory's Taxonomy of Motivation



Note: Figure 3 was derived from Ryan and Deci, 2020, p.2.

The theory has been applied and evaluated in various fields, including gamification in education. Research on motivation in education has consistently shown that intrinsic motivation is associated with higher performance (Ryan & Deci, 2020). The primary use of gamification in education is to motivate and engage students so that their

learning will be enhanced. Game elements can be intrinsically motivating when applied intentionally in a meaningful way (Kapp, 2012).

Game elements such as points, badges, levels, challenges, and leaderboards are the building blocks of gamification to promote autonomy, competence, and relatedness. Points and badges facilitate competence by providing feedback on individual progress and performance. Leaderboards promote competence and relatedness by providing social comparison and feedback and can be used to facilitate internalization of extrinsic motivation, encourage competition, and foster a sense of community.

Self-Determination Theory has been used in studies to investigate whether and how gamification affects student intrinsic and extrinsic motivation (for example, Gupta & Goyal, 2022; Hanus & Fox, 2015; Jones et al., 2022; Mekler et al., 2017). However, the findings of these studies are mixed. In Hanus and Fox's study (2015) comparing a gamified course with a non-gamified course, they found that the game elements implemented (i.e., competitive context, badges, and leaderboards) negatively impacted student motivation, satisfaction, and empowerment over time, which in turn affected student learning performance (Hanus & Fox, 2015). In contrast, Jones et al. (2022) investigated students' intrinsic motivation in a class in which a gamified platform GradeCraft was used and found a significant increase in students' competence and autonomy (Jones et al., 2022). The game elements used in their study included points, badges, levels, and progress bar. Mekler et al. (2017) assessed the effect of game elements (points, levels, and leaderboards) on intrinsic motivation and performance in a task. They found that participants' task performance did increase significantly in the

gamified condition, however, no significant differences were found in the satisfaction of the need for competence or intrinsic motivation (Mekler et al., 2017).

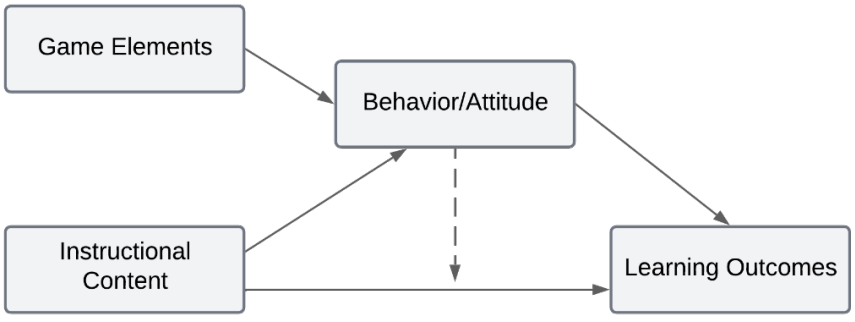
The findings of these studies showed the complexity of using gamification to increase motivation in formal educational contexts. There is insufficient evidence to support the benefits and more research is needed to understand the effects of gamification on student motivation.

Theory of Gamified Learning

Proposed by Landers (2014), the Theory of Gamified Learning is a framework that conceptualizes the causal relationship between gamification and learning. Seeking to understand the specific process in which game elements can affect learning, the theory takes into consideration other educational variables and maps the relationship between these variables, highlighting the mediating and moderating effects of gamification in teaching and learning. The theory has four components: instructional content, game characteristics (i.e., game elements), behaviors and attitudes, and learning outcomes (Landers, 2014). Figure 4 illustrates the relationship between these components.

Figure 4

Theory of Gamified Learning



Note: Figure 4 was derived from Landers, 2014, p. 760.

The Theory of Gamified Learning proposes the two processes by which game elements can affect learning—a mediating process and a moderating process (Landers, 2014). There are five propositions in the Theory of Gamified Learning (Landers, 2014). The first proposition states that "instructional content influences learning outcomes and behaviors and attitudes" (Landers, 2014, p. 760). As illustrated in Figure 4, there is a direct path (causal relationship) between instructional content and learning outcomes, and between instructional content and behavior and attitude. The effects of instructional content on learning outcomes (cognitive, behavioral, and affective) are well documented and theorized in educational research. For any gamification intervention to be successful, the instructional content must be effective. Effective instructional content is critical to the success of gamification (Landers, 2014). Merely adding points and badges to an ineffective instructional content does not solve the problem.

The second one states that "behaviors and attitudes impact learning" (Landers, 2014, p. 760). There is a direct path between behavior and attitude and learning outcomes (see Figure 4). The causal relationship between behavior and attitude and learning has been well documented in educational research literature. Positive behavior and attitude lead to higher levels of engagement and active participation, resulting in better learning.

The third proposition states that "game elements affect learner changes in behaviors and attitudes" (Landers, 2014, p. 761). Landers proposes a direct causal relationship between game elements and learner behaviors and attitudes. For gamification to be effective, it must successfully make a change in learner behavior or attitude. Empirical studies have shown evidence for this relationship. Game elements such as points, badges, and leaderboards have been found to increase the frequency of student

taking practice quizzes (Decheva, Caldwell, & Guy, 2020), class participation (Dias, 2017), and behavioral and affective engagement (Thomas & Baral, 2023; Tan & Hew, 2016).

Next the theory proposes that "game elements affect learner behaviors and attitudes that moderate instructional effectiveness" (Landers, 2014, p. 761). This proposition shows an indirect moderating effect of gamification on learning. A moderator is a variable that affects the direction and/or strength of the relationship between an independent variable and a dependent variable (Baron & Kenny, 1986). As presented in Figure 4, instructional content is directly linked to learning outcomes. Well-designed high quality instructional content leads to positive learning outcomes. By integrating game elements, student engagement increases, further strengthening the causal relationship between instructional content and learning outcomes (Landers, 2014).

Lastly the theory proposes that "the relationship between game elements and learning outcomes is mediated by behaviors and attitudes" (Landers, 2014, p. 762). This proposition shows a direct mediating effect of gamification on learning. A mediator is a variable that explains the relation between the independent variable and dependent variable (Baron & Kenny, 1986). As illustrated in Figure 4, game elements do not directly affect learning outcomes, but mediate the relationship between learner behavior and attitude and learning outcomes. In other words, game elements do not directly cause learning; game elements affect learner behaviors and attitudes, which in turn influence learning outcomes. Denny et al. (2018) conducted an experiment study examining the relationship between gamification and learning outcomes. They found badges significantly increased student voluntary self-testing activities (behavior), which resulted

in a significant improvement in exam scores, providing empirical support for this proposition.

In summary, the Theory of Gamified Learning emphasizes that gamification itself does not directly affect student cognitive learning outcome. It proposes two processes gamification can influence learning: (1) through its direct impact on student behaviors /attitudes—direct mediating effect, and (2) through its direct impact on student behaviors/attitudes that moderate student learning—indirect moderating effect (Landers, 2014). The theory highlights the essential role instructional content plays in student learning, and that gamification is a process that uses design principles to add game elements to an existing process (i.e., instruction) to change how that process influence people (Landers, 2014; Landers et al., 2018). Gamification is intentional, aiming at a change in the outcome.

Gamification Design Elements

Gamification design elements are the basic building blocks of gamification applications. Commonly used gamification design elements include points, badges, leaderboards, levels, progress bar (or performance graphs), feedback, rewards, narratives, game fictions, avatars, etc. When carefully designed and integrated into instruction, these elements can help motivate students and create an engaging and enjoyable learning environment.

Research on gamification has been centered on the relationship between game design elements and motivation. Overall, the results are inconsistent (Dichev & Dicheva, 2017; Sailer & Homner, 2020). In this section, the researcher synthesized the empirical findings in the literature regarding the effects of the commonly studied gamification

design elements on student learning outcomes (cognitive, behavioral, and affective/motivational).

Game Fiction Elements

Game fiction refers to the fictional game world and story created to engage users (Kapp, 2012). It is a key element of gamification that aims to make the experience more immersive and enjoyable. Game fiction can be used to create a sense of purpose and meaning in the activity, which can enhance motivation and engagement. Fiction elements in gamification include narratives/stories and fictional characters/avatar.

Stories have been used in instruction for centuries. Adding a storyline or narrative to gamification allows students to experience through the story while learning and applying what they learn (Kapp, 2012). Frost and colleagues conducted an experiment investigating the impact of gamification on student motivation, satisfaction, and learning (Frost et al., 2015). The game elements they implemented included a storyline, avatar, leaderboards, badges, and lives. They deployed a hero's adventure storyline and reframed assignments and assessments as the quests that students needed to complete to fight "monsters". Their study yielded a positive effect of gamification on the need for relatedness, one of the three basic psychological needs. The authors attributed leaderboards and storyline to the small but positive effect (Frost et al., 2015).

In a quasi-experiment study conducted by Bai and colleagues (2023), a fantasy world was introduced. When comparing the two studies, one with fantasy and the other without, they found the introduction of fantasy significantly increased student engagement with the content and with their peers, which led to a better learning

performance. Similar results were found in Rodrigues and colleges' study in which fiction was implemented (Rodrigues et al., 2022).

In their synthesis of gamification research, Sailer and Homner (2020) found a significant positive relationship between game fiction and behavioral learning outcomes. They suggested that when game fiction was included students were more likely to invest effort in completing tasks than when game fiction was not included. This confirms the mediating effect of game elements proposed by the Theory of Gamified Learning (Landers, 2014).

Points, Badges, and Leaderboards

Points, badges, and leaderboards (PBLs) are the most implemented game design elements and have been studied extensively in gamification research as they can be easily activated (Seaborn & Fels, 2015). These elements are often implemented as a combination of two or three. The use of these three elements is often referred to as the pointification approach in gamification research.

Points, also called experience points (XP), are usually awarded for completing activities in a gamified leaning environment. Points, just like points in non-gamified system, provide students with feedback about their progress. In a gamified learning environment, points are generally implemented along with other elements, such as badges and leaderboards.

Badges are generally awarded when students complete specific tasks or a certain number of activities and are visual representations of achievements. Like points, badges provide feedback about students' progress. Badges can be easily activated in a gamified learning system. Studies on the effectiveness of badges yielded overall positive but mixed

results (Balci et al., 2022). In some experiments badges have been found to improve engagement (Dicheva et al., 2020) and increase activities (Hamari, 2017), and in others they have been found to have either no effects on learning outcomes (Balci et al., 2022; Kyewski & Kramer, 2018; Morris et al., 2019), or negative impact on motivation (Hanus & Fox, 2015).

Leaderboards are the rankings of performance of individual students or teams. The rankings on the leaderboards are generally based on certain criteria, such as points and/or badges earned. As leaderboards rank students/teams based on their achievements, they not only provide feedback on students' progress and performance, but they also create a sense of competition among students as they compare their performance with others (Landers & Landers, 2014). Social comparison and competition, facilitated by leaderboard, can have positive impact as they encourage students to set a higher goal for themselves, leading to an increase in their performance (Landers et al., 2015). In their meta-analysis of the effect of gamification design elements, Ritzhaupt et al. (2021) found that competition is the only element that has significant impact on affective outcomes. Social comparison and competition, however, can be "a double edge sword" (Sailers & Sailers, 2021, p.78). Leaderboards have been found to have negative effect on student motivation due to social comparison (Hanus & Fox, 2015).

In their meta-analysis of gamification, Sailer and Homner (2020) suggest that a combination of competition and collaboration in gamification are more likely to bring positive behavioral outcomes. In their experimental study investigating the impact of specific game design elements on learning and motivation, Sailer and Sailer (2021) gamified a quiz using points and a team leaderboard in a flipped classroom. The study

yielded positive results in favor of the gamified quiz. Points and a team leaderboard were found to have positive effects on student intrinsic motivation and a positive indirect mediating effect on application knowledge (Sailer & Sailer, 2021), providing support for the Theory of Gamified Learning.

In summary, points, badges, and leaderboards are the most used and studied gamification desgin elements. The research on their effects on learning outcomes has yielded mixed results. The success of points/badges/leaderboards (and gamification design elements in general) is highly contextual. Individual and contextual factors play an important role. Gender has been identified as a moderating factor. Tsay and colleagues (2018) conducted a study investigating the impact of a gamified learning system with badges and leaderboards on student behavioral engagement and learning performance. They found positive effects of gamification in behavioral engagement, which led to enhanced learning performance. When examining personal factors, they found female students outperformed male students in behavior engagement, and students with jobs participated more in course activities than those without (Tsay et al., 2018).

According to the Theory of Gamified Learning, gamification design elements do not directly affect learning. Its impact, if any, is on students' attitude and behavior, which in turn affects learning (Landers, 2014). When studying gamification design elements, researchers need to take other factors into consideration, such as gender, age, game play experiences, learning contexts, disciplines, and so on (Landers et al., 2018).

Levels, Progress, Feedback, and Rewards

Levels, progress, feedback, and rewards are not as widely implemented as points, badges, and leaderboards, consequently, they are not researched as much. *Levels* are the

different stages of progression that students choose to attain. In some gamified learning systems, levels are referred to as level-ups or power-ups. As levels convey students' performance status, it facilitates the satisfaction of the needs for competence and autonomy. *Progress (bar)* is also referred to as performance graph, depending on the gamified learning systems it is implemented. Progress visually displays the progression students have made, provides them with feedback on their performance and facilitates the satisfaction of the need for competence. *Feedback*, often referred to as responsive feedback, is the information or response provided to students based on their actions and performance in a gamified learning system. In gamification design, several elements can function as feedback, such as points, badges, leaderboards, and progress. *Rewards* are incentives. It's one of the commonly used elements in game design. In gamification in education, rewards are not implemented as widely and are often treated like extra credit or extra points as in non-gamified learning environments.

These gamification design elements are considered second tier elements (Ritzhaupt et al., 2021) as they are not implemented as much as points, badges, and leaderboard and are often used along with them. The research on those elements alone is scarce. Aguilar and colleagues (2018) conducted an experiment study examining a gamified learning system and its effects on students' intrinsic motivation. The system they used was called GradeCraft in which power ups (i.e., levels) were implemented along with other elements. The study reported an overall positive effect of the gamified learning system on satisfying students' need for autonomy (Aguilar et al., 2018).

In summary, these gamification elements are under-studied, especially levels and feedback. The effect of feedback on learning has been well-documented in educational

research. Lack of empirical studies on elements other than points/badges/leaderboards has been a recurring issue in the previous reviews (Ritzhaupt et al., 2021).

Social Interaction

There are two types of social interaction pertaining to this study: competition and collaboration/cooperation. Social interaction plays an important role in a gamified learning environment. There are several benefits of integrating social interaction in gamification design. First, competition is a motivating factor that drives students to improve their performance. Students who like to compete are driven by several factors including the desire to win, the satisfaction that comes with winning or performing well, and the satisfaction that comes with being recognized (Franken & Brown, 1999). Competition can create a sense of achievement, which helps satisfy the need for competence (Ryan & Deci, 2000). Competition has been found to have a positive impact on affective outcomes (Ritzhaupt et al., 2021). Second, indirect competition (such as ranking on leaderboards) satisfies the need for competence (Ryan & Deci, 2000). Competition often appears along with other game elements such as points and leaderboards. In a controlled experiment, Landers et al. (2019) found that competition alone (without any other gamification design elements) can improve performance.

Third, collaboration allows for the exchange of ideas among students. The educational value of collaborative learning has been well documented. Research shows that collaboration supports the development of critical thinking skills, self-management, and leadership skills and promotes student-student interaction (Laal & Ghodsi, 2012). When students work together towards a common goal, they are more likely to be engaged and motivated to share ideas. Collaboration in gamification has been found to have a

significant impact on cognitive learning outcomes (Ritzhaupt et al., 2021). Fourth, competition creates a sense of belonging, and collaboration promotes a sense of community; both help satisfy the need for relatedness (Ryan & Deci, 2000). As Sailer and Hommer suggested, a combination of competition and collaboration is a promising strategy for gamification (Sailer & Homner, 2020).

Summary

Gamification has been studied extensively, especially in educational settings (Dichev & Dicheva, 2017; Seaborn & Fels, 2015). However, the findings of the studies are inconclusive. Although research has shown overall positive effect of gamification on student learning outcomes, the findings are mixed with regards to the effect of specific gamification design elements such as badges and leaderboards. There are no conclusive findings on what elements or combinations of elements have the most impact.

Research in gamification in education are still very centered on investigating the effects of a few gamification design elements (such as badges and leaderboards) on student learning outcomes, and has yielded inconclusive results (Dichev & Dicheva, 2017; Landers et al., 2018), which could partially be attributed to the lack of theoretical foundation. Theory of Gamified Learning proposes that game elements have a direct effect on student attitudes and behavior. There are many factors that come into play in this process. Researchers and instructors will need to take these factors into consideration when implementing gamification in instruction. It is necessary to understand what gamification is and its theoretical connection before implementing it in instruction.

This chapter started with the conceptualization of gamification. It introduced the theoretical foundation pertaining to this study, Self-Determination Theory and Theory of

Gamified Learning. It then discussed the most common gamification design elements and the empirical evidence on the effects of these elements on student learning outcomes. The chapter concluded with a summary of the literature review.

Chapter Three

Methodology

The purpose of this study was to investigate the influence of gamification on student learning in higher education context. It aimed to identify the influential factors of gamification on student learning outcomes and examine the extent to which these influential factors contribute to its success.

This chapter describes the methodology of this study. It begins with the research questions, followed by the research design and data collection procedures. It then explains the criteria for data inclusion and briefly describes the final sample, followed by the explanation of the coding method and procedure. The chapter concludes with the results of interrater reliability analysis.

Research Questions

This study was guided by the following research questions:

1. Can the probability that a gamified learning case is successful be predicted by the use of any of the eleven gamification design elements: Goals & Challenges (GC), Fiction Elements (FE), Points (P), Badges (B), Leaderboards (L), Levels (LV), Progress (PG), Rewards (RW), Feedback (FB), Social Interaction (SI), and Theory & Instructional Design (TD)? If yes, to what extent do the significant gamification design elements influence such probability?
2. Are there significant differences in the proportions between successful and unsuccessful gamified learning cases in relation to the presence and absence of certain gamification design elements?

Research design

A correlational research design approach was adopted to determine if gamification design elements used could predict whether the implementation of gamification was successful. Correlational research is a type of nonexperimental research that examines the statistical relationship between two or more variables without manipulating them (Price et al., 2017). This research design was chosen because (1) the researcher was interested in the relationship between gamification design elements and student learning outcomes, and (2) the researcher was unable to control the variables as the sample of the study was from the existing literature.

A quantitative content analysis method was adopted in this study. Content analysis is "a research technique for the objective, systematic and quantitative description of the manifest content of communication" (Berelson, 1952, p. 18, as cited in Liu, 2022). Content analysis can be used qualitatively or quantitatively for analyzing content systematically. The content (i.e., source data) is qualitative and can be in various formats, such as texts, drawings, photographs, audio recording, videos, etc. (Liu, 2022). While qualitative content analysis makes inferences by categorizing the source data and analyzing the themes, quantitative content analysis records and quantifies qualitative source data and uses statistical methods for hypothesis testing. Content analysis differs from meta-analysis in that the former can be qualitative and quantitative while the latter is generally quantitative. Meta-analysis collects and analyzes quantitative data, specifically, effect sizes, from individual studies to synthesize the research on a specific topic or issue (Wolf, 1986). This study adopted the quantitative content analysis method.

The general procedure of quantitative content analysis resembles any other quantitative methods (Liu, 2022). In this study, it involved identifying the problem, formulating questions, determining sample/data selection criteria, data collection, data screening, data coding, data analysis, and result interpretation.

Sampling Procedures

The following procedures were undertaken in data collection and sampling.

Literature Search Tool and Sources

The literature search was conducted using the search tool called Library Search. Library Search is a one-stop search tool for the major collections available at the institution where this study was conducted. This search tool includes content from major databases, including academic databases such as EBSCOhost Education Source, EBSCOhost Academic Search Premier, Wiley Online Library, Sage Journals, Elsevier ScienceDirect Journals Complete, Education Database, SpringerLink Journals, Social Science Premium Collection, ERIC, Taylor & Francis Online, ACM Digital Library, Web of Science, ProQuest, and so on. The search results can be filtered using the Advance Search option within the search tool.

Search Terms

To have as wide a coverage of the potential studies as possible, when searching for literature, the following search terms are used: *gamification OR gamif* AND "higher education"*. The search terms *gamification OR gamif** was adopted from previous systematic review and meta-analysis (Sailer & Homner, 2020; Seaborn & Fels, 2015). To narrow the search, an advanced search was applied with three limitations: (1) the

publication dates were between *January 1, 2014* and *December 31, 2023*; (2) the publications were written in *English*; and (3) the type of publication was *Journals*.

The search terms yielded 1038 publications. To further narrow down the search, two filters were applied: (1) *Peer-Reviewed Journals* for the Item Type, and (2) Education and Educational Research under Topic. 625 records were remaining after this application.

Inclusion and Exclusion Criteria

The remaining 625 publications were further screened following four inclusion criteria:

1. The studies must be conducted in formal higher education settings with undergraduate and/or graduate students as participants. This criterion excluded all the studies conducted on Massive Open Online Courses (MOOC). It also excluded the studies that recruited online participants through third-party channels.
2. The studies used an experimental or quasi-experimental research design.
3. The studies used at least one game design element as described in the data coding section below.
4. The studies examined at least one domain of learning outcomes: cognitive, behavioral, and/or affective.

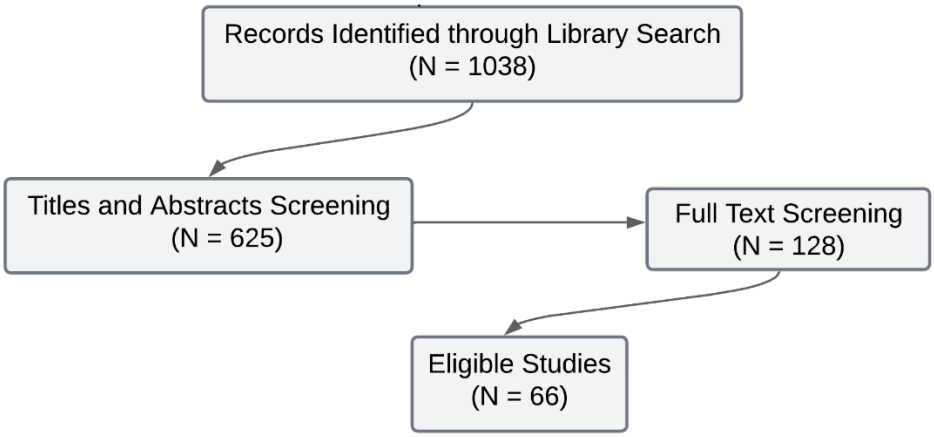
This screening process was conducted in two phases. The first phase involved screening through the titles and abstracts of the publications. In the cases when the information of the above four criteria were unavailable in the abstracts, a scan of the methodology section was needed to determine the inclusion or exclusion of the

publications. The publications of which the full text was not available were excluded as well. This phase yielded 118 articles for the next phase—full text screening.

In this full text screening phase, using the four inclusion criteria detailed above, the researcher carefully went through the remaining publications for coding and extracting of information. This phase resulted in a final sample of 66 publications reporting 67 experiments. Figure 5 presents the data identification and selection flow chart.

Figure 5

Data identification and selection flow chart



Final Sample

The final sample of this study consisted of 66 publications reporting 67 experiments or quasi-experiments. They were published between 2014 and 2023 and examined a total of 12,720 participants.

Ninety-six percent of the studies in the final sample were published in 40 peer-reviewed journals, including 18% in *Computers & Education*, and 11% in *Computers in Human Behaviors*. Other journal titles include *British Journal of Educational*

Technology, *ACT Transactions on Computing Education*, *Journal of Computer Assisted Learning*, *Journal of Educational Computing Research*, *Simulation & Games*, to name just a few. Three publications were from international conference proceedings.

The studies in the final sample covered various disciplines in higher education. Thirty percent of the studies were in Business, including business management, marketing, economics, information system, etc.; 21% in Education, including science education, ICT, and research methods; 20% in Computer Science, with Programming being the most studied content subject.

Data Coding

The final sample consisted of 67 experiments from 66 studies. Each experiment was treated as one case. Using content analysis, each experiment was examined to identify and code the variables of interest. The variables and coding criteria are described below, along with the process of random sampling for the second coder and the result of interrater reliability analysis.

Coding of the Variables

Learning Outcomes

This study was to explore the impact of gamification on student learning outcomes. One of the inclusion criteria of the study was that the study assessed at least one of three domains of learning: cognitive, behavioral, and/or affective. The studies in the final sample explored a range of outcomes including learning performance (e.g., knowledge acquisition and retention), behavioral outcomes (e.g., participation, time on task), affective outcomes (e.g., motivation, satisfaction).

When coding for the response variable Learning Outcomes (LO), the researcher reviewed each sample to identify what domain of learning was assessed. A value of 1 was coded for being "***successful***" when the study reported improved outcome(s) in any of the domains of learning. A value of 0 was coded for being "***unsuccessful***" when the study did not produce the expected outcome(s). The researcher recorded the category of the domains (that is, cognitive, behavioral, or affective) each study examined.

Gamification Design Elements

Gamification design elements are the explanatory or predictor variables. Based on the literature, eleven elements were included in this research. The researcher reviewed each sample to identify the gamification design elements used in the experiment. A value of 1 was coded for being "***present***" when the element was used. A value of 0 was coded for being "***absent***" when the element was not used.

Goals and Challenges (GC). Goals are the desired outcomes students are expected to achieve. Goals provide a sense of direction and purpose, guiding students and motivating them to progress. Challenges are specific tasks and activities. Examples of goals and challenges in the final sample include assignments with clear objectives and grading criteria, in-class or out-of-class individual or group projects, etc. In some samples the term missions/quests are used in place of goals/challenges. If goal, challenge, mission, or quest, was used in the study, a value of 1 was coded for being "present". If the study did not mention any of the elements, a value of 0 was given for being "absent".

Fiction Elements (FE). Fiction refers to the fictional game world created to engage players. In a gamified learning environment, fictional elements include fictional stories and narratives, fictional characters, avatars, and pseudonyms. Examples include

Bai and colleagues' introduction of the story of "Save princess Joanne" (Bai et al., 2022), and Frost and colleagues' inclusion of a hero's adventure with monsters (Frost et al., 2015). If any of the fiction elements was used in the study, it was then coded as 1 for being "present". The type of fiction elements was also recorded. If the study did not mention any of the elements, a value of 0 was given for being "absent".

Points (P). The most commonly used game elements, points (or experience points) are a measure of achievement. They are commonly used to track learning progress (as they do in traditional learning environments). In a gamified learning environment, points are also used as the basis for qualification of badges or advancement to a higher level. Points can be awarded to individuals and groups as well. If points or experience points were used in the study, it was then coded as 1 for being "present". Otherwise, a value of 0 was given for the "absence" of the element.

Badges (B). Badges are another most used game element. Badges are granted to students for achieving a particular goal or completing specific tasks/activities. They can also be awarded to students as they progress through the gamified learning system. Badges can be awarded to individual students and/or groups. If badges were used in the study, it was then coded as 1 for being "present". A value of 0 was given for the "absence" of the element if otherwise.

Leaderboards (L). Leaderboards are used to display who, individuals or group alike, has earned the most points or badges (or other forms of awards) in a gamified learning system. If leaderboards were used in the study, it was then coded as 1 for being "present". A value of 0 was given for the "absence" of the element if otherwise.

Levels (LV). Levels represent different stages of progression in a gamified system. The higher the level, the more challenging the task. Depending on the design of the gamified learning environment, levels could be placed within a learning unit or a large project. Examples of levels include practice quizzes with different levels of difficulty for students to choose from. If levels used in the study, it was then coded as 1 for being "present". A value of 0 was given for the "absence" of the element if otherwise.

Progress (PG). Progress or progress bar is a visual display of students' progress in specific tasks. Progress bar is available in some gamified learning system in the studies, and in most Learning Management Systems through timed activities or tasks (e.g., quizzes). If progress or progress bar was used in the study, it was then coded as 1 for being "present". Otherwise, a value of 0 was given for the "absence" of the element.

Rewards (RW). In a gamified learning system, rewards are incentives to encourage students to complete more activities than required, like extra credit in a non-gamified learning environment. Examples of rewards include a special badge, extra points, clues or keys that unlock the next level of a challenge. If rewards were used in the study, the variable was then coded as 1 for being "present". If the study did not mention any forms of rewards, a value of 0 was given for being "absent".

Feedback (FB). Feedback is the response or reaction provided to students by the gamified system, the instructor, and/or peers. Feedback provides students with helpful information about the "correctness" or "incorrectness" of a response or activity. A value of 1 was given to the study if feedback was present. A value of 0 was given for the "absence" of the element.

Social Interaction (SI). Social interaction involves facilitating interactions between students. In this study two types of interaction were identified as social interaction: competition and collaboration/cooperation. If the study included competition and/or collaboration/cooperation, the variable for the study was coded as 1. A value of 0 was given if there was no mention of competition and/or collaboration/cooperation. Note that not all studies directly mention competition. The use of leaderboard implies social comparison, which naturally leads to competition. For any studies that implemented leaderboards, a value of 1 was given. Otherwise, a value of 0 was given for the "absence" of the element.

Theories & Instructional Design (TD). Not all studies were guided by theories or instructional design principles. When theories and/or instructional design were employed in the study, they were generally explained and discussed in the article. In this case the variable was coded as 1. A value of 0 was given for the "absence" of the element.

Table 1 provides a summary of coding for the response variable and all the explanatory variables used in data analysis.

Table 1

Coding of the Response Variable and Explanatory Variables

Variables	**Values**	
	1	**0**
Response Variable		
Learning Outcomes (LO)	Successful	Unsuccessful
Explanatory Variables		
Goals & Challenges (GC)	Present	Absent
Fiction Elements (FE)	Present	Absent
Points (P)	Present	Absent
Badges (B)	Present	Absent
Leaderboards (L)	Present	Absent
Levels (LV)	Present	Absent
Progress (PG)	Present	Absent
Rewards (RW)	Present	Absent
Feedback (FB)	Present	Absent
Social Interaction (SI)	Present	Absent
Theory & Instructional Design (TD)	Present	Absent

Interrater Reliability Analysis for Data Coding

The researcher completed the coding for a total of twelve variables (the response variable *Learning Outcomes* and eleven explanatory variables) using all 67 samples. To conduct interrater reliability analysis, the first step was to determine the reliability sample size (Lombard et al., 2002; Urdhwareshe, 2020). According to Landis and Koch, 15% of the total number of the data will be considered as appropriate for the interrater reliability check (Landis & Koch, 1977). In this study, the researcher decided to use 30% (20 samples) of the total amount of data for the interrater reliability analysis.

The next step was to randomly select 20 samples. The random sample selection process was conducted in Excel by adding a column called “random number” next to the “Publication ID” column (every publication included in this study was assigned an ID for identification) and using the random function =RAND() in the formula bar to generate random numbers to fill in the cells in that column. Once random numbers were generated, the column “random number” was sorted from smallest to largest so that the column “Publication ID” were in random order and any consecutive samples in this column would be random samples. Twenty samples were then selected for the second coder to recode data.

The third step was to decide if the second coding for the interrater reliability analysis met certain criteria. The coder is expected to be qualified in terms of expertise, research area, and experiences (Liu, 2022; Lombard et al., 2002). The second coder for this study is a scholar who has been working and conducting research in the field of instructional design and quantitative methods of data analysis for more than twenty years. The second coder followed the same criteria of data coding as the first coder used and recoded the 20 randomly selected samples.

Finally, an interrater reliability analysis was conducted using Cohen’s Kappa to determine the agreement of the coding results for the variables between the two coders (Cohen, 1960). Table 2 shows the interrater reliabilities between the two coders on all twelve variables. A value of Kappa between .40 and .59 is considered moderate, between .60 and .79 is considered substantial, and above .80 is considered outstanding (Landis & Koch, 1977). Based on this guideline, the levels of agreement between the two coders on the twelve variables were generally very good (as the values of Kappa ranged

from .644 to .904). The data from the researcher, the first coder, was used for data analysis.

Table 2

Levels of Agreement between Two Raters (N = 20)

Variable	**Kappa Coefficient**	***p*-value**
Learning Outcomes (LO)	.877	<.001
Goals & Challenges (GC)	.644	.002
Fiction Elements (FE)	.889	<.001
Points (P)	.859	<.001
Badges (B)	.786	<.001
Leaderboards (L)	.901	<.001
Levels (LV)	.811	<.001
Progress (PG)	.859	<.001
Rewards (RW)	.904	<.001
Feedback (FB)	.690	.001
Social Interaction (SI)	.667	.002
Theory & Instructional Design (TD)	.811	<.001

After the completion of data coding and the interrater reliability analysis, the data was entered using IBM SPSS Statistics version 29 for further analysis. The results were reported in the next chapter.

Summary

This chapter described the research methodology that was used in this study. It began with the research questions, then described the research design. Data collection method and procedures were explained at great length, followed by the description of the

sample. It then described the coding method and explained how each variable was coded. The chapter concluded with the report of the analysis of interrater reliability.

Chapter Four

Data Analysis and Results

This study aimed to examine the influence of gamification on student learning outcomes and identify the gamification design elements that had significant impact on the successful implementation of gamification in higher education settings. This chapter provides the results of data analysis. It starts with the data analysis method used for each research question. After that, the results of data analysis are presented.

Data Analysis and Results for Research Question 1

Question 1. Can the probability that a gamified learning case is successful be predicted by the use of any of the eleven gamification design elements: Goals & Challenges (GC), Fiction Elements (FE), Points (P), Badges (B), Leaderboards (L), Levels (LV), Progress (PG), Rewards (RW), Feedback (FB), Social Interaction (SI), and Theory & Instructional Design (TD)? If yes, to what extent do the significant design elements influence such probability?

The Logit Model and Variables in the Study

For research questions 1, logistic regression analysis was conducted. A general form of the logit model for logistic regression can be expressed as below (Merler & Reinhart, 2017):

$$logit\,(P(Y=1|X_1, \ldots, X_n)) = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n$$

In this model, the left side of the equation indicates the logit of *Y. Y* is the response variable (RV) and is coded into binary data (for example, pass = 1, fail = 0) or nominal data for multilevel logistic regression. Logistic regression examines the extent to

which the probability of *Y* to be 1 (e.g., to pass) can be predicted by the predictor variables or explanatory variables (*X*s) as combined in the logit model (Greene, 1993; Mertler & Reinhart, 2017; Press & Wilson, 1978). β_0 is the constant of the model, and β_1 *to* β_n are the coefficients for each of the explanatory variables.

In the logistic regression analysis for the present study, the response variable (RV) was Learning Outcomes, and the eleven gamification design elements were the explanatory variables (EV). The frequencies for each variable are shown in Table 3.

Table 3

Frequencies (N = 67)

Variables	**Values**	
	1	**0**
Response Variable		
Learning Outcomes (LO)	47	20
Explanatory Variables		
Goals & Challenges (GC)	54	13
Fiction Elements (FE)	13	54
Points (P)	48	19
Badges (B)	46	21
Leaderboards (L)	49	18
Levels (LV)	28	39
Progress (PG)	10	57
Rewards (RW)	21	46
Feedback (FB)	25	42
Social Interaction (SI)	54	13
Theory & Instructional Design (TD)	43	24

Two regression methods used for the logistic regression analysis in this study were: (a) forward selection, and (b) backward deletion. The results are reported in the next sections.

Results of the Model with Forward Method

In logistic regression, *Forward* method "only enters explanatory variables that significantly contribute to the model" (Mertler & Reinhart, 2017, p. 193). That is, only those accounting for a significant amount of unique variance in the response variable are kept in the model. Explanatory variables "are entered one variable at a time. When no more variables account for a significant amount of variance, the process ends" (Mertler & Reinhart, 2017, p. 193).

Using *Forward* method, the results from the first logistic regression analysis showed that among all eleven gamification design element variables, only *Social Interaction* was retained in the model equation (*Wald* $\chi^2 = 6.868$, $p = .009$).

Model summary results showed that the model with this explanatory variable was significant ($\chi^2 = 7.154$, $p = .007$) and accounted for about 14.4% of the variation in the response variable (Nagelkerke $R^2 = .144$), indicating that this model significantly predicts group membership. The Hosmer and Lemeshow Goodness-of-Fit Statistic of 11.359 ($p = .124$) was not significant, indicating that the hypothesis that the model provides a good fit of data should be accepted. Specifically, 8 out of 20 (40%) unsuccessful gamified learning cases and 42 out of 47 (89.3%) successful cases, a total of 50 out of 67 (74.6%) cases, were correctly predicted by the model.

The results in the final step of the forward method are presented in Table 4.

Table 4

Logistic Regression (Forward Method) Output

	DF	Parameter Estimate	Standard Error	Wald Chi-Square	*P*	Odds Ratio
(SI)	1	1.723	0.657	6.686	.009	5.600
Constant	1	-0.407	0.570	0.680	.410	0.625

Note: Response variable: Learning Outcome (LO). Explanatory variable: Social Interaction (SI)

A significant Wald chi-square value for a given variable indicates that the variable is significantly related to the response variable. The Wald chi-square value for the variable *Social Interaction (SI)* was significant. The Parameter Estimate generates the coefficients of the fitted logistic regression model, and they are used to formulate the following logistic regression equation (1):

$$\text{logit}\,(\hat{p}) = -0.407 + 1.723(SI) \text{ ---------- (1)}$$

The sign ($\hat{p}$) indicates an estimated probability value (also called *log odds*) for the response variable Learning Outcome (*LO*) to be 1, and logit represents *logit transformation* of the event probability.

An estimated coefficient indicates the contribution that explanatory variable makes to the possibility of the response variable being 1. For example, when the variable *Social Interaction* (*SI)* is 1 (that is, when social interaction was present in the gamified learning case), the logit transformation of event probability (that a gamification case is successful) increases by 1.723 (see Table 4).

Odds ratio is another statistic to explain the contribution of an explanatory variable to the model. If the odds ratio for a given explanatory variable is larger than 1,

the probability of the response variable being 1 increases because of the presence of that explanatory variable. For example, the odds ratio for variable *Social Interaction (SI)* is 5.600 (see Table 4), indicating that a gamified learning case would be 5.6 times more likely to be successful if social interaction is implemented in the gamified learning experience, compared to cases that do not have social interaction implemented. If the odds ratio is smaller than 1, the probability of the response variable being 1 decreases (that is, the probability that a gamified learning case is successful decreases when that explanatory variable is present).

Results of the Model with Backward Method

In logistic regression, *Backward* method "enters all explanatory variables one at a time and then removes them one at a time based upon a level of significance for removal (the default is $p \geq .10$). The process ends when no more variables meet the removal requirement" (Mertler & Reinhart, 2017, p. 193).

Using *Backward* method, the results from the second logistic regression analysis showed that among all eleven gamification design element variables, three were retained in the model equation and they were *Fiction Element (FE), Badges (B),* and *Leaderboards (L)*.

Model summary results showed that the model with these three explanatory variables was significant ($\chi^2 = 14.213$, $p = .003$) and accounted for about 27.1% of the variation in the response variable (Nagelkerke $R^2 = .271$), indicating that this model significantly predicts group membership. The Hosmer and Lemeshow Goodness-of-Fit Statistic of .902 ($p = .924$) was not significant, indicating the hypothesis that the model provides a good fit of data should be accepted. Specifically, 6 out of 20 (30%)

unsuccessful gamified learning cases and 45 out of 47 (95.7%) successful cases, a total of 51 out of 67 cases (76.1%), were correctly predicted by the model.

The results in the final step of the backward method are presented in Table 5.

Table 5

Logistic Regression (Backward Method) Output

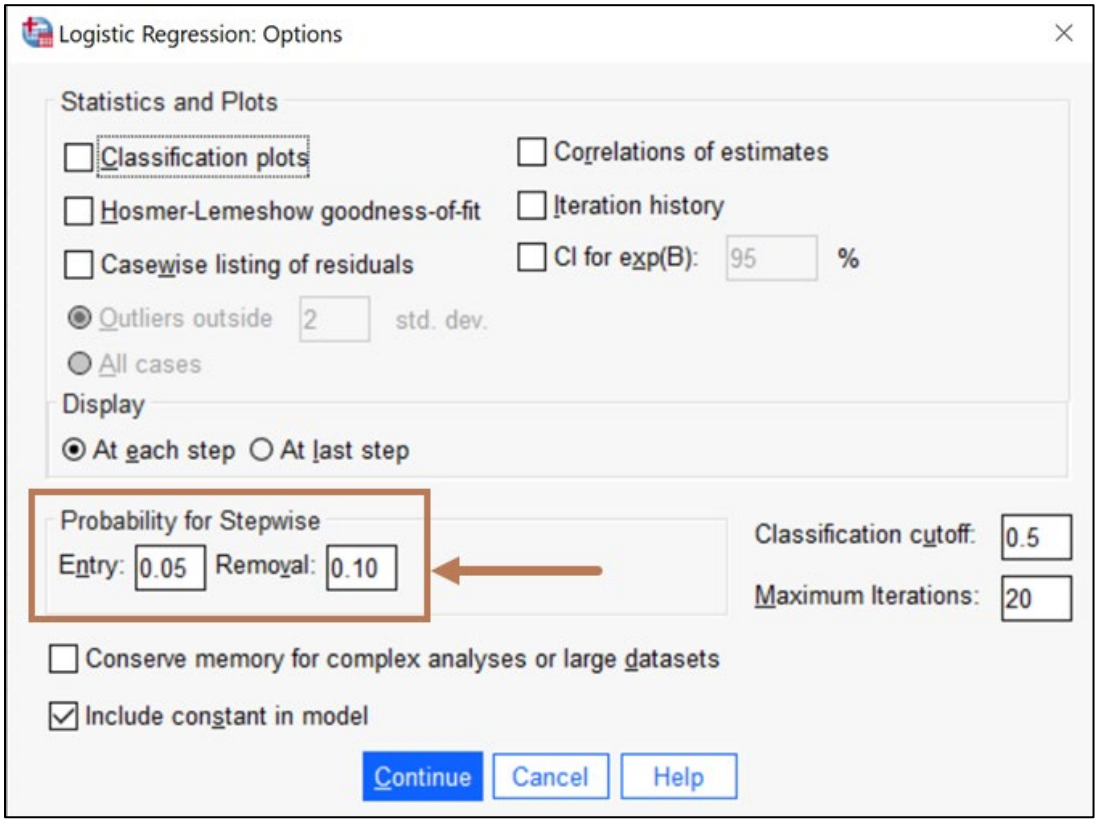
	DF	**Parameter Estimate**	**Standard Error**	**Wald Chi-Square**	***P***	**Odds Ratio**
(FE)	1	1.886	1.094	2.974	.085	6.593
(B)	1	-1.471	0.778	3.579	.059	.230
(L)	1	1.899	0.738	6.630	.010	6.682
Constant	1	.320	0.667	0.230	.632	1.377

Note: Response variable: Learning Outcome (LO). Explanatory variable: Fiction Element (FE), Badges (B), and Leaderboards (L)

As shown in the results from the **Variables in the Equation** (see Table 5), two gamification design element variables (that are in the equation) are not significant: *Fiction Elements* (*Wald* $\chi^2 = 2.974$, $p = .085$), and *Badges* (*Wald* $\chi^2 = 5.579$, $p = .059$). They were included in the final model for three reasons. First, the model was significant in the model summary results as reported in the previous paragraph. Second, this model was the final model from the backward deletion process, and no more variables met the removal requirement (Mertler & Reinhart, 2017). As shown in Figure 6, for the option **Probability for Stepwise**, the default range is .05 for entry and .10 for removal. The significant values of the explanatory variables in the final model (as shown in Table 5) were all smaller than 0.1.

Figure 6

Backward deletion criteria (from SPSS)



Third, note that the significant value in Table 5 (from the SPSS results **Variables in the Equation**) is reporting the Wald test significance for the variables. However, when *Backward* method is used, likelihood ratio tests are conducted (IBM, 2023) and the results are shown in an SPSS table titled "**Model if Term Removed**" (see Table 6). For this study, these three variables significantly influence the change in the likelihood ratios of the model if any of them are removed from the model (p = .031, .036, and .005 for the three variables respectively).

Table 6

Model if Term Removed

	DF	**Model Log Likelihood**	**Change in -2 Log Likelihood**	***P***
(FE)	1	-36.054	4.636	.031
(B)	1	-35.927	4.381	.036
(L)	1	-37.702	7.932	.005

Therefore, all three variables are retained in the final model. The Parameter Estimate generates the coefficients of the fitted logistic regression model, and they are used to formulate the following logistic regression equation (2):

$$\text{logit}(\hat{p}) = 0.320 + 1.886(FE) - 1.471(B) + 1.899(L) \text{ ---------- (2)}$$

The sign ($\hat{p}$) indicates an estimated probability value (also called *log odds*) for the response variable Learning Outcome (*LO*) to be 1, and logit represents *logit transformation* of the event probability. The interpretation of the coefficients, odds ratios, and the model are similar as described in the first model and equation (1).

Summary of Results in the Two Models

In the logistic regression analysis, forward selection and backward deletion methods were used and two models were generated. In the first model (see equation 1), *Social Interaction* was included in the final model. In the second model (see equation 2), *Fiction Element, Badges,* and *Leaderboards* are included in the final model. The two models varied in the presence of the explanatory variables. Upon closer investigation, the two models have produced similar results: *Social Interaction* was the only significant variable included in the first model while *Leaderboards* was the only significant variable

in the second model. In this study two types of interaction were identified as social interaction: competition and collaboration/cooperation. If a study included competition and/or collaboration/cooperation, the *Social Interaction* variable was coded as 1 for being present. In addition, as leaderboards are related to competition, if a study implemented *leaderboards*, a value of 1 was given to the variable *Social Interaction* for that study. It is not surprising that *Leaderboards* was retained as a significant predictor in the second model.

As for the other two variables in the second model, *Fiction Elements* and *Badges*, as explained earlier, these two variables were retained in the model because their significant value were smaller than .10, the default value for removal. They play a significant enough role that they shall not be removed, otherwise the model will change significantly.

Data Analysis and Results for Research Question 2

Question 2. Are there significant differences in the proportions between successful and unsuccessful gamified learning cases in relation to the presence and absence of certain gamification design elements?

Chi-Square Test and Results

In the data analysis for research questions 2, a nonparametric analysis method – Chi-Square test (test of independence) was used. Each of the eleven gamification design elements (*Goals & Challenges, Fiction Elements, Points, Badges, Leaderboards, Levels, Progress, Rewards, Feedbacks, Social Interaction, and Theory & Instructional Design*) was examined with Chi-Square (χ^2) tests by the two types of gamified learning cases

(successful or unsuccessful). That is, eleven 2 X 2 Chi-Square (χ^2) tests were conducted, in which

- The Row Variable (A) = each of the gamification design element variables, with 2 categories (a1 = present, a2 = absent)
- The Column Variable (B) = gamified learning cases (learning outcomes), with 2 categories (b1 = successful, and b2 = unsuccessful)

Significant Results

All eleven variables were examined, only two of them were significant. The following are the results from the two significant (χ^2) tests.

Social Interaction by Learning Outcome. The overall (χ^2) test result was significant: χ^2 (1, N=67) = 7.734, p = .005, and effect size Phi (φ) = .215, p = .006, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were significantly different between those in which social interaction was implemented, and those in which social interaction was absent. In 47 cases that were successful (b1), 42 (89.4%) included social interaction, and 5(10.6%) did not. In 20 cases that were unsuccessful (b2), 12 (60.0%) included social interaction, and 8 (40.0%) did not.

Leaderboards by Learning Outcome. The overall (χ^2) test result was significant: χ^2 (1, N=67) = 4.772, p = .029, and effect size Phi (φ) = .267, p = .029, indicating that the proportions of the two types of learning cases (successful and unsuccessful) were significantly different between those in which leaderboards were present, and those in which leaderboards were absent. In 47 cases that were successful (b1), 38 (80.9%) used

leaderboards, and 9 (19.1%) did not. In 20 cases that were unsuccessful (b2), 11 (55.0%) used leaderboards, and 9 (45.0%) did not.

Nonsignificant Results

The other nine Chi-Square tests (between Learning Outcomes and each of the other nine gamification design elements) were NOT significant. The nonsignificant results indicated that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which a particular gamification element was present, and those in which that element was absent. The following nine nonsignificant results are of reference.

Goals & Challenges by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 0.571, p = .450, and effect size Phi (φ) = .092, p = .450, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which goals and challenges were included and clearly stated, and those in which goals and challenges were not included. In 47 cases that were successful (b1), 39 (83.0%) clearly stated goals and challenges, and 8 (17.0%) did not. In 20 cases that were unsuccessful (b2), 15 (75.0%) clearly stated goals and challenges, and 5 (25.0%) did not.

Fiction Elements by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 3.782, p = .052, and effect size Phi (φ) = .238, p = .052, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which fiction elements were clearly present, and those in which fiction elements were absent. In 47 cases that were successful (b1), 12 (25.5%) fiction elements were used, and 35 (74.5%) did not. In

20 cases that were unsuccessful (b2), 1 (5.0%) used fiction elements, and 19 (95.0%) did not.

Points by Learning Outcome. The overall (χ2) test result was not significant: χ2 (1, N=67) = 0.038, p = .846, and effect size Phi (φ) = .024, p = .846, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which points were used and those in which points were not included. In 47 cases that were successful (b1), 34 (72.3%) used points, and 13 (27.7%) did not. In 20 cases that were unsuccessful (b2), 14 (70.0%) used points, and 6 (30.0%) did not.

Badges by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, *N*=67) = 1.705, *p* = .192, and effect size Phi (φ) = .160, *p* = .192, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which badges were present and those in which badges was not presented. In 47 cases that were successful (b1), 30 (63.8%) used badges, and 17 (36.2%) did not. In 20 cases that were unsuccessful (b2), 16 (80.0%) used badges, and 4 (20.0%) did not.

Levels by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, *N*=67) = 1.629, *p* = .202, and effect size Phi (φ) = .156, *p* = .202, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which levels were included and those in which levels was not included. In 47 cases that were successful (b1), 22 (46.8%) used levels, and 25 (53.2%) did not. In 20 cases that were unsuccessful (b2), 6 (30.0%) used levels, and 14 (70.0%) did not.

Progress by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 0.210, p = .091, and effect size Phi (φ) = .151, p = .091, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which progress bar was present and those in which progress bar was absent. In 47 cases that were successful (b1), 7 (14.9%) used progress bar, and 40 (85.1%) did not. In 20 cases that were unsuccessful (b2), 3 (15.0%) included progress bar, and 17 (85.0%) did not.

Rewards by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 0.024, p = .877, and effect size Phi (φ) = .019, p = .877, indicating that the proportions of the two types of learning cases (successful and unsuccessful) were not significantly different between those in which rewards were used and those in which rewards was not used. In 47 cases that were successful (b1), 15 (31.9%) used rewards, and 32 (68.1%) did not. In 20 cases that were unsuccessful (b2), 6 (30.0%) used rewards, and 14 (70.0%) did not.

Feedback by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 0.065, p = .798, and effect size Phi (φ) = .031, p = .798, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which feedback was present and those in which feedback was absent. In 47 cases that were successful (b1), 18 (38.3%) used feedback, and 29 (61.7%) did not. In 20 cases that were unsuccessful (b2), 7 (35.0%) used feedback, and 13 (65.0%) did not.

Theory & Instructional Design by Learning Outcome. The overall (χ^2) test result was not significant: χ^2 (1, N=67) = 0.217, p = .642, and effect size Phi (φ) = .057, p

= .642, indicating that the proportions of the two types of gamified learning cases (successful and unsuccessful) were not significantly different between those in which theory and/or instructional design principles were applied, and those in which use of theory and/or instructional design principles were not present. In 47 cases that were successful (b1), 31 (66.0%) used theory and/or instructional design principles, and 16 (34.0%) did not. In 20 cases that were unsuccessful (b2), 12 (60.0%) used theory and/or instructional design principles, and 8 (40.0%) did not.

All the eleven Chi-Square test results were summarized in Table 7.

Table 7

Summary of Chi-Square tests

Variable A **Gamification Elements**		**Variable B** **Learning Outcomes**		**Chi-Square Results** *df = 1, N = 67*		
		0[a] n = 20	1[b] n = 47	χ^2	*p*	*Phi (φ)**
**Social Interaction	0[c]	8 (40%)	5 (10.6%)	7.734	.005	.340
	1[d]	12 (60%)	42 (89.4%)			
**Leaderboards	0	9 (45%)	9 (19.1%)	4.772	.029	.267
	1	11 (55%)	38 (80.9%)			
Goals & Challenges	0	5 (25%)	8 (17%)	0.571	.450	.092
	1	15 (75%)	39 (83%)			
Fiction Elements	0	19 (95%)	35 (74.5%)	3.782	.052	.238
	1	1 (5%)	12 (25.5%)			
Points	0	6 (30%)	13 (27.7%)	0.038	.846	.024
	1	14 (70%)	34 (72.3)			
Badges	0	4 (20%)	17 (36.2%)	1.705	.192	.160
	1	16 (80%)	30 (63.8%)			
Levels	0	14 (70%)	25 (53.2%)	1.629	.202	.156
	1	6 (30%)	22 (46.8%)			
Progresses	0	17 (85%)	40 (85.1%)	0.210	.091	.151
	1	3 (15%)	7 (14.9%)			
Rewards	0	14 (70%)	32 (68.1%)	0.024	.877	.019
	1	6 (30%)	15 (31.9%)			
Feedbacks	0	13 (65%)	29 (61.7%)	0.065	.798	.031
	1	7 (35%)	18 (38.3)			
Theory & Instructional Design	0	8 (40%)	16 (34%)	0.217	.642	.057
	1	12 (60%)	31 (66%)			

Notes: (*) all the Phi (φ) tests had the same significant level of p as in each of the χ^2 tests.

(**) significant gamification elements

a. unsuccessful; b. successful; c. element absent; d. element present.

Consistency with Logistic Regression Results

Chi-Square tests produced the same results as logistic regression analyses. Chi-Square test results showed that *Social Interaction* and *Leaderboards* were significantly related to the successful implementation of gamification, which is consistent with the two models in the logistic regression. As discussed earlier, the variables Social Interaction and Leaderboards are closely related to each other. A value of 1 was given to the variable Social Interaction for a study if it implemented leaderboards. Chi-Square tests results provided further support for the results of logistic regression analyses.

The two tests provided strong evidence that for the implementation of gamification to be successful, social interaction and leaderboards need to be included in the design of gamified learning.

Summary

This chapter presented the results from data analyses for the two research questions. For research question 1, logistic regression was conducted to identify the gamification design elements that contribute to enhanced learning outcomes (cognitive, behavioral, and/or affective). Two stepwise methods were applied, forward method and backward method. Both methods produced similar results. Chi-Square tests were conducted to examine research question 2 and yielded the same results as logistic regression analyses, providing further support for the role social interaction and leaderboards play in the successful implementation of gamification in education.

Chapter Five

Discussion and Conclusion

This study investigated the factors that influence the successful implementation of gamification in higher education settings. The purpose of the study was to determine what gamification design elements were more likely to influence the success of a gamified learning case; in other words, what elements had the most influence on student learning outcomes.

This chapter first summarizes the current state of empirical gamification research in higher education. It then provides discussions of the findings for the research questions. The implications for practice and future research are discussed, followed by the limitations of this study.

Current State of Empirical Gamification Research in Higher Education

The application of gamification in education is a comparatively new phenomenon. One consistent finding in the syntheses of early scholarship is that gamification research lacks theoretical foundation and methodological rigor (Dichev & Dicheva, 2017, Seaborn & Fels, 2015). The field has grown ever since and the research is more focused on understanding how individual game design element works, and on advancing theories in the field (Rapp et al., 2019). As the field keeps growing, it is necessary to find out if the previous findings of lacking theoretical foundation and methodological rigor still hold.

In their synthesis of literature, Seaborn and Fels (2015) found that the majority (87%) of the experiments did not address theoretical foundation. In this study the researcher reviewed and analyzed 67 empirical studies of gamification on student learning outcomes in higher education settings, published between 2014 and 2023 in

peer-reviewed journals. Forty-three out of 67 (65%) studies discussed theories, instructional design principles, or theoretical models (see Table 3). Self-Determination Theory was the most applied theory, in 44% of studies, followed by Goal Setting Theory (9%) and Theory of Gamified Learning (9%). Four studies applied instructional design principles in their design of gamification. This finding showed that gamification research has made progress in applying and validating theories, and in improving its usefulness in education (Rapp et.al, 2019).

Nonetheless, there are still challenges facing gamification research in education. One-third (33%) of the studies did not mention theoretical foundation. Theories are essential to research as they provide frameworks for understanding how things work and how concepts are related to each other, for guiding the research process and for making sense of research findings and translating them to practice (Bhattacherjee, 2012). Without the guidance of theories and instructional design principles, gamification interventions may not effectively achieve desired learning outcomes. This was evident in the results reported in the experiments included in this study. Although many reported positive effects of gamification on student learning outcomes, 30% of the experiments did not yield the results they expected (see Table 3). The inconclusive results found in this study are consistent with the findings in previous syntheses (Dichev & Dicheva, 2017, Huang et al., 2020; Ritzhaupt et al., 2021; Sailer & Homner, 2020).

In summary, although progress has been made, gamification research in higher education still faces various theoretical and methodological challenges (Dichev & Dicheva, 207; Landers et al., 2018; Rapp et al., 2019). More theory guided empirical studies are needed in order to advance the field of gamification research.

Gamification Design elements

Gamification is the intentional use of game design elements in non-game contexts to increase motivation, engagement, and interaction (Deterding et al., 2011; Kapp 2012; Seaborn & Fels, 2015). For gamification intervention to be effective, instructors will need to identify the issue and the course of actions that can solve the issue, and then carefully select the design elements that can help facilitate this process, whether it is to increase self-test practices, online discussion participation, or improved time on task. Therefore, it is imperative to investigate gamification design elements and identify the ones with the greatest potential. The purpose of this study was to examine the effects of gamification on student learning outcomes. It aimed to identify specific gamification design elements that had significant influence on learning outcomes. The results of data analyses showed that *social interaction* and *leaderboards* were the two gamification design elements that have the most impact on student learning outcomes, followed by *badges* and *fiction elements*.

Social Interaction

Social interaction has been found to have the most significant impact on student learning outcomes. This result is consistent with the findings in Sailer and Homner's (2020) meta-analysis on gamification and learning. In their study they identified three types of social interaction: competition, collaboration, and competition-collaboration combination, and found that the competition-collaboration type of social interaction has a significant effect on behavioral outcome (Sailer & Homner, 2020). This result is also consistent with Huang, Ritzhaupt, and colleges' (2020 and 2021) syntheses of literature in which they found competition has positive impact on affective outcomes and

collaboration positively affect cognitive outcomes (Huang et al., 2020; Ritzhaupt et al., 2021).

It is not surprising that this study found that social interaction has a significant impact on learning outcomes. In this study, social interaction refers to competition and collaboration/cooperation between individual students and/or groups/teams and was coded based on this definition. Self-Determination Theory (Ryan & Deci, 2000) proposes that there are three basic psychological needs: the needs for competence, autonomy, and relatedness. These needs are essential for individuals to experience intrinsic motivation. When these needs are satisfied, individuals are more likely to be intrinsically motivated to perform the required tasks and experience optimal learning outcomes (Ryan & Deci, 2000). Competition and collaboration/cooperation support basic psychological needs for competence and relatedness. Landers and colleagues (2019) conducted an experiment in which they only applied one design element—competition. Their finding has shown that competition alone can improve performance (Landers et al., 2019), providing empirical support for Self-Determination Theory.

Social interaction plays an important role in everyday life and has been researched extensively in social science. However, there has been no studies in gamification research in education that examines the effect of social interaction as a gamification design element on learning outcomes, with the exception for one—Sailers and Homner's (2020) meta-analysis and their analysis focused more on the methodological rigor of gamification research. In gamification research, the discussions on gamification design elements are generally centered on the classic elements in game design, such as points, badges, leaderboards, levels, challenges, etc. Little attention has been given to other

design elements such as social interaction. This study contributed to literature in that it has included social interaction as a gamification design element. More empirical studies are needed to intentionally implement social interaction in the design of gamification in instruction and examine its impact on student learning outcomes.

Leaderboards

Leaderboards have been found to be significantly related to the successful implementation of gamification. This finding is consistent with the existing literature (Dias, 2017; Garcia-Cobot et al., 2019, Landers et al., 2017, Landers & Landers, 2014, Mekler et al., 2017, Sailer & Sailer, 2021). Leaderboards are the rankings of performance of individual students or teams. As leaderboards rank students/teams based on their achievements, they create a sense of competition among students as they compare their performance with others, hence, facilitate the satisfaction of the need for competence. Landers and Landers (2014) found in their experiment that leaderboard alone could improve student time on task (behavioral outcome), similar results were found in Mekler and colleagues' study (Mekler et al., 2017).

In gamification practice, leaderboards are often used along with points, badges, and/or levels. When comparing points, levels, and leaderboards, Mekler et el. (2017) found that levels and leaderboard significantly improved participants' tagging performance (behavioral outcome). Sailer and Sailer (2021) implemented points and a team leaderboard in a flipped classroom. By using a team leaderboard, they incorporated both competition and collaboration (i.e., social interaction) in the experiment. The result was promising. They found that the use of points and a team leaderboard had positive effects on student intrinsic motivation and a positive indirect mediating effect on

application knowledge (Sailer & Sailer, 2021). Their study validated the two theories used in this research—Self-Determination Theory and Theory of Gamified Learning, highlighting the importance of theoretical foundation in empirical research.

Nonsignificant Gamification Elements

Badges, although not statistically significant, have been found to be negatively related to the successful implementation of gamification (see Table 5). Badges provide feedback about students' achievements. Depending on the design, badges can be visually appealing and can be easily implemented in most Learning Management Systems. Studies on the effectiveness of badges yielded positive but mixed results. In some experiments included in this study, badges have been found to have no effect on learning outcomes (Balci et al., 2022; Kyewski & Kramer, 2018; Morris et al., 2019), or negative impact (Hanus & Fox, 2015). Badges are generally implemented and examined along with other elements such as points and leaderboards, with a few exceptions (Dicheva et al., 2020; Hamari, 2017). Dicheva et al. (2020) found students who used the system in which badges were implemented practiced more (behavioral outcome) than those in the system without badges, leading to a better academic performance.

The findings on the effectiveness of badges in the literature are mixed. The nonsignificant but negative impact of badges found in this study has added to the mixed results of research, providing further evidence that the effectiveness of gamification may vary depending on various factors, such as individual and situational factors, learning contexts, disciplinary factors, and methodology factors (Landers et al., 2018, Ritzhaupt et al., 2021, Sailer & Homner, 2020).

Fiction elements have been found to be related to the successful implementation of gamification in this study, which is consistent with the findings in the previous meta-analysis (Sailors & Homner, 2020). Although the element itself is not significant, its contribution to the model significance is undeniable (see Table 5). The result provided further support that game fiction can enhance student engagement by creating a more immersive experience that captures students' attention and motivates them to put in more efforts in the course activities.

Fiction elements, especially narratives and storylines, aim to make the learning experience more immersive and enjoyable, and to create a sense of purpose and meaning in the activity, which can enhance motivation and engagement (Kapp, 2012). In their experiment, Frost and colleagues (2015) used a hero's adventure storyline and reframed assignments and assessments as quests to fight "monsters". They found that gamification has a small but positive effect of gamification on relatedness, one of the three basic psychological needs. The authors attributed leaderboards and the storyline to the small but positive effect (Frost et al., 2015). In the other two experiments (Bai et al., 2023; Rodrigues et al., 2022), the introduction of fantasy has been found significantly increased student engagement with the content and interaction with peers, which led to a better learning performance.

However, fiction elements are the least used design elements; only 13 out 67 (17 %) of experiments included in this study implemented fiction elements. Among those 13 experiments, only 4 integrated narratives or fantasy stories throughout the course (Bai et al., 2023, Frost et al., 2015; Giraldez et al., 2022; Rodrigues et al., 2022). This may be because an immersive gamified system is costly to design and develop and requires the

collaboration of instructors, instructional designers, graphic designers, programmers, etc. (Ritzhaupt et al., 2021). Nevertheless, adding fiction elements in gamification design has shown to be worthwhile. Research has pointed out that one limitation of gamification (or a gamified learning system) has been its novelty effect—it may not sustain student interest in the long term (Huang et el., 2020; Sanchez et al., 2020; Tsay et al., 2019). The four experiments (Bai et al., 2023, Frost et al., 2015; Giraldez et al., 2022; Rodrigues et al., 2022) have provided empirical evidence that narratives and fictional storylines help overcome this novelty effect.

It is without a doubt that creating fictional stories and narratives is time and labor intensive, and not every instructor is a creative writer or graphic designer. With the recent advancement and availability of Generative AI such as ChatGPT, it is worthwhile to explore the potential of this new tool. Creating a fictional story may become an easier task than one thinks.

The rest of the gamification design elements—*goals & challenges, points, levels, progress, rewards, feedback, theory & instructional design*—were not found to have any significant influence on the success of gamification implementation. There can be several reasons for this result. Some elements were not present in many studies and their contribution could not be identified, for example, *progress* (or the progress bar), which was only implemented in 10 out of 67 studies. Progress is comparatively easy to implement in a gamified learning system. It provides instant feedback to students about their performance and is worth further exploration. The nonsignificant result of the element *theory & instructional design* is consistent with the findings in the literature. As discussed earlier in this chapter, there is still a big portion (30%) of the empirical

experiments included in this study that did not discuss or mention theoretical foundation, highlighting the challenge facing gamification research in higher education.

It is worth noting that nonsignificant results do not necessarily mean that these design elements have no influence on student learning outcomes. It only indicates that they were not significant in this study, which was limited to 67 studies and not all studies have strong theoretical foundation and methodology rigor. This finding may be used as a reference.

Implications and Future Studies

This study investigated the influential factors of gamification in higher education. It examined the commonly used gamification design elements and identified the ones most influential to the successful implementation of gamification. Social interaction and leaderboards have been found to be significantly associated with the successful implementation of gamification in higher education settings. Below are some implications for practice and future research.

Implication for Practice

The main implication of this study is related to the design of gamification in higher education settings. It is critical to understand what gamification is and is not. Gamification is the *intentional* use of *game design elements* in non-game contexts to *increase motivation, engagement, and interaction* (Deterding et al., 2011; Kapp, 2012; Seaborn & Fels, 2015). Gamification is *not* simply adding game elements to any contexts. It is a *design* process that enhances the learning process that is already existing (Landers et al., 2018). It is also critical to understand that gamification itself does not have a direct impact on student cognitive learning outcomes. Instructional content is the most

important factor that affects student learning (see Figure 4). Without well-designed instructional content, even gamification with state-of-the-art design cannot help. In addition, the effects of gamification on learning are through its impacts on student behaviors and attitudes (Landers et al., 2014) (see Figure 4). There are many factors affecting the effectiveness of gamification. When designing gamification, instructors and instructional designers will need to consider individual and situational factors that may affect the effectiveness of the gamification intervention. Such individual and situational factors include (and not limited to) gender, age, learning environment (online vs in person), and disciplines, etc. (Landers et al., 2018; Ritzhaupt et al., 2021; Sailers & Homner, 2020).

Social interaction plays an important role in everyday life. The three basic psychological needs—the need for competence, autonomy, and relatedness—are motivational resources. Relatedness is essential for motivation and well-being (Ryan & Deci, 2000). When students feel related to their peers and community, they are more likely to be motivated and engaged in learning activities.

Based on Self-Determination Theory and Theory of Gamified Learning, the researcher put forward the following suggestions for instructors and instructional designers regarding the design of gamification application:

Design for the need for competence. The need for competence refers to the feeling of being able to do well in a task. To facilitate the satisfaction of this need, instructors and instructional designers can (1) provide clearly defined goals and objectives of the gamified learning experience, which gives students a sense of direction and purpose; (2) use a progress bar that allows students to track their progress; (3)

incorporate levels for students to advance through, which gives them a sense achievement; (4) provide timely and meaningful feedback on students' performance (feedback is the second most important factor on learning); and (5) use team leaderboards to motivate students to collaborate with peers and improve their performance.

Design for the need for autonomy. The need for autonomy is the sense of ownership one feels in the decision he/she makes and the direction he/she chooses. To facilitate the satisfaction of the need for autonomy, instructors and instructional designers can (1) provide students with choices such as different activities/tasks or different levels of difficulty to choose from; (2) allow for personalization such as avatars; (3) use fictional narratives or storylines to create a personal and immersive gamified learning experience; (4) provide multiple pathways to success; and (5) provide constructive feedback with actionable comments and directions for improvement.

Design for the need for relatedness. The need for relatedness is the feeling of a sense of attachment to and a sense of belonging among other people. To facilitate the satisfaction of the need for relatedness, instructors and instructional designers can (1) incorporate social interaction (competition and collaboration) in the gamified learning environment by using group work and team leaderboards; (2) provide opportunities for various social interaction such as commenting, the use of emojis and the *Like* button, and peer feedback; (3) create narratives or storylines that resemble the real-world experiences. Narratives do not have to be fictional; they can be real world scenarios that students can feel related to.

In summary, at the time when student disengagement and disconnection is at an all-time high level, it is imperative for instructional designers and instructors to make

collaborative effort to help alleviate this issue by providing opportunities that facilitate the satisfaction of the basic psychological needs of students. It is also important to note that gamification is intentional, aiming at a change in the outcome. It is a process that uses design principles to add game elements to an existing process (i.e., instruction) to change how that process influence students (Landers, 2014; Landers et al., 2018). Effective instructional content is the key. Well-designed gamification facilitates the changes in the learning outcomes.

Implications for Future Studies

Gamification research has come a long way in the past 20 years. The field has made progress but there are still challenges (Deterding et al., 2017; Rapp et al., 2018). Empirical studies on gamification are still very much concentrated on classic game elements such as points, badges, leaderboards, and levels, and research on other elements still lacks (Ritzhaupt et al., 2021). Design elements such as narratives, fictions, and social interaction have great potential in improving student learning outcomes. Future studies can explore those under-researched elements and examine how they impact student attitudes and behaviors in the gamified learning environment. In addition, sizable studies still lack theoretical foundation, as is evident in the findings of this study and in other reviews and meta-analyses (Landers et al., 2018; Ritzhaupt et al., 2021; Sailers & Homner, 2020). There are many factors that come to play when implementing gamification in instruction. Well-established and field-tested theories help researchers identify those factors. Self-Determination Theory and Theory of Gamified Learning are such theoretical frameworks that can be applied to gamification research. While Self-Determination Theory focuses on the elements that affect human motivation, Theory of

Gamified Learning centers on the factors that affect the gamification design and implementation process. It is imperative that future studies use theories to guide the gamification design, implementation, and evaluation process, and to validate and advance theories in the field. Afterall, gamification is a design process. It is about students. It is about bringing changes to students.

Limitations

There are a few limitations to this study. First, this study employed a correlational research design approach. Correlational research can only determine the association between the variables and cannot establish causal relationships (Sprinthall, 2003). The sample is from existing literature. The methodological rigor of the empirical studies included in this research directly affects the correctness in the association between the variables found in this study. Second, this study was only able to retain 67 cases in the final sample due to strict inclusion criteria. For an expected odds ratio to be 3.0, a sample size of 96 is needed for logistic regression analysis (Liu et al., 2019). The comparatively small sample size may limit the generalizability of the study. Therefore, the results from this study can only provide a reference for future research and practice.

Summary

This chapter discussed the findings in this research. It summarized the current state of empirical gamification research in higher education, and provided discussions of the findings regarding the research questions. The implications for practice and future research were discussed. The chapter concluded with the limitations of this study.

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