Gamification pedagogy: A motivational approach to student-centric course design in higher education

Fiona Gironella
MacEwan University, Canada, gironellaf@macewan.ca

Gamification pedagogy: A motivational approach to student-centric course design in higher education

Abstract

This article explores the praxis of gamification pedagogy and post-secondary course design. The literature on gamified design theory and current research on its application as a pedagogy are explored. A student-centric, motivationally based gamification design model is proposed, operationalized, implemented, evaluated, and reiterated. The design process, application strategies and challenges, and resulting qualitative outcomes over a two-year implementation period of the re-designed gamified course are detailed. Student evaluations rated both the overlaid gamified structural design and the integrated course mechanics as highly motivating and contributing significantly to their success and positive learning experience. The gamified course design was able to resolve historical challenges for the identified course and increased student engagement. Gamification pedagogy proved uniquely effective for two sub-groups of students, those struggling with anxiety and second language learners. This innovative pedagogy effectively leveraged students' unique intrinsic and extrinsic motivators to create an empowering, supportive, and highly effective learning framework.

Practitioner Notes

1. A comprehensive gamification pedagogical course design involves the identification and matching of student motivators and gamified mechanics to engage learners to achieve academic success.
2. Gamification pedagogy can bridge contemporary students' learning needs and existing university course content by designing student-centric motivationally based course frameworks that enhance learning engagement.
3. Gamification can be applied to resolve historical challenges in courses, while maintaining existing course content and academic rigor.
4. Subsets of students reported that select groupings of gamification mechanics mitigated their anxiety and language barrier needs, contributing significantly to their academic success.
5. By design, student-centric, motivationally based gamification pedagogy should theoretically be equally effective with any targeted group of students and any subject matter to achieve desired outcomes.

Keywords

Gamification pedagogy, motivational approach, student-centric course design, higher education

Introduction

Contemporary post-secondary students are different on many dimensions from previous generations (Holston, 2020; Isaacs et al., 2020). Most of these students are digital natives raised in the era of information technology connectivity. This reality has implications to their learning proclivity for digital elements in education (Koumachi, 2019). Also referred to as Gen Z (born after 1995), these students have preferences for fun, relational, inclusive, and dynamic learning environments that offer choice, practical skills, assessment rationale, opportunities for knowledge sharing, micro-chunks of learning, and informal immediate feedback (Cretu et al., 2020; López-Santacruz & Guízar-Mendoza, 2022; Mohr & Mohr, 2017). As such, universities need to reconsider traditional post-secondary course formats to ensure relevance and responsiveness to the contemporary student.

Herein, gamification pedagogy (the application of game theory and mechanics to non-gaming contexts) is explored as a student-centric instructional design process which effectively applies gamified mechanics to motivate student learning and academic behaviour. This study explores whether a comprehensive application of gamification pedagogy to course redesign can effectively target the natural motivators of contemporary post-secondary students, address historical challenges within a specific course, the Child and Youth Care Professional (CYCP), and create an engaging and empowering learning environment. Operationalization of gamification pedagogy from transformation of course design and development to analysis of students' experiences is explored.

Research Context

MacEwan University is an undergraduate post-secondary institution in Alberta, Canada offering 10 bachelor's degrees with 32 majors, and 40 diploma and certificate programs to approximately 20,000 students. The Bachelor of Child and Youth Care is a four-year degree program, with a two-year diploma exit, that equips students to engage therapeutically with children, youth, and families struggling with mental health, addiction, poverty, and conflict. Targeted for this study is the Child and Youth Care Professional course, an introductory first-year course traditionally taught in a lecture format. The course covered professional roles and responsibilities, scope and ethics, intergenerational cycles of abuse and neglect, developmental challenges, legislation, and ethical intervention approaches.

The potentially emotionally triggering content, diverse scope of information, and extensive assessment requirements of the original course presented challenges to student success. The subject matter changed with each 80-minute class, resulting in a lack of continuity and the need for multiple and frequent

forms of assessment. The topics related to childhood trauma, addictions, marginalization, and intergenerational cycles of abuse presented potential mental health triggers for students, leading some to disengage and withdraw. MacEwan students' rates of anxiety, depression and stress were approximately 10% higher than the national average for post-secondary students (American College Health Association, 2019b), and these high rates of mental health concerns have been shown to be barriers to success, adversely impacting study focus, academic achievement, and retention rates among university students (American College Health Association, 2019a; Bruffaerts et al., 2018; Mental Health Commission of Canada, n.d.). A recent study by Adkins-Jablonsky et al. (2021) found gamification elements increased engagement and decreased perceived anxiety levels among post-secondary students.

Gamification pedagogy was explored as a course design approach to address these structural challenges, decrease anxiety, meet student learning needs, and enhance learning experience (Borrás-Gené, 2019; Litvin et al., 2020). The study sought to effectively define and operationalize gamification pedagogy and then answer the following questions: 1. Can gamification pedagogy increase learning engagement? 2. Can a comprehensive gamified redesign address historical course challenges? As the focus of this research was on gamification pedagogy rather than student performance, the MacEwan Research Ethics Board determined that ethics approval was not required.

Literature

Gamification is the use of game theory and mechanics in non-gaming contexts to engage, motivate, stimulate learning, achieve goals, and improve user experiences (Helmefalk, 2019; Kapp, 2012; Koivisto & Hamari, 2019). In the last decade, gamification has been extended from an instructional design model used in the corporate training industry (Alsawaier, 2018; Helmefalk, 2019; Polyanska et al., 2022) to academic usage as an innovative pedagogy (Huang & Hew, 2021; Mustafa & Karimi, 2021; Nurtanto et al., 2021). Although the effectiveness of implementing select gamification mechanics in educational contexts is contented (Facey-Shaw et al., 2020; Kalogiannakis et al., 2021; Mekler et al., 2017), gamification is reported to increase students' intrinsic and extrinsic motivation, engagement, learning achievements, task completion rates, learning experiences, and outcomes (Aleksic-Maslac et al., 2018; Bouchrika et al., 2021; Huang & Hew, 2021; Krath et al., 2021; Mustafa & Karimi, 2021; Urh et al., 2015). The divergent results may be attributed to how gamification is conceptualized, as either the introduction of specific game mechanics into pre-existing courses, or as a pedagogical approach that integrates game theory and mechanics foundationally into course development.

Some frameworks broadly conceptualize gamification as having three components: affordances, psychological processes, and domain-specific outcomes (Helmefalk, 2019; Hamari et al., 2014). Affordances are the specific game mechanics (e.g., leaderboards and badges) that are used to induce psychological experiences (such as competence and empowerment motivators), which in turn drive behavioural changes (i.e., increased study activity and improved achievement). These frameworks orient motivation in the impact of gamification mechanics, and as such, are not user-centric as the players' unique characteristics and motivators are not foundational to course design (Hamari et al., 2014; Kapp et al., 2014).

A student-centric gamification design addresses motivational issues, increases learner engagement, interactivity, knowledge acquisition, and behaviour change (Kapp et al., 2014; Sailer et al., 2017). This comprehensive pedagogical approach involves course development that identifies student motivators, defines desired outcomes, selects effective course mechanics, and draws students into customized and purposeful success-driven learning experiences (Hamari et al., 2014; Helmefalk, 2019; Kalogiannakis et al., 2021; Nurtanto et al., 2021). The intent to engage participants' intrinsic and extrinsic motivators to compel them to successfully complete a program is central to gamification theory (Kapp, 2012; Klemke et al., 2018; Nicholson, 2012; Xu et al., 2021). While motivation is a consistent component in gamification, divergence exists on how motivators are framed (Burke, 2014; Kapp, 2012; Reiss, 2013). In player-centric design, identifying player persona characteristics is foundational to determining which gamification mechanics are selected to "hook" players' distinctive motivators to achieve identified goals (Burke, 2014; Nicholson, 2012). The design elements must be driven by the players' intrinsic and extrinsic motivators, technological proficiency, goals, interests, and potential barriers to learning (Boller & Kapp, 2017; Nicholson, 2012).

In gamification, mechanics are the building blocks of gamified program design that define, structure, and interact with the players as they engage and progress through an activity (Helmefalk, 2019; Werbach & Hunter, 2012). The seven most frequently used mechanics in education are leaderboard, points, badges, levels, progress bar, challenges, feedback, and rewards (Mustafa & Karimi, 2021). However, gamification in academia is often limited to points, badges, and leaderboards (Dichev & Dicheva, 2017; Nicholson, 2012). There has been a marked absence of explanations for the reasoning behind mechanic selection in educational contexts, leaving some to question whether these choices are random (Dichev & Dicheva, 2017; Krath et al., 2021; Mustafa & Karimi, 2021). The introduction of gamified mechanics unconnected to theoretical design frameworks may limit their value and effectiveness (Costa et al., 2021; Hamari et al., 2014).

Studies of gamification characterized by the addition of two or three mechanics into pre-existing courses (Gallego-Duran et al., 2019; Hung, 2017; Krath et al., 2021; Mustafa & Karimi, 2021) have shown limited or mixed success. For instance, despite research findings that badges were effective in recognizing knowledge acquisition and status (Botra et al., 2014; Collmus et al., 2016), a recent study by Facey-Shaw et al. (2020) found that when badges are adopted in isolation, they do not increase student's intrinsic motivation. Attali and Arieli-Attali (2015) found no increase in achievement with the implementation of the points mechanic, whereas, Hew et al. (2016) found increased engagement and results. Similarly, Landers et al.'s (2017) reported increased outcomes with leaderboards, contrasting with Mekler et al.'s (2017) findings that points, levels, and leaderboards did not increase intrinsic motivation. Dichev and Dicheva (2017) likewise found no positive outcomes for the use of badges and leaderboards. It is posited that the mixed findings obtained from studies focused on mechanics implemented in isolation (Facey-Shaw, et al., 2020; Mekler, et al., 2017) may originate from inaccuracies in how the pedagogy was conceptualized rather than in the effectiveness of gamification pedagogy itself (Mekler et al., 2017).

The present study explores the efficacy of a comprehensive, student-centric, motivationally based gamification pedagogical model as a transformative framework for course redesign and learning engagement medium in higher education.

Method

The new gamification pedagogy for student-centric course design fundamentally diverges from traditional higher education instructional models where professors authoritatively disseminate knowledge via lectures and evaluate student learning through exams and research papers (McInnes, 2013; Miller et al., 2013). Gamification pedagogy shifts the starting point of learning to reconceptualizing course design in response to students' unique motivators to entice them to engage, learn, and succeed (Molina-Carmona & Llorens-Largo, 2020). This fundamental shift in course development may feel disruptive to some in the world of academia; however, this adjustment is vital if post-secondary education is to remain relevant and accessible to contemporary students, with specific learning preferences (Sarker et al., 2019) and higher levels of anxiety (Mohr & Mohr, 2017; Schlee et al., 2020).

It was posited that redesigning the CYCP course to shift the learning paradigm, resituate the course content, restructure the course delivery format, assessment elements, and engagement strategies based on a student-centric motivational framework could provide a substantive context for examining the effectiveness of gamification pedagogy (Burke, 2014; Helmefalk, 2019; Koivisto & Hamari, 2019). The current study seeks to define and immerse course design and learning context in gamification pedagogy, drawing upon Costa et al.'s (2021) pedological design principles for gamified learning: analysis, design, implementation, evaluation, and revision. Principles learnt from this study could be applied to other student cohorts, courses, learning challenges, and disciplines.

Pedagogical Model

From the outset, the gamified course redesign involved a purposeful approach, built on knowledge of learning objectives, course content, and student motivators (Kapp et al., 2014; Klemke et al., 2018; Nurtanto et al., 2021). Kapp's (2012) nine elements of gamification (game-based; mechanics; aesthetics; game thinking; engagement; people; motivate action; promote learning; and solve problems) and Gallego-Duran et al.'s (2019) components of game-design-based gamification (autonomy, challenge, learning by trial and error, progress assessment, feedback, randomness, discovery, emotional entailment, playfulness enabled, and automation) were incorporated in the course redevelopment process to maximize student learning experiences. Drawing upon gamification theory and practice, a user-centric gamification design paradigm was developed (see figure 1). This design model became the context within which course objectives, content delivery, learning assessments, and learning experiences were realized.

Figure 1.
Student-centric, motivationally based gamification design model
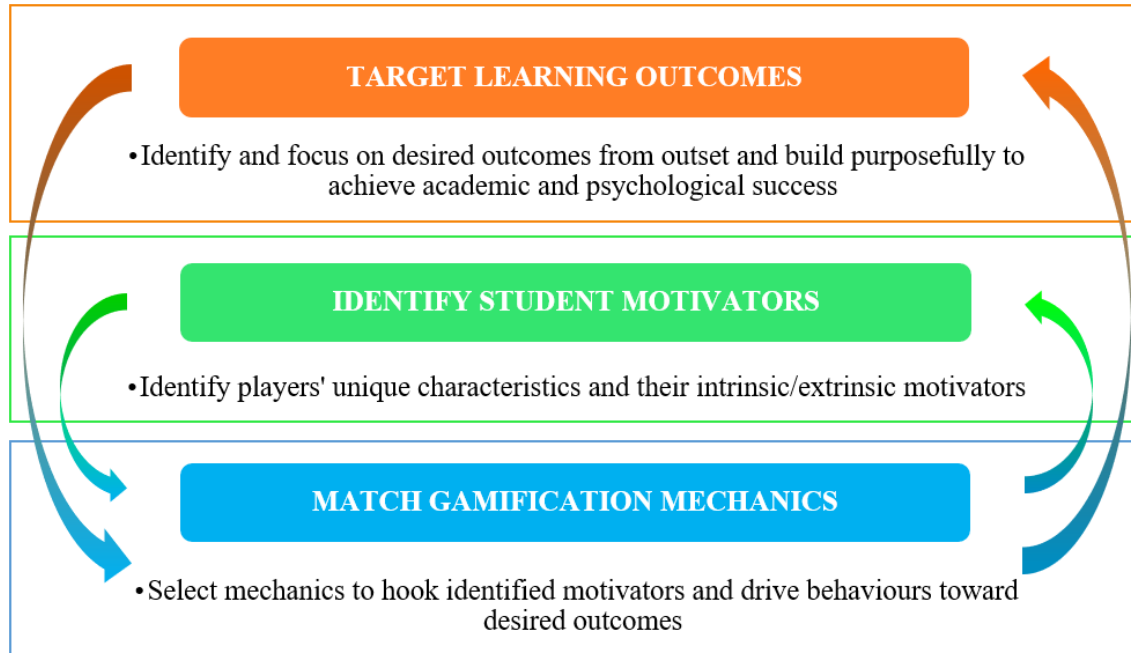
Determination of Course Redesign Goals

The redesign process sought to structurally unify the course content and create understanding among students for the requirement of multiple assessments of mastery. Other goals were to engage students in an innovative learning environment that resonates with digital natives (Paľová & Vejačka, 2022), and increase enjoyment of their learning process (Molina-Carmona & Llorens-Largo, 2020). In the gamified redesign, the learning context expanded from on-campus classes to additional interactive online elements to engage students between scheduled classes (Paľová & Vejačka, 2022). Sensitivity to student's mental health needs was also considered to create a safe and successful learning context (Fleming et al., 2017).

Creation of Player Prototypes and Identification of Motivators

Identifying and defining user types was crucial to this player-centric gamified design process as effective mechanics were selected to match students' motivational preferences (Andrias & Sunar, 2019; Smiderle et al., 2020). Using knowledge of program cohorts, personality tests, observed behaviours, and past academic performance, four distinct player personas were constructed to identify participant students' characteristics and motivators (see figure 2). As a foundation for course design, these player personas were representative of student demographics, interests, abilities, and motivators.

SUSIE SOCIAL		ANGELA ACHIEVER	
(60% population)		(20% population)	
Gender: female		Gender: female	
Age: 18-22 years		Age: 18-20 years	

Education: high school	Education: honors high school
Dreams and Goals: graduate, secure employment, satisfy desire to help others, happy marriage/family	Dreams and Goals: achieving high grades, acceptance into graduate school, successful career, successful family
Interests: social activities, friends, family	Interests: studying, excelling, family
Fears & Frustrations: rejection, disappointing others	Fears & Frustrations: academic failure, criticism
Background: healthy family, active in school, good circle of friends, works 8 hrs/wk	Background: high achiever, professional parents, positive peers, works 8 hrs/wk
Technology & Training: cell phone, family computer, values in-person learning (consistent attendance)	Technology & Training: personal laptop, cell phone, values all learning formats (perfect attendance)
Motivators: acceptance, curiosity, family, social contact, status, tranquility	Motivators: beauty, competition, curiosity, family, honour, order, status
TANYA TRAUMA (10% population) Gender: female Age: 20-22 years Education: GED	**COREY COACH** (10% population) Gender: male Age: 18-22 years Education: high school
Dreams and Goals: being the counsellor that she never had, finding happiness	Dreams and Goals: balance between school & personal life, recreational youth work position, enjoy life
Interests: advocacy for abused youth, self-care	Interests: playing sports, social activities, hanging out, having fun with friends
Fears & Frustrations: rejection, relapse, rigidity	Fears & Frustrations: disappointing others, rigidity
Background: unresolved attachment & abuse issues from past involvement in Children's Services, works 20 hrs/wk	Background: athletic, outgoing, fun-loving, easy-going, works 14 hrs/wk
Technology & Training: cell phone, social media life, values in-person learning (inconsistent attendance)	Technology & Training: cell phone, gaming computer, values in-person learning (consistent attendance)
Motivators: acceptance, beauty, honour, idealism, independence, order, tranquility	Motivators: acceptance, competition, independence, physical activity, social contact

(Adapted from Peters and Cornetti (2019), Learner Persona format)

The four player personas represented the broad interests and backgrounds of both class cohorts (88 students). Motivators repeated between player personas were *acceptance* (desire to meet

expectations, build self-confidence, and feel validated), *beauty* (desire for appealing aesthetics), *competition* (desire to excel and achieve greater than others), *curiosity* (desire to understand), *family* (desire to belong and care for others), *honour* (desire for integrity, knowledge of success criteria, and personal accomplishments), *independence* (desire to have control over actions, choices, and achievements), *order* (desire for clear structured expectations), *social contact* (desire for collaboration and engagement with peers), *status* (desire for respect based on accomplishments), and *tranquility* (desire to safely understand expectations, feel accepted, reduce risk, and experience peace) (Reiss, 2013). To ensure equity-centred design for academic success (Costa et al., 2021), the motivators of idealism (desire for equal distribution of resources and rewards), and physical activity (desire for action) were also considered in the re-design process.

Selection of Gamified Mechanics

The transformation to gamification pedagogy came from both a gamified structural overlay and the introduction of gamified mechanics into existing course components (content, instructional delivery format, and assessment), selected to hook identified student motivators towards successful course completion. Gamification mechanics were selected to drive students' natural motivators to engage in the immersive learning context, successfully complete course requirements and learning outcomes (Dichev & Dicheva, 2017; Molina-Carmona & Llorens, 2020). Aligning with Kapp et al.'s (2014) ideation of structural gamification, all content from previous years was presented and evaluated. Mechanic selection was limited by the instructor's ability to manage the course and the constraints of the university's learning management system (Blackboard Learn). The course transitioned from a traditional hierarchical linear progression format to a design that offered students choice and flexibility to engage with classmates towards content mastery and successful course completion (Paľová & Vejačka, 2022). The system of course assessments shifted from static one-time constructs to continuous mastery-based learning configurations. In addition, course elements were introduced designed to foster a supportive learning community and to mitigate potential barriers to success. Throughout this gamified redesign process, the endgame was to motivate students to learn (Buckley et al., 2018; Costa et al., 2021; Huang & Hew, 2021).

Table 1 identifies student motivators and matched gamification mechanics, followed by brief explanations for these selections and how the mechanics were realized.

Table 1

Paired Student Motivators and Gamification Mechanics

Student	Gamification Mechanics

Motivators

	Course Narrative	Aesthetics	Self-determination	Points	Teams	Unlimited Attempts	High Score	Badges	Leaderboard	Bonuses & Rewards	Coins
Acceptance	✓			✓	✓	✓	✓			✓	✓
Beauty		✓									
Competition				✓		✓	✓	✓	✓	✓	
Curiosity	✓				✓	✓		✓			
Family		✓			✓						✓
Honour	✓		✓					✓	✓		
Idealism					✓					✓	
Independence	✓		✓	✓		✓	✓		✓		
Order	✓		✓	✓		✓	✓	✓			
Physical Activity			✓		✓					✓	
Social Contact					✓				✓		✓
Status			✓	✓		✓	✓		✓	✓	
Tranquility	✓				✓	✓	✓	✓			

Note: motivator and mechanic terms were adapted from Peters and Cornetti (2019) and Reiss (2013).

Course Narrative. In gamification, narrative introduces the character, storyline sequence, theme, and objectives of a program to make it coherent and meaningfully integrated (Pujolà & Argüello, 2019). The course narrative consisted of an Epic Adventure with Knight Aidan to explore knowledge, and complete quests and challenges, along the journey to become a Child and Youth Care Professional. This storyline structurally unified the diverse course elements and engaged students in an immersive adventure. Course components were also reframed within this themed medieval narrative (quizzes and assignments became quests and challenges; course expectations became an Epic Adventure; progression options changed to map directions; percentages became points needed to conquer the kingdom).

Aesthetics. Aesthetics in gamification enhance visual attractiveness, course navigation, and organizes information for the user experience (Hsieh & Yang, 2020; Schell, 2014). The attractive design of the knight avatar, rewards graphics, and colourful themed epic adventure map reinforced the narrative. These graphics were integrated consistently across the course outline, PowerPoints, assignment instructions, activity handouts, online course components, emails, and

themed awards. The character's name and appearance were gender neutral to be inclusive and relatable for all students.

Self-Determination. Autonomy is foundational to gamification design as it correlates positively to intrinsic motivation, psychological health, and enhanced learning experiences (Kam & Umar, 2018; Mekler et al., 2017). Students controlled their progression through course elements, including required and optional summative assessments with flexible deadlines. With the freedoms inherent in self-determination, students had to take initiative and responsibility to complete course expectations. The two major assignments for this course provided students with choices over topics, individual or group completion, presentation formats, and timelines.

Points. Points encourage focus on learning, task completion, and provide feedback on content mastery (Inchamnan & Chomsuan, 2021; Mekler et al., 2017). Rather than earning percentages for assessments, students accumulated up to a maximum of 1000 points throughout the course. This mastery driven design created a positive focus on building skills and competencies, as students' point tallies increased with course progression.

Teams. With a desire to establish a positive learning community, efforts to build social belongingness and learning through the teams mechanic were integral to this course (Borrás-Gené, 2019). In-class leadership activities and assignments included self-selected small group work that increased social connectivity and afforded collaborative learning. Assessments were constructed to encourage interdependence, problem-solving, and peer support.

Unlimited Attempts Tests. Utilizing test banks, knowledge acquisition was assessed throughout the term using eight randomly generated, automatically graded with immediate feedback, online quizzes (Krath et al., 2021). Students could attempt these 10-questions-in-10-minutes quizzes an unlimited number of times. This mechanic reinforced trial and error learning as a means to play, improve, and reduced single-attempt test anxiety (Molina-Carmona & Llorens-Largo, 2020). It rewarded engagement and incremental effort, not just successful completion (Alsawaier, 2018).

High Score. With the intent to increase points of contact with course materials, knowledge mastery, reward incremental gains without penalty, and decrease test anxiety, only the highest score was recorded for each quiz (Agapito & Rodrigo, 2018). Student success on the quizzes could potentially increase their confidence and competence to complete the larger scaffolded single-attempt check-point quizzes (midterm and final exams) that were unlocked once students met a threshold of 16/20 points on sets of four quizzes.

Badges. Badges often play into game-based learning to boost performance and recognize competency achievements (Inchamnan & Chomsuan, 2021). Within the course, virtual badges were awarded for task completion to provide visual online tracking of student progress.

Coins. In the second iteration of the course, medieval themed community coins were added as currency to recognize positive community building efforts within the classroom for demonstrations of kindness, support, and acceptance (Borrás-Gené, 2019). Three large silver-plated themed

coins were awarded on the final day of class for one instructor-defined and two student-defined recognitions.

Leaderboard. The leaderboard was a dynamic online chart that revealed accumulated points to date for each student, confidentially comparing their standing with classmates, and engaging their desire for competition and recognition (Inchamnan & Chomsuan, 2021; Jia et al., 2017). Students received congratulatory emails at random intervals from Knight Aidan when they reached the top of the leaderboard and public recognition for this achievement was periodically given in class. At the end of the term, the reigning student at the top of the leaderboard received a certificate and prize.

Bonuses and Rewards. In-class participation, student engagement, and risk taking (answering questions) were encouraged and reinforced throughout the term with the reward of bonus points, praise, and small candy treats. Rewards were utilized to recognize incremental changes, significant achievements, and at times randomly to ensure that all students received recognition, inclusion, and experienced success (Adams & Preez, 2021). At the end of term, certificates were awarded to students for both instructor and student defined achievements.

Prototype, Evaluation, and Re-Iteration

A two-year implementation plan was designed (fall 2018 and 2019 terms) to afford course re-design, deployment, evaluation, and reiteration. As the student response was exceedingly positive to the first iteration, almost all elements of the initial gamified course redesign were carried through to the second iteration. Encouraging student feedback and implementing responsive revisions reinforced user engagement and investment in the redesign process (Barzola et al., 2021).

Based on student feedback and knowledge gained on the pedagogy, four adjustments were made to the second iteration. An on-boarding quiz was added to familiarize students with the quiz format and ensure they understood the structure of the gamified course (Kapp, 2012). Students also completed the Reiss Motivational Profile (Reiss et al., 2017) before the second iteration; however, the group data did not identify any new patterns of motivators other than food, which was already hooked with rewards. The badges mechanic was deemphasized due to perceived ineffectiveness and community coins were added to increase social contact.

Findings

Student evaluations were considered a logical form of qualitative assessment since the focus of this exploration of gamification pedagogy was user experience (Bai et al., 2020). Students completed anonymous formal written evaluations at the end of each term following debriefings on gamification pedagogy. Evaluation response rates were high, totalling 37/44 (84.1%) for the first iteration and 42/44 (95.5%) for the second iteration. In addition, some quantitative information was collected on behavioural indicators as a measure of gamification engagement (Majuri et al., 2018; Perski et al., 2017; Zainuddin et al., 2020).

Students assessed the overall structural gamification design and 12 gamified mechanics for their effectiveness in motivating learning engagement using a Likert scale. The formal course evaluation responses were consolidated in Figures 3 and 4.
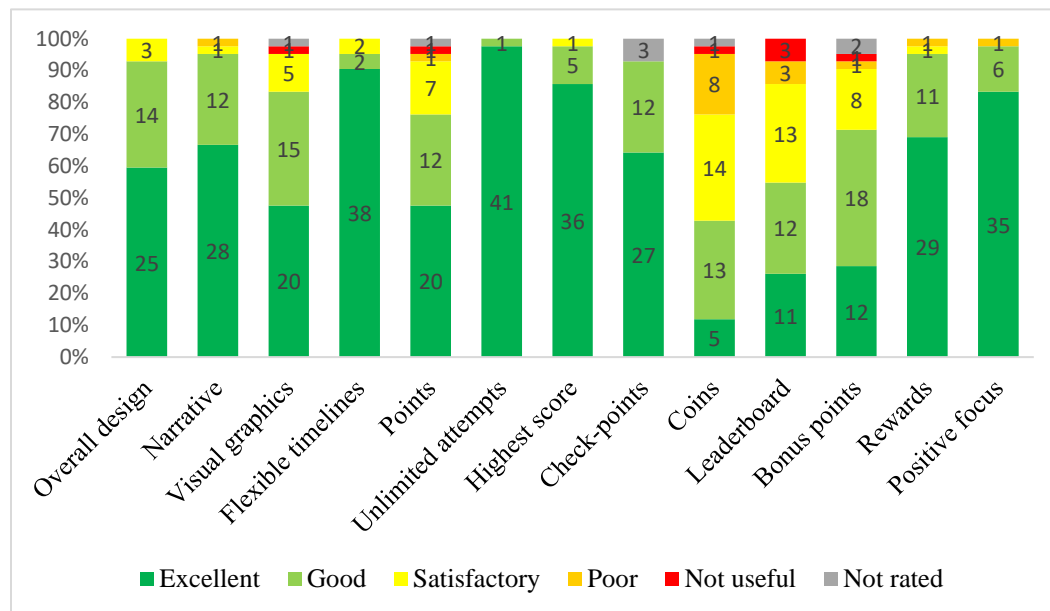
Figure 3

Student Evaluation Results on Perceived Effectiveness of Mechanics for Learning Engagement (Fall 2018), n = 37
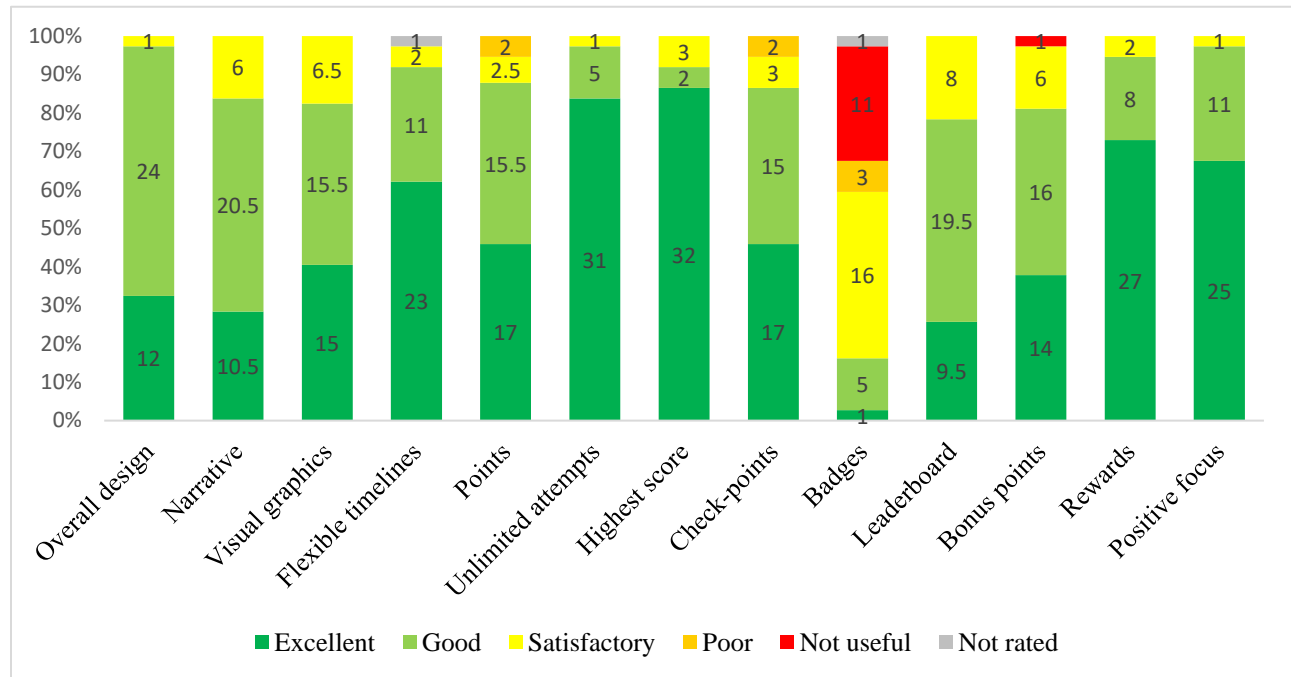
Figure 4

Student Evaluation Results on Perceived Effectiveness of Mechanics for Learning Engagement (Fall 2019), n=44

The evaluations also elicited qualitative feedback with five open-ended questions that assessed perceived effectiveness of gamified course elements in engaging learning and achieving content mastery. The following summary of qualitative results represents student feedback for both iterations of the redesigned gamified course. (Note: descriptors were taken directly from student evaluations).

Table 2

Summary of Student Evaluation Responses to Open-ended Questions (Fall 2018 and 2019)

Mechanic	Student Feedback
Gamified Course Design	Students described the overall gamified design as fun, engaging, motivating, and interesting. Some students directly attributed their success in the course to gamification pedagogy, saying it made the class feel more relaxed, less stressful, and motivated students to complete their work.
Narrative	The themed narrative tied course elements together and provided comprehensive information on evaluation and rubrics. Students found periodic congratulatory emails from the course avatar reinforced and rewarded achievements.
Visual Graphics	Students enjoyed the graphics, found the colors exciting, the inclusion of an avatar fun, and they appreciated the continuity of graphics between the on-campus and online course components.

Flexible Timelines	Flexible timelines increased students' sense of autonomy and reduced anxiety by providing freedom to work at their own pace. They also noted that this flexibility promoted responsibility.
Points	Points helped build confidence, decreased stress, and points accumulation motivated students toward content mastery. Some student comments were more ambivalent; however, this decrease in perceived effectiveness may be related to one student "gaming the system" (see discussion).
Unlimited Attempts	Unlimited attempts encouraged and motivated students to learn, decreased test anxiety, promoted effective study habits, and gave students agency over their grades. This mechanic was highly valued by international students for additional learning opportunities in their second language.
Highest Points	Students reported realizing increased achievement without the risk of negative consequences to be motivating and reinforcing. Studying for and completing multiple attempts at quizzes also increased student contact with course content and enhanced knowledge mastery.
Check-Points	Two single attempt check-point exams were unlocked based on quiz results. Some students credited this mechanic for their success in the course, said the scaffolding value of repeating quizzes was an effective study strategy, and valued their format in terms of accountability.
Badges	In the first iteration of the gamified course, online badges tracked completion of quests and challenges. Only 16.7% of students rated this mechanic good/excellent and 38.9% rated it poor/not useful. Due to these poor evaluations, badges were removed from the second iteration.
Coins	Medieval themed community coins were introduced in the second iteration to promote positive community development and recognition. Students commented this element was cool but needed more emphasis during class to encourage them to physically bring coins to participate.
Leaderboard	Competition motivated students enjoyed leveling-up, becoming a master, and said this mechanic drove them to get higher marks. The leaderboard was motivating, valuable in checking individual and classmates' progress.
Bonus Points	Although the bonus points only amounted to 1% of students' final grade, some students were highly motivated by this mechanic, arriving 15 minutes early for class to request opportunities to earn bonus points. They recommended increasing this mechanic's weighting in future iterations.
Rewards	The reward treats encouraged students to overcome previous inhibitions about public speaking and contribute to class discussions. Students expressed appreciation for the immediacy of the reward system, stated it promoted a positive learning culture, and fun learning experiences.
Positive Focus	The positive approach helped balance the seriousness of course content and promoted a supportive learning environment with a manageable workload. Students attributed part of the positive focus and their success to the instructor's openness, effectiveness, and relational style of teaching.

| Teams | The in-class self-selected processing groups, small group assignment, and the group research assignment promoted engagement, inclusivity, and made students feel that their voices mattered and were heard. Students learnt from each other's experiences and developed leadership skills. |

Discussion

This study explored whether gamification pedagogy could be effectively conceptualized and operationalized in higher education to address historical issues within an identified course and enhance student learning engagement. The discussion section will explore students' responses to the redesigned gamified CYCP course in terms of these research questions and situate their experiences within recent research.

Gamification Pedagogy and Course Redesign

The comprehensive student-centric, motivationally based model of gamification pedagogy was effectively operationalized for course design, met contemporary students' learning needs, and resolved pre-existing course challenges. The results support previous findings that gamification design increased student engagement, academic success, study behaviour, and learning experience (Aleksic-Maslac et al., 2018; Bouchrika et al., 2021; Huang & Hew, 2021). In addition, students reported experiencing increased empowerment, agency, and decreased anxiety, likely demonstrating an effective matching of motivators, mechanics, and learning outcomes (Dichev & Dicheva, 2017; Molina-Carmona & Llorens, 2020). Gamification pedagogy also effectively addressed historical challenges with the course content, structure, and assessments, and provided an engaged, success-driven, and enjoyable learning environment. The generalizability of these results lies not in the specific redesign of this course, but in how it's methodology can be applied to other users, content areas, and objectives.

While the course content and academic rigor were preserved, the learning culture, course structure, and student experience were transformed. Building on Aleksic-Maslac et al. (2018) and Huang and Hew's (2021) findings on gamification, students reported increased motivation to engage with and learn course content, and enhanced learning experiences. The consistently high survey results suggest that the motivators identified in the player prototypes effectively "hooked" students to engage, learn, and succeed (Dichev & Dicheva, 2017; Molina-Carmona & Llorens, 2020).

This study reinforced findings that gamification heightened student experience, engagement, behavioural changes and learning outcomes (Fleischmann & Ariel, 2016; Jo et al., 2018; Nurtanto et al., 2021), and that a systematic framework for gamification design resulted in targeted behaviour change (Epstein et al., 2021; Molina-Carmona & Llorens-Largo, 2020), as opposed to mixed results from only introducing gamified mechanics (Gallego-Duran et al., 2019; Hung, 2017).

The course design appealed to contemporary students' values, interests, and learning needs, resulting in the course elements and teaching approach being perceived as relevant and responsive (Mohr & Mohr, 2017). The motivator-mechanic pairings built an inclusive learning

context replete with agency, community, engagement, inclusion, recognition, enjoyment, and success (Cretu et al., 2020; Henley, 2019). Students described a positive learning culture that embraced support, challenge, and capacity. They found the learning strategies effective, practical, varied, and valued developing trusting and supportive relationships.

The student-centric design process afforded opportunities to expand definitions of success beyond traditional high grades. Supporting Guay's (2016) study, student motivators reflected cultural constructs of achievement and success and were incorporated into the embedded mechanics of the gamified design. By engaging with diverse student motivators, a broader definition of academic success was created, valuing a greater range of students' real-world attributes and abilities. This range of acknowledgement created room for students to recognize and celebrate each other's strengths, and built a supportive, inclusive, and empowering learning community (Kumar et al., 2018).

Enhanced Student Engagement

Throughout the course, students expressed and displayed enthusiasm for the immersive gamification pedagogy. The flexibility of the mechanics provided opportunities for course design elements that met contemporary students' learning preferences, such as digital assessments, micro-chunks of learning, responsive and casual communications, knowledge-sharing, choices, and a relational style of instruction (Cretu et al., 2020; López-Santacruz & Guízar-Mendoza, 2022; Mohr & Mohr, 2017).

Students identified the narrative and thematic graphics across on-campus and online course components as innovative, unifying, and fun, supporting previous findings that integrated visual graphic mechanics created an immersive learning context that enhanced user experience (Hsieh & Yang, 2020; Majuri et al., 2018). Congratulatory emails from the course avatar were also highly valued, confirming the value of 'juicy' feedback (Perryer et al., 2016) and Roche et al.'s (2018) findings that completion emails increased student engagement.

The use of the points mechanic over percentages motivated students to positively focus on completing assessments, reinforcing points motivational impact on learning engagement and increased performance (Helmefalk, 2019; Saran et al., 2018). Points built into the leaderboard mechanic, which most students reported highly motivational, reaffirming Sun and Hsieh's (2018) findings that interactive and competitive mechanics increased student attention and learning; however, one student found this mechanic discouraging as it reflected how far they were falling behind their classmates.

The relatively lower ratings of leaderboard and points in the second iteration were contrary to studies on its effectiveness (Aldemir et al., 2018; Ortiz-Rojas et al., 2019) and may be related to one student "gaming the system" (Kapp et al., 2014, p. 235) near the end of the second iteration by learning modules and completing quests ahead of the course schedule in order to stay on top of the leaderboard. This impacted the motivational capacity of the competitive mechanic for other students. In future iterations, adaptive release of quizzes could prevent this anomaly.

Contrary to studies supporting the efficacy of badges (Hamari, 2017; Helmefalk, 2019; Xu et al. 2021), 38.9% of students rated badges poor/not useful. Part of the lack of this mechanic's success may lie in how it was undervalued in the course in terms of lacking any extrinsic reward or recognition system. Interestingly, Kyewski and Krämer (2018) also found that student activity was unmotivated by badges and Facey-Shaw et al. (2019) determined that as external motivators, badges decreased intrinsic motivation. The coins mechanic was also not well received by students. The relative failure of these two mechanics might be due to improper motivator-mechanic pairings, a lack of emphasis by the professor, or a satiation of motivators matched to other mechanics.

Students stated the combination of unlimited attempts, high score, and check-points created a safe and positive learning context. Consistent with Hung's (2017) research, students reported realizing increased achievement without the risk of negative consequences to be motivating and reinforcing. Students with high anxiety and second language learners credited this combination for their academic success, affirming Petrovic-Dzerdz's (2019) finding of benefits for retrieval-based learning activities.

The system of playful incentivization, bonus points, and peer-defined awards were seen to be socially motivating and fostered prosocial learning (Borrás-Gené, 2019; Hwang & Choi, 2020; Roche et al., 2018). Supporting Antonaci et al.'s (2019) research on gamified community-building, students stated the small groups promoted engagement, inclusivity, and made them feel their voices mattered and were heard. Student evaluations also supported findings that student perceptions of a caring and supportive professor reinforced a positive learning culture and increased student satisfaction (Geier, 2020; Mendoza et al., 2021).

Resolution of Historical Course Challenges

Supporting Palomino's (2019) findings, the unifying narrative engaged students and empowered them to successfully control their progress through the course. The necessity of multiple assessments was readily accepted as part of the narrative and digitally enhanced gamified design. Students on average chose to complete each quiz six times, contributing to higher final grade outcomes, supporting findings that systematic gamification frameworks result in behaviour change (Epstein et al., 2021).

In terms of scope of course content, the points mechanic created a positive focus on building skills and competencies and reportedly encouraged content mastery (Venter, 2020). Flexible timelines increased students' sense of autonomy and reduced anxiety by providing the freedom to self-pace, encouraging responsibility and accountability (Atmaja & Mandyartha, 2020). A strengths-based context for diverse platforms of learning and assessment emerged. Students reportedly felt empowered to successfully manoeuvre through the potentially triggering scope of the course content.

The gamified design empowered students struggling with anxiety to surmount previous barriers to success. They reported a combination of gamified mechanics (unlimited attempts, high score, flexible timelines, points, positive focus) allowed them to manage their anxiety more effectively,

to the point that no student with approved accommodations requested any additional supports. Pitoyo (2019) similarly found that access to repeat online quizzes increased students' motivation, confidence, and decreased test anxiety.

Conclusion

This research is significant in that it creates room for innovative pedagogy in post-secondary education, while maintaining existing learning objectives, course content, and academic rigor. It also presents a new educational standpoint that realigns course design with contemporary students' natural motivators, requiring a shift from the traditional power structure of academia (McInnes, 2013; Miller et al., 2013) to a student-centric course design process (Nurtanto et al., 2021).

While all students may not have been motivated by all mechanics in this study, the comprehensive gamified design was inclusive enough to engage every student throughout the course. Although these results are promising, further study into the specific motivator-mechanic matches is needed (Kocadere & Çağlar, 2018). A rigorously designed scientific methodology could assess the effectiveness of specific motivator-mechanic pairings at a granular level.

The successful implementation of gamification as a comprehensive pedagogy necessitated the development of operational expertise in gamification, in addition to the area of academic study. This need for proficiency in gamified design was also identified by Mellor et al. (2018) when they ran into design and development challenges that their academic teams could not address. Cross-disciplinary knowledge is needed to reorient the academic course designer's standpoint to reconceptualize course development from an instructional design perspective (Yamani, 2021).

As gamification pedagogy is student-centric, it also requires knowledge of learner characteristics and their motivators (Barber, 2021). A purposeful and thorough strategy must be employed to acquire this knowledge, and courses must be redesigned in response to cohort changes. This requires faculty to invest significant energy and time in course development to plan for student success. As gamified design is based on targeted learners' motivators, periodic reassessment of students' player prototypes and adjustments to course mechanics would be required.

The pedagogy of gamification in course design holds some limitations in terms of applicability, development, and sustainability. Gamification is not indicated for every subject and may not align with every faculty member's teaching philosophy (Geier, 2020; Palmquist, 2021). In addition, gamified projects take significant time to develop and facilitate effectively. Even when course content, instructional philosophy, and design considerations align, subsequent iterations of a gamified course remain dependent on whether this pedagogy resonates with future faculty.

By design, student-centric, motivationally based gamification pedagogy should theoretically be equally effective with any targeted group of students and any subject matter to achieve desired outcomes. As such, it shows great potential to energize and modernize education, as well as design empowering, successful, and enjoyable learning experiences. The inclusive design can

afford tailored learning opportunities to hook divergent student groups' motivators within a single learning context.

This pedagogy could be used to explore whether traditional post-secondary education aligns with the natural motivators of marginalized people (Haigh, 2020). Could an unappreciated mismatch in motivator-mechanics be contributing to poor engagement, academic outcomes, and the perceived inaccessibility of education among racialized, Indigenous, and immigrant people (Banks & Dohy, 2019; Connauton, 2020; Dari et al., 2021; Nichols et al., 2020)? If this were found to be the case, then could operationalizing a comprehensive gamification pedagogy redress this?

Similarly, for students that have been unsuccessful in traditional classrooms, could a comprehensive gamification approach hook the natural motivators of special needs students in either resourced or integrated classroom settings? Often the cognitive and physical developmental needs of such students are assessed in program design (Hargreaves, 2020), but what about consideration of how they could be intrinsically motivated to learn and succeed both academically and socially?

Gamification has been applied to engage online learners (Borrás-Gené et al., 2019) and address issues of student engagement and retention (Bornschlegl & Cashman, 2019). Could effective motivator-mechanic parings increase engagement with course content, sense of learning community, and academic success in distance delivery educational programs? In addition, could mechanics such as unlimited attempts, high score, and unlocking, offer unproctored assessment options for online courses that support academic integrity and maintain academic rigor?

Finally, in light of the adverse mental health impacts on students from the recent COVID pandemic (Rudenstine et al., 2020; Wang et al., 2020), further research into whether gamification pedagogy could help alleviate student anxiety and re-engage them positively in a learning community could be valuable (Xu et al., 2021). As universities pivot to bring students back on campus following the realities of disrupted modalities of teaching, could gamification pedagogy be a useful pedagogical tool to bridge student re-engagement between online and on-campus learning contexts?

Conflict of Interest

References

Adams, S.P. & Du Preez, R. (2022). Supporting Student Engagement Through the Gamification of Learning Activities: A Design-Based Research Approach. *Tech Know Learn,* 27, 119–138. https://doi.org/10.1007/s10758-021-09500-x

Adkins-Jablonsky, S. J., Shaffer, J. F., Morris, J. J., England, B., & Raut, S. (2021). A tale of two institutions: Analyzing the impact of gamified student response systems on student anxiety in two different introductory biology courses. *CBE—Life Sciences Education*, 20(2). https://doi.org/10.1187/cbe.20-08-0187

Agapito, J., Rodrigo, M. M. (2018, November). Identifying Meaningful Gamification-Based Elements Beneficial to Novice Programmers [Conference paper]. 26th International Conference for Computers in Education (ICCE 2018), 26-30, Metro Manila, Philippines. https://archium.ateneo.edu/discs-faculty-pubs/53/

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behavior*, 78, 235-254. https://doi.org/10.1016/j.chb.2017.10.001

Aleksic-Maslac, K., Rašić, M. & Vranesic, P. (2018, May 21-25). *Influence of gamification on student motivation in the educational process in courses of different fields* [Conference paper]. 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 0783-0787. https://doi:10.23919/MIPRO.2018.8400145

Alsawaier, R. S. (2018). The effect of gamification on motivation and engagement. *International Journal of Information and Learning Technology*, 35(1), 56-79. http://dx.doi.org/10.1108/IJILT-02-2017-0009

American College Health Association (2019a). American College Health Association - National College Health Assessment II: Canadian Consortium. Executive Summary Spring 2019. Silver Spring, MD: American College. Health Association; 2019. Retrieved May 1, 2022 from https://www.cacuss.ca/files/Research/NCHA-II%20SPRING%202019%20CANADIAN%20REFERENCE%20GROUP%20EXECUTIVE%20SUMMARY.pdf

American College Health Association. (2019b). American College Health Association - National College Health Assessment II: MacEwan University Executive Summary Spring 2019. Silver Spring, MD: American College. Health Association; 2019. Retrieved May 1, 2022 from https://www.cacuss.ca/files/Research/NCHA-II%20SPRING%202019%20CANADIAN%20REFERENCE%20GROUP%20EXECUTIVE%20SUMMARY.pdf

Andrias, R. M. (2019). User/player type in gamification. *International Journal of Advanced Trends in Computer Science and Engineering*, 8(1.6), 89–94. https://doi.org/10.30534/ijatcse/2019/1481.62019

Antonaci, A., Klemke, R, & Specht, M. (2019). The effects of gamification in online learning environments: A systematic literature review. *Informatics*, 6(3), 32. https://doi.org/10.3390/informatics6030032

Atmaja, P., & Mandyartha, E. (2020). Gamification of assessment test through multiple question paths to facilitate participants' autonomy and competence. *Letters in Information Technology Education*, 3(1), 9–17. https://doi.org/10.17977/um010v3i12020p009

Attali, Y., & Arieli-Attali, M. (2015). Gamification in assessment: Do points affect test performance? *Computers & Education*, 83, 57–63. https://doi.org/10.1016/j.compedu.2014.12.012

Bachelor of Child and Youth Care, MacEwan University (2022). Retrieved May 10, 2022, from https://www.macewan.ca/academics/programs/bachelor-of-child-and-youth-care/

Bai, S., Hew, K. F. & Huang, B. (2020). Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review*, 30. https://doi.org/10.1016/j.edurev.2020.100322

Banks, T., & Dohy, J. (2019). Mitigating barriers to persistence: A review of efforts to improve retention and graduation rates for students of color in higher education. *Higher Education Studies*, 9(1), 118. https://doi.org/10.5539/hes.v9n1p118

Barber, C. S. (2021). When Students Are Players: Toward a Theory of Student-Centric Edu-Gamification Systems. *Journal of Information Systems Education,* 32(1), 53-64. https://aisel.aisnet.org/jise/vol32/iss1/5

Barzola, V., Pichardo, H., Macías, J., Zambrano, D. & Echeverria, V. (2021, September 20-24). *"I Need More Motivation": Engaging Students in the Gamification Design Process.* [Conference presentation]. Technology-Enhanced Learning for a Free, Safe, and Sustainable World: 16th European Conference on Technology Enhanced Learning, EC-TEL 2021, Bolzano, Italy, 310–314. https://doi.org/10.1007/978-3-030-86436-1_26

Boller, S., & Kapp, K. M. (2017). Play to learn: Everything you need to know about designing effective learning games. Alexandria, VA: ATD Press.

Bornschlegl, M., & Cashman, D. (2019). Considering the role of the distance student experience in student satisfaction and retention. *Open Learning*, 34(2), 139–155. https://doi.org/10.1080/02680513.2018.1509695

Borrás-Gené, O., Martínez-Núñez, M., & Martín-Fernández, L. (2019). Enhancing fun through gamification to improve engagement in MOOC. *Informatics*, 6(3), 28. https://doi.org/10.3390/informatics6030028

Botra, A., Rerselman, M., & Ford, M. (2014, May 7-9). *Gamification beyond badges* [Conference Paper]. IST-Africa conference proceedings, IEEE. Mauritius. http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6880651

Bouchrika, I., Harrati, N., Wanick, V. & Wills, G. (2021). Exploring the impact of gamification on student engagement and involvement with e-learning systems. *Interactive Learning Environments*, 29(8), 1244-1257. https://doi.org/10.1080/10494820.2019.1623267

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*, 225, 97–103. https://doi.org/10.1016/j.jad.2017.07.044

Buckley, J., DeWille, T., Exton, C., Exton, G., & Murray, L. (2018). A Gamification–Motivation Design Framework for Educational Software Developers. *Journal of Educational Technology Systems*, 47(1), 101–127. https://doi.org/10.1177/0047239518783153

Burke, B. (2014). Gamify: how gamification motivates people to do extraordinary things. Brookline, MA: Gartner.

Collmus, A. B., Armstrong, M. B., & Landers, R. N. (2016). Game-thinking within social media to recruit and select job candidates. *Social Media in Employee Selection and Recruitment*, 103–124. https://doi.org/10.1007/978-3-319-29989-1_6

Connauton, J. J. (2020). "It Feels Like A Battle to Tell Myself That I Am Worthy of Being Here": Understanding the Racially Marginalized Student Experience in Canadian Higher Education (thesis). Education and Research Archive, Edmonton.

Costa, F., Raleiras, M. & Viana, J. (2021, November 8-9). *12 Pedagogical Principles for the use of Gamification in Higher Education*. [Conference Paper]. ICERI 2021, Seville, Spain. https://doi.org/10.21125/iceri.2021.1607

Cretu, I., Grigore, M., & Scripcariu, I.-S. (2020). Get Ready for Gen Z, Our Next Generation of Medical Students. *Revista de Cercetare Si Interventie Sociala*, 69, 283–292. https://doi.org/10.33788/rcis.69.18

Dari, T., Chan, C. D., & Del Re, J. (2021). Integrating culturally responsive group work in schools to foster the development of career aspirations among marginalized youth. *The Journal for Specialists in Group Work*, 46(1), 75–89. https://doi.org/10.1080/01933922.2020.1856255

Dichev, C., & Dicheva, D. (2017). Gamifying education: what is known, what is believed and what remains uncertain: a critical review. *International Journal of Educational Technology in Higher Education*, 14(9). https://doi.org/10.1186/s41239-017-0042-5

Epstein D, Zemski A, Enticott J, & Barton C. (2021). Tabletop Board Game Elements and Gamification Interventions for Health Behavior Change: Realist Review and Proposal of a Game Design Framework, *JMIR Serious Games*, 9(1). https://doi.org/10.2196/23302

Facey-Shaw, L., Specht, M., van Rosmalen, P., & Bartley-Bryan, J. (2020). Do Badges Affect Intrinsic Motivation in Introductory Programming Students? *Simulation & Gaming*, 51(1), 33–54. https://doi.org/10.1177/1046878119884996

Fleischman, K., & Ariel, E. (2016). Gamification in Science Education: Gamifying Learning of Microscopic Processes in the Laboratory. *Contemporary Educational Technology, 7*(2), 138-159. https://doi.org/10.30935/cedtech/6168

Fleming, T. M., Bavin, L., Stasiak, K., Hermansson-Webb, E., Merry, S. N., Cheek, C., & Hetrick, S. (2017). Serious games and gamification for mental health: current status and promising directions. *Frontiers in Psychiatry*, 7, 215. https://doi.org/10.3389/fpsyt.2016.00215

Gallego-Durán, F. J., Villagrá-Arnedo, C. J., Satorre-Cuerda, R., Compañ-Rosique, P., Molina-Carmona, R., & Llorens-Largo, F. (2019). A guide for game-design-based gamification. *Informatics*, 6(4), 49. https://doi.org/10.3390/informatics6040049

Geier, M. T. (2021). Students' Expectations and Students' Satisfaction: The Mediating Role of Excellent Teacher Behaviors. *Teaching of Psychology*, 48(1), 9–17. https://doi.org/10.1177/0098628320959923

Guay, F. (2016). The virtue of culture in understanding motivation at school: Commentary on the special issue on culture and motivation. *British Journal of Educational Psychology*, 86(1), 154–160. https://doi.org/10.1111/bjep.12105

Hamari, J. (2017). Do badges increase user activity? A field experiment on the effects of gamification. *Computers in Human Behavior*, 71. https://doi.org/10.1016/j.chb.2015.03.036

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January 6–9). *Does gamification work? – A literature review of empirical studies on gamification* [Conference paper]. Proceedings of the 47th Hawaii International Conference on System Sciences, Hawaii, USA, 3025-3034. https://people.uta.fi/~kljuham/2014-hamari_et_al-does_gamification_work.pdf

Hargreaves, A. (202). Large-scale assessments and their effects: The case of mid-stakes tests in Ontario. *Journal of Educational Change*, 21, 393–42. https://doi.org/10.1007/s10833-020-09380-5

Landers, R. N,, Bauer, K. N. & Callan, R. C. (2017). Gamification of task performance with leaderboards: A goal setting experiment. *Computers in Human Behavior*, 71, 508-515. https://doi.org/10.1016/j.chb.2015.08.008

Haigh, M. (2020). Curriculum design for diversity: layering assessment and teaching for learners with different worldviews. *Journal of Geography in Higher Education*, 44(4). https://doi.org/10.1080/03098265.2020.1803224

Helmefalk, M. (2019). An interdisciplinary perspective on gamification: Mechanics, psychological mediators and outcomes. *International Journal of Serious Games*, 6(6), 3-26. https://doi.org/10.17083/ijsg.v6i1.262

Henley, D. (2019, July 16). *How to inspire and Motivate your Gen Z employees.* Forbes. Retrieved August 17, 2022, from https://www.forbes.com/sites/dedehenley/2019/07/11/how-to-inspire-and-motivate-your-gen-z-employees/

Hew, K. F., Huang, B., Chu, K. W. S., & Chiu, D. K. (2016). Engaging Asian students through game mechanics: Findings from two experiment studies. *Computers & Education*, 92, 221–236. https://doi.org/10.1016/j.compedu.2015.10.010

Holston, J. M. (2020). "Lofty Goals" vs. "I just want my degree, dude": Tailoring Compressed-Length Courses to Generation Z. *Currents in Teaching & Learning*, 12(1), 65–78.

Hsieh, H. C. L. & Yang, H. H. (2020). Incorporating gamification into website design to facilitate effective communication. *Theoretical Issues in Ergonomics Science*, 21(1), 89-111. https://doi.org/10.1080/1463922X.2019.1645920

Huang, B., & Hew, K. F. (2021). Using Gamification to Design Courses: Lessons Learned in a Three-year Design-based Study. *Educational Technology & Society*, 24(1), 44–63. https://www.researchgate.net/publication/348136309_Using_Gamification_to_Design_Courses_Lessons_Learned_in_a_Three-year_Design-based_Study

Hung, A. C. Y. (2017). A Critique and Defense of Gamification. *Journal of Interactive Online Learning*, 15 (1). ISSN: 1541-4914. https://www.ncolr.org/jiol/issues/pdf/15.1.4.pdf

Hwang, J. & Choi, L. (2020). Having fun while receiving rewards?: Exploration of gamification in loyalty programs for consumer loyalty. *Journal of Business Research*, 106, 365-376. https://doi.org/10.1016/j.jbusres.2019.01.031

Inchamnan, W., & Chomsuan, J. (2021). The Gamification Design for Affordances Pedagogy. *Advances in Science, Technology and Engineering Systems Journal*, 6(4), 138–146. https://doi.org/10.25046/aj060416

Isaacs, A. N., Scott, S. A. & Sarah A. Nisly, S. A. (2020). Move out of Z way Millennials. *Currents in Pharmacy Teaching and Learning*, 12(12), 1387-1389. https://doi.org/10.1016/j.cptl.2020.07.002

Jia, Y., Liu, Y., Yu, X. & Voida, S. (2017, May 7-11). Designing Leaderboards for Gamification: Perceived Differences Based on User Ranking, Application Domain, and Personality Traits [Conference paper]. The 2017 CHI Conference, Colorado, 1949-1960. https://doi.org/10.1145/3025453.3025826

Jo, J., Jun, H., & Lim, H. (2018). A comparative study on gamification of the flipped classroom in engineering education to enhance the effects of learning. *Computer Applications in Engineering Education, 26*(5), 1626-1640. https://doi.org/10.1002/cae.21992

Kalogiannakis M., Papadakis S., & Zourmpakis A. I. (2021). Gamification in Science Education. A Systematic Review of the Literature. *Education Sciences*, 11(1), 22. https://doi.org/10.3390/educsci11010022

Kam, A. H., & Umar, I. N. (2018). Fostering authentic learning motivations through gamification: A self-determination theory (SDT) approach. *Journal of Engineering Science and Technology*, 13, 1-9. http://jestec.taylors.edu.my/i-Cite%202018/i-Cite_01.pdf

Kapp, K. M. (2012). The Gamification of learning and instruction: Game-based methods and strategies for training and education. San Francisco, CA: Pfeiffer.

Kapp, K. M., Blair, L., & Mesch, R. (2014). *The gamification of learning and instruction fieldbook: Ideas into practice*. San Francisco, CA, CA: Wiley & Sons.

Klemke, R.; Eradze, M.; & Antonaci, A. The flipped MOOC: Using gamification and learning analytics in MOOC design—A conceptual approach. *Education Sciences,* 2018, 8, 25. https://doi.org/10.3390/educsci8010025

Kocadere, S. A. & Çağlar, S. (2018). Gamification from Player Type Perspective: A Case Study. *Journal of Educational Technology & Society*, 21(3), 12-22. https://www.jstor.org/stable/26458503

Koivisto, J. & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. *International Journal of Information Management*, 45, 191-210. https://doi.org/10.1016/j.ijinfomgt.2018.10.013

Koumachi, B. (2019). The Digital Turn in Higher Education: "Digital Natives" Mythbusted. *International Journal of Technology in Education and Science*, 3(1), 56-62. Retrieved August 16, 2022 from https://www.learntechlib.org/p/207268/

Krath, J., Schürmann, L., & von Korflesch, H. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, 125. https://doi.org/10.1016/j.chb.2021.106963

Kumar, R., Zusho, A., & Bondie, R. (2018). Weaving Cultural Relevance and Achievement Motivation Into Inclusive Classroom Cultures, *Educational Psychologist*, 53(2), 78-96, https://doi.org/10.1080/00461520.2018.1432361

Kyewski, E., & Krämer, N. C. (2018). To gamify or not to gamify? an experimental field study of the influence of badges on motivation, activity, and performance in an online learning course. *Computers & Education*, 118, 25–37. https://doi.org/10.1016/j.compedu.2017.11.006

Litvin, S., Saunders, R., Maier, M. A., & Lüttke, S. (2020). Gamification as an approach to improve resilience and reduce attrition in mobile mental health interventions: A randomized controlled trial. *PLOS One*, 15(9). https://doi.org/10.1371/journal.pone.0237220

López-Santacruz, H. D., & Guízar-Mendoza, J. M. (2022). A new challenge for Dental Education: Generation Z. *Odovtos - International Journal of Dental Sciences*, 36–40. https://doi.org/10.15517/ijds.2022.50804

Majuria, J., Koivistoa, J., & Hamari, J. (2018, May 21-23). *Gamification of education and learning: A review of empirical literature* [Conference paper]. 2nd International GamiFIN Conference (GamiFIN 2018), Pori, Finland. http://ceur-ws.org/Vol-2186/paper2.pdf

McInnes, D. (2013). The performance of academic identity as pedagogical model and guide in/through lecture discourse. *Teaching in Higher Education*, 18(1). https://doi.org/10.1080/13562517.2012.678327

Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. *Computers in Human Behavior*, 71, 525–534. https://doi.org/10.1016/j.chb.2015.08.048

Mellor, K. E., Coish, P., Brooks, B. W., Gallagher, E. P., Mills, M., Kavanagh, T. J., Simcox, N., Lasker, G. A., Botta, D., Voutchkova-Kostal, A., Kostal, J., Mullins, M. L., Nesmith, S. M.,

Corrales, J., Kristofco, L., Saari, G., Steele, W. B., Melnikov, F., Zimmerman, J. B., & Anastas, P. T. (2018). The safer chemical design game. Gamification of green chemistry and safer chemical design concepts for high school and undergraduate students, *Green Chemistry Letters and Reviews*, 11(2), 103-110. https://doi.org/10.1080/17518253.2018.1434566

Mendoza, I. D. C., Campuzano, M. F. P., & Laz, E. M. S. A. (2021). Traditional Methodologies and Gamification: A Proposal for Interactive Classes. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 18(08), 4033-4042. https://archives.palarch.nl/index.php/jae/article/view/9637

Mental Health Commission of Canada (2020). Post-Secondary Students Standard. Retrieved May 01, 2020, from https://www.mentalhealthcommission.ca/English/studentstandard

Mental Health Commission of Canada (n.d.). Post-Secondary Student Mental Health - Promoting Student Success. Retrieved June 1, 2020 from https://www.mentalhealthcommission.ca/sites/default/files/2019-06/post_secondary_student_standard_one_pager_eng.pdf

Miller, C., Metz, M., & McNear, J. (2013). A comparison of traditional and engaging lecture methods in a large, professional-level course (719.9). *Advances in Physiology Education*, 37(4), 347–355. https://doi.org/https://doi.org/10.1152/advan.00050.2013

Mohr, Kathleen A. J. & Mohr, Eric S. (2017) Understanding Generation Z Students to Promote a Contemporary Learning Environment. *Journal on Empowering Teaching Excellence*, 1(1). https://doi.org/10.15142/T3M05T

Molina-Carmona, R., & Llorens-Largo, F. (2020). Gamification and advanced technology to enhance motivation in education. *Informatics*, 7(2), 20. https://doi.org/10.3390/informatics7020020

Morschheuser, B., Hassan, L. Werder, K. & Hamari, J. (2017). How to design gamification? A method for engineering gamified software. *Information and Software Technology,* 95, 219-237. https://doi.org/10.1016/j.infsof.2017.10.015

Mustafa, A. & Karimi, K. (2021). Enhancing Gamified Online Learning User Experience (UX): A Systematic Literature Review of Recent Trends. In *Human-Computer Interaction and Beyond: Advances Towards Smart and Interconnected Environments* (pp.74-99). Bentham Science Publishers. https://doi.org/10.2174/9789814998819121010007

Nacke, L. E., & Deterding, C. S. (2017). The maturing of gamification research. *Computers in Human Behaviour*, 71, 450-454. https://doi.org/10.1016/j.chb.2016.11.062

Nichols, L., Ha, B., & Tyyskä, V. (2020). Canadian immigrant youth and the Education-Employment Nexus. *Canadian Journal of Family and Youth / Le Journal Canadien De Famille Et De La Jeunesse*, 12(1), 178–199. https://doi.org/10.29173/cjfy29497

Nicholson, S. (2012, June 13-15). *A user-centered theoretical framework for meaningful gamification*. [Conference paper]. *Proc. Games + Learn. + Soc. 8.0.*, 223–230, Madison, WI. https://scottnicholson.com/pubs/meaningfulframework.pdf

Nurtanto, M., Kholifah, N., Ahdhianto, E., Samsudin, A., & Isnantyo, F. D. (2021). A Review of Gamification Impact on Student Behavioral and Learning Outcomes. *International Journal of Interactive Mobile Technologies*, 15(21), 22–36. https://doi.org/10.3991/ijim.v15i21.24381

Ortiz-Rojas, M., Chiluiza, K., & Valcke, M. (2019). Gamification through leaderboards: An empirical study in engineering education. *Computer Applications in Engineering Education*, 27, 777-788. https://doi.org/10.1002/cae.12116

Palmquist, A. (2021, June 1-3). *'Gamification was not the problem': A case study exploring factors affect teachers approvement of gamification* [Conference paper]. Mindtrek '21, Tampere/Virtual, Finland. https://doi.org/10.1145/3464327.3464347

Palomino, P. T., Toda, A. M., Oliveira, W., Cristea, A. I., & Isotani, S. (2019, July 15-18). *Narrative for Gamification in Education: Why Should you Care?* [Conference paper]. 2019 IEEE 19th International Conference on Advanced Learning Technologies, Maceió-Alagoas, Brazil. https://doi.org/10.1109/ICALT.2019.00035

Paľová, D., & Vejačka, M. (2022). Implementation of gamification principles into higher education. *European Journal of Educational Research*, 11(2), 763-779. https://doi.org/10.12973/eu-jer.11.2.763

Perryer, C., Celestine, N. A. Scott-Ladd, B. & Leighton, C. (2016). Enhancing workplace motivation through gamification: Transferrable lessons from pedagogy. *The International Journal of Management Education,* 14(3), 327-335. https://doi.org/10.1016/j.ijme.2016.07.001

Perski, O., Blandford, A., West, R., & Michie, S. (2017). Conceptualising engagement with digital behaviour change interventions: a systematic review using principles from critical interpretive synthesis. *Translational Behavioral Medicine*, 7(2), 254–267. https://doi.org/10.1007/s13142-016-0453-1

Peters, J., & Cornetti, M. (2020). Deliberate fun: A purposeful application of game mechanics to learning experiences. US: Sententia Publishing.

Petrovic-Dzerdz, M. (2019). Gamifying Online Tests to Promote Retrieval-Based Learning. *International Review of Research in Open and Distributed Learning*, 20 (2). https://doi.org/10.19173/irrodl.v20i2.3812

Pitoyo, M. D. (2019). Gamification based assessment: A Test Anxiety Reduction through Game Elements in Quizizz Platform. *Indonesian Journal of Educational Research*, 4 (1). https://doi.org/10.30631/ijer.v4i1.92

Polyanska A, Andriiovych M, Generowicz N, Kulczycka J, Psyuk V. (2022). Gamification as an Improvement Tool for HR Management in the Energy Industry—A Case Study of the Ukrainian Market. *Energies,* 15(4), 1344. https://doi.org/10.3390/en15041344

Pujolà, J.-T., & González Argüello, M. V. (2019, October 22). *Stories or Scenarios: Implementing Narratives in Gamified Language Teaching* [Conference paper]. 3rd International Symposium on Gamification and Games for Learning (GamiLearn'19), Barcelona, Spain. http://ceurws.org

Reiss, S. (2013). Myths of intrinsic motivation. IDS Publishing Corporation.

Reiss, S., Gianella, B., Gianella, D., Koch, D. M., Krötlinger Mag Irene, & Schulz, B. (2017). *The Reiss Motivation Profile what motivates you?* Werdewelt Verlags- und Medienhaus GmbH.

Roche, C. C., Wingo, N. P., Westfall, A. O., Azuero, A., Dempsey, D. M., & Willig, J. H. (2018). Educational Analytics: A New Frontier for Gamification? *Computers, Informatics, Nursing*, 36(9), 458–465. https://doi.org/10.1097/CIN.0000000000000455

Rudenstine, S., McNeal, K., Schulder, T., Ettman, C. K., Hernandez, M., Gvozdieva, K., & Galea, S. (2020). Depression and anxiety during the COVID-19 pandemic in an urban, low-income public university sample. *Journal of Traumatic Stress*, 34(1), 12–22. https://doi.org/10.1002/jts.22600

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior, 69*, 371-380. https://doi.org/10.1016/j.chb.2016.12.033

Saran, M., Al-Magsoosi, D. & Mohammed, D. (2018, October 22-23). *Gamification in e-learning: The Effect on Student Performance* [Conference paper]. 9th Annual International Conference on Computer Science Education: Innovation and Technology (CSEIT 2018), Singapore. https://www.researchgate.net/publication/329415817_Gamification_in_e-learning_The_Effect_on_Student_Performance

Sarker, M. N., Wu, M., Cao, Q., Alam, G. M. M., & Li, D. (2019). Leveraging Digital Technology for Better Learning and Education: A systematic literature review. *International Journal of Information and Education Technology*, 9(7), 453–461. https://doi.org/10.18178/ijiet.2019.9.7.1246

Schell J. (2014). The Art of Game Design: A Book of Lenses, Second Edition. FL, USA: CRC press.

Schlee, R. P., Eveland, V. B., & Harich, K. R. (2019). From Millennials to Gen Z: Changes in student attitudes about group projects. *Journal of Education for Business, 95*(3), 139-147. https://doi.org/10.1080/08832323.2019.1622501

Smiderle, R., Rigo, S. J., Marques, L. B., Peçanha de Miranda Coelho, J. A., & Jaques, P. A. (2020). The impact of gamification on students' learning, engagement and behavior based on their personality traits. *Smart Learning Environments*, 7(3). https://doi.org/10.1186/s40561-019-0098-x

Sun, J. C.-Y., & Hsieh, P. H. (2018). Application of a Gamified Interactive Response System to Enhance the Intrinsic and Extrinsic Motivation, Student Engagement, and Attention of English Learners. *Journal of Educational Technology & Society*, 21(3), 104–116. http://www.jstor.org/stable/26458511

Urh, M., Vukovic, G., Jereb, E., & Pintar, R. (2015). The model for introduction of gamification into e-learning in higher education. *Procedia - Social and Behavioral Sciences*, 197, 388–397. https://doi.org/10.1016/j.sbspro.2015.07.154

Venter, M. (2020, April 27-30). Gamification in STEM programming courses: State of the art [Conference paper]. *2020 IEEE Global Engineering Education Conference*, 859-866, Porto, Portugal/Virtual. https://doi:10.1109/EDUCON45650.2020.9125395

Wang, X., Hegde, S., Son, C., Keller, B., Smith, A., & Sasangohar, F. (2020). Investigating mental health of US college students during the COVID-19 pandemic: Cross-sectional Survey Study. *Journal of Medical Internet Research*, 22(9). https://doi.org/10.2196/22817

Werbach, K. & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business.* Philadelphia, PA: Wharton Digital Press.

Xu, J., Lio, A., Dhaliwal, H., Andrei, S., Balakrishnan, S., Nagani, U., & Samadder, S. (2021). Psychological interventions of virtual gamification within academic intrinsic motivation: A systematic review. *Journal of Affective Disorders*, 293, 444–465. https://doi.org/10.1016/j.jad.2021.06.070

Yamani, H. A. (2021). A conceptual framework for integrating gamification in elearning systems based on instructional design model. *International Journal of Emerging Technologies in Learning (IJET)*, 16(04), 14. https://doi.org/10.3991/ijet.v16i04.15693

Zainuddin, Z. (2018). Students' learning performance and perceived motivation in gamified flipped-class instruction. *Computers & Education,* 126. https://doi.org/10.1016/j.compedu.2018.07.003

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review*, 30. https://doi.org/10.1016/j.edurev.2020.100326