Educational Innovation in Focus: Advocating Game Design Principles in the Development of Business Simulations for Higher Education Learning

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Abstract

This paper explores the synergy between academic engagement and game design principles in higher education Game Simulation. Examining literature, empirical studies, and practical implementations, we identify key principles—such as narrative immersion, progression systems, and feedback mechanisms—that significantly enhance student engagement and learning outcomes. Drawing on real-world case studies, we offer insights into practical applications and lessons learned. This research contributes valuable considerations for educators and policymakers seeking to optimize academic engagement in higher education through the strategic integration of game design principles.

Keywords: Game Simulations, Game Design, Pedagogy

1 Introduction

In the dynamic landscape of education and technology, keeping pace with evolving trends is increasingly challenging. Despite these changes, higher education often adheres to traditional models, where students enroll to classes, review materials, complete coursework, and receive grades. Emerging challenges, such as shortened attention spans and the integration of AI as instructors, add complexity and additional challenge in providing an effective learning experience. As Instructors we have the duty and responsibility to prepare our students to be capable of problem solving and stray away from the ”One question, One answer”. This is to say, students must know how to solve multi-faceted problems that do not have one direct solution. To address these issues, the researcher proposes that Simulations and games offer a potent avenue for innovating the learning landscape. When implemented effectively, Simulations and Games can significantly boost student engagement, introduce alternative assessment methods, and foster stronger student connections. Despite common assumptions about its ineffectiveness in higher education, many studies who claim the in-effectivity of utilizing this tool, overlook crucial game design principles.

In the video game development industry, experts meticulously focus on creating, testing, and implementing game designs to optimize user experience, engagement, and retention. However, even with their expertise, challenges persist. This highlights the intricate nature of utilizing games and simulations, making it clear that non-experts in the game design field face an even greater challenge in conceptualizing and using games and simulation. Crafting compelling educational experiences is already a formidable task, but utilizing games and simulations, when approached correctly, holds promise in overcoming the existing challenges in higher education. In this paper The researcher would like to examine and argue why certain implementations of simulations and games in higher education were inconsistent or ineffective. In this paper it will first be discussed on the Advantages of incorporating Games and Simulations in Higher education, which will then go further into detail about Irregularities Arising from the Lack of Game Design Principles.

2 Advantages of Utilizing Games and Simulations in Higher Education

Let us first Examine the reason and benefits of actually utilizing Games and Simulations for learning purposes in higher education. According to [1], It can be observed that the learning outcomes of games and simulations can be broken down into 3 Categories. These Categories were, Cognitive outcomes, Behavioral outcomes and Affective Outcomes. The cognitive outcomes observed were “Knowledge acquisition”, “Perceptual skills”, and “Instructors’ engagement”. In the “knowledge acquisition” it was argued that, “Additionally, simulations provide an environment in which students can experiment with different strategies, adopt different roles, and take charge of their own decisions by assuming responsibility. Researchers found that, when solving problems, students are more likely to learn via playing a game than via a traditional learning experience [1]. In “Perceptual Skills”, it was also argued that “Other studies confirm the power of games and simulations in developing cognition abilities, especially in the instances of virtual simulations enhancing complex cognitive skills, such as self-assessment, or

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higher-order thinking. These are meta-cognitive skills, regarded as essential elements of in-depth learning. The incorporation of game mechanisms into simulations is widely recognised by researchers as beneficial, especially regarding laboratory tasks, where simulation scenarios urge students towards problem solving and reflection, thus achieving metacognitive outcomes [1] and Finally as in the Learning outcome from "Instructors' engagement", it was also argued that "Students are challenged to develop interpersonal, analytical and creative skills, discouraging absenteeism, feelings of boredom and reluctance, leading to academic achievement. However, simulations not only exhibit positive effects in the learning experience of the student, but also, do so for instructors, as well, in the context of teaching experience [1]. The Behavioral Outcomes obtained by the students were observed by the researchers to be "Social skills/teamwork" and "Interaction and feedback". The behavioral outcomes improved "Social skills/teamwork" by the students because of the relatively higher stakes of input from each student. It was argued that "Simulation games are often seen as powerful tools in promoting teamwork and team dynamics, collaboration, social and emotional skills, and other soft skills, including project management, self-reflection, and leadership skills, which are acquired through reality based scenarios with action-oriented activities [1]. On the other hand the learning outcome of "Interaction and feedback" was argued that "In GBL methods, meaningful feedback is a key factor in students achieving the objectives, as well as in being encouraged to reflect on misunderstandings and to transfer learning to new educational contexts. The affective outcomes were the most common benefit made by researchers in implementing Games and simulations. This is due to the fact that the affective outcome was "Motivation and engagement". In this research, It was argued that "Motivation is a combination of elements such as attention, relevance, confidence, and satisfaction, which can increase germane cognitive loads. According to the post-game evaluation, student motivation comes from peer learning and user cooperation. Moreover, when instructors teach strategy, this enhances student motivation and engagement, encouraging acceptance of the game, and leading to stronger interest in course-directed learning.". Observing all these learning outcomes, It can be noted that utilizing games and simulations for learning in higher education can be crucial in improving student experience and skills. Through Games and Simulations, students were able to gain necessary practical skills in a safe environment, improve their ability to work with their peers, and even become more motivated to engage in learning.

3 Irregularities Arising from the Lack of Game Design Principles

Despite the substantial amount of benefits from utilizing games and simulations for learning in higher education, There is still the existence of research that argues and debates the effectiveness of utilizing this tool for education. However, the researcher finds it somewhat misleading and unfair to put Games and Simulations in a blanket statement. As one researcher's implementation may far differ from another researcher's implementation. This is due to the nature of Games and simulations to be considerably varied. It can be observed that it is similar to having a group of students play basketball, having most of the students say it is not-enjoyable, and concluding the statement that "All sports games are not enjoyable for students". In this scenario, it could be argued that some students simply may find some other sport as interesting. Games and simulations should be in the same scenario as there is a wide variety of ways to implement Games and simulations. Because of this, the researcher would like to argue that some Games and Simulations became inconsistent due to bad implementation, but this can be resolved through understanding some game design principles. The researcher would like to observe are Understanding Player types, Utilizing systems for Player Retention, and Having good Difficulty scaling. The first game design principle that is commonly overlooked is the Omission of considering Player types. In some Research, it was argued that some students were very engaged while a large number of students in the same group have had an adverse response to the implementation. This may not be the fault of the implementation per se, but simply by the fact that not all students or players will have the same form of interest. Hence the disconnect or divide between the response to the implementation of games and simulation. According to Bartle's Taxonomy of Player Types [2], Individual players will have a preference on what they may find interesting in a game. Game designers commonly adhere to the principle of understanding player types, as comprehending the user base interacting with the system provides clarity on the necessary features. Bartle's Taxonomy of Player Types serves as a model to identify and comprehend the various player categories. According to Bartle's Taxonomy [2], the first player type is the Achiever, driven by goals within the game world, seeking mastery, optimal weapons, and points or achievements. Achievers often prioritize ranking and hierarchy, making competitive players fall into this category. Meeting the preferences of this type of player requires the incorporation of key elements. This includes establishing clear objectives and goals within the game, implementing a robust progression system, offering optimal rewards for achievements, and incorporating elements of competition and leaderboards. These features contribute to a gaming experience that aligns with the desires and motivations of this particular player archetype. The second type, Explorers, begins with exploring the game's topology and delves into breaking in-game physics, searching for knowledge, and gaining praise for it. Catering to the preferences of this player type necessitates the integration of specific elements within the gaming experience. It involves creating rich and expansive environments that encourage exploration and discovery, fostering knowledge acquisition as players delve into the intricacies of the game. Puzzle and mystery elements add an extra layer of engagement, challenging players intellectually.

Furthermore, incorporating narrative depth enhances the overall experience, immersing players in a compelling story that unfolds as they progress through the game. By weaving these elements together, one can create an environment that not only captivates but also resonates with the motivations of this particular player archetype. Socializers, the third type, emphasize community, relationships, and interactions. They enjoy conversations, sympathizing, joking, and value connecting with other players. Addressing the preferences of this player type requires the inclusion of specific elements within the gaming environment. This entails incorporating robust social features to facilitate communication and connection among players. Additionally, the establishment of guilds or clans and other group structures provides avenues for forming communities with shared interests. Social achievements become pivotal, encouraging positive interactions and recognizing players for their social engagement. Furthermore, promoting collaborative gameplay and incorporating roleplaying elements enhances the overall experience, fostering a sense of camaraderie and allowing players to immerse themselves in a dynamic social environment. By integrating these elements, one can create a gaming space that resonates with and satisfies the motivations of this particular player archetype. The fourth type, Killers, has distinct motivations, finding enjoyment in superiority and hierarchy. However, their nature differs from Achievers. Fulfilling the preferences of this player type necessitates the incorporation of specific elements within the gaming experience. This involves integrating competitive gameplay that challenges players and taps into their desire for strategic engagement. Leaderboards and rankings add a layer of competition, allowing players to showcase their skills and achievements. The inclusion of player vs. player (PvP) content fosters direct competition, creating an environment where combat and strategy take center stage. Rewarding PvP achievements becomes crucial, recognizing and incentivizing players for their prowess in player combat. Player consequences, such as the impact of in-game actions, add a dynamic element to the experience. Ensuring balanced competition is vital to maintain fair and enjoyable gameplay, while dynamic enemy artificial intelligence (AI) introduces challenging opponents, contributing to a consistently engaging and competitive gaming environment. Integrating these elements caters to the preferences of this particular player archetype, delivering a compelling and satisfying gaming experience. Considering these player types, an implementation of a game or simulation that caters to only one or two types may result in disengagement or disinterest of the other type of players which equates to a significant number of students. To establish an effective game and simulation systems in higher education, all player types' satisfaction must be taken into account. Failing to engage half the class in a gamified approach could lead to a negative perception of the overall system.

The second type of game design principle being overlooked is the Insufficient Consideration of Systems for Sustaining Player Retention. One issue that can be noted from research [1] is that there is initially a positive reception of games in simulation for learning. However, as time progresses it can be noted that there the engagement and interest of the students gradually go down. In this section, the researcher would like to argue that this is due to the games and simulations implemented in those researches, which did not have any systems to account for Player Retention. In the study of "player retention is still often overlooked as a crucial part of the design process of free to-play mobile games. In reality, it is an important aspect of the free-to-play business model, and strong player retention is often required for sustainable success." [3]. Though [3] has argued this in the context of free-to-play games, the same concept still applies as the main goal is to have user retention using specific strategies and systems. [3] has also argued that retention methods can be categorized in 3 types. Namely, Core retention methods, Advanced retention methods, and additional retention methods. The first category, which is the Core Retention methods, are defined by [3] as "These player retention methods affect the immediate engagement of the player, featuring the core loop of the game as well as game mechanics and gameplay elements which are closely tied within the core loop and progression of the game. This is the first layer of player retention and aims to bring the players back to the game after their first play sessions by providing enough initial goals and rewards." [3]. In core retention methods it can also be subcategorized further as, Core gameplay loops, appointment trigger, and progression and goals. The core gameplay loop is defined [3] in a Gamasutra article, the core loop is the beating heart of the game – a basic thing which the players do all over and over again while playing.". Because of this it was argued further that "Core loops can be considered as the basis for all the other retention methods, since everything else in the game is built on top of them. That is why the core loops are treated as the base for all other retention techniques in this thesis – in order to be able to understand why certain retention methods are relevant for the game in question, it is important to first understand the core motivation that drives the player forwards within the game. [3]. The Appointment trigger under core retention methods can be described as "According to Luton, appointment triggers are often tied within the core wait loop and are one of the most commonly used player retention techniques in free-to-play mobile games. They simply mean rewarding the player at a set time in the future, giving the players a reason to return to the game." This was noted as the most commonly used retention method as it can be relevant to all player archetypes. "In the end, each of these games utilize sessioning by leaving the player onto the wait point of the core loop, and offer rewards on returning, leaving the players wanting more and encouraging them to check back into the game by enticing them with rewards. They 53 serve as a motivation for each of the player archetypes, or in other words, do not specifically cater for any type since they offer rewards needed to progress and are necessary in order to advance in the game – unless paid to skip of course." [3]. The

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third subcategory Core Retention used is “progression and goals”. This subcategory has been defined as the sense of progression as well as goals and rewards are a very important part of the modern free-to-play mobile games and encourage the player to keep playing in order to achieve their goals, while making them feel rewarded for completing them [3]. Utilizing all these 3 can prove to be very effective in having user retention. However, they prove to be very intricate and complex to implement. Therefore, this is also supplemented with Advanced Retention Methods. Advanced retention methods were defined in this paper as “Whereas core retention methods is about the player retention methods which are integral parts of the core loop, advanced retention methods aim to engage the player as an extension to the core loop and mechanics, offering more advanced and not necessarily gameplay tied methods in order to further retain the player.” [3] The advanced retention methods were then subcategorized further into 3 more categories. These categories were Social interaction, Social Competition and New Game Content. The first subcategory was Social interaction. Social interaction was argued in the paper on Inside Social Games that there is no doubt that mobile games with robust social elements will be the leaders of entertainment, while engaging and ultimately retaining loyal users. On top of that, according to Luton, one of the rarest but possibly also one of the strongest player retention techniques utilized is social obligation, meaning the obligation the players feel when their response or actions are required for the progress of other players [3]. This was then further discussed that “Since social interaction is considered important for long the time retention by Dharni and Chiu, and social obligation is believed to be an effective method for player retention by Luton [3]. Social Competition falls into a somewhat similar method with social interaction however this focuses more on a competitive aspect rather than cooperative. Additionally, Luton states that competition is in human nature, and competitive mechanics in free-to-play include everything that has to do with competing against other human players, friends or random players alike. Because of the above, competitive elements can also be considered a strong player retention technique since they also create unlimited and never-ending challenges for the players competing against each other.”. And Finally, the last subcategory under Advanced retention methods was New game content. From the name itself it should be self-explanatory that this involves creating new content for players. According to [3], to maximize player retention for free-to-play mobile games, the developers must continuously release new content after the launch, so the players will not run out of content and churn because of this.”. This was further described by [3] as “In practice the new content may include anything from new levels, items and areas to explore to things to unlock. These content updates will keep even the veteran players coming back to the game to continue their progression and try out the new content, whereas they might remain churned. [3]. This, along with the core retention methods, holds great promise in achieving user retention. However, further methods can be applied which can be seen in the 3rd category argued by the paper. The 3rd category was named additional retention methods. Again, in this category it has been divided further into 3 more categories. These 3 categories were Push notifications, Daily Login rewards, Limited time events. In push notifications, it was argued as “According to Luton, push notifications or nudge triggers are often used in free-to-play mobile games, but they are considered both one of the most ineffective player retention methods and sometimes annoying spam by the players. They often act to remind the player of the existence of the game when they have seemingly already churned, tempting them to return.” [3]. This is followed similarly by utilizing the next category, Daily login rewards. In daily login rewards these were argued to be one of the simplest player retention methods are daily rewards, which offer a bonus to the player once a day for simply turning up and playing the game. These are given to the player at the beginning of the first session of the day and often increase over multiple days to encourage the player to return, but the escalation is reset upon missing a day as a punishment [3]. Finally, the last subcategory that was brought to be Limited time events that was argued to be “Events and sales as a player retention technique, though self-explanatory, can work as a strong trigger to engage the players. Events, associated with for example Christmas or Halloween, and limited time sales of the hard currency, both feed on the same principle – offering something special and for a limited time only [3]. Player retention methods observed by [3] though were in the context of free-to-play videogames. These methods can still be applied for gamification, games and simulation for learning in higher education. By utilizing all 3 types of retention methods (Core-retention methods, Advanced retention methods, and additional retention methods), one will be able to increase engagement for gamification, games and simulation for learning in higher education. The Third type of game design principle being overlooked is the Importance of Scaling Difficulty. Another point the researcher would like to argue that could lead to the in-effectivity of an implementation of gamification, games and simulations for learning in higher education is that there is the lack of understanding of giving a difficulty scaling. According to [4] “One of the fundamental issues to tackle in the design of video games is mostly referred to as creating a well-shaped difficulty curve. This means that one of the core elements of a good game design is to make the game just as difficult as it has to be, so that the player feels challenged enough, but not too much.” [4]. As without implementing the understanding of good difficulty scaling can lead to disengagement and negative learning experience by students. This may be due to losing interest as the simulation may be too easy or the simulation being too difficult that they cannot learn and progress. As cited in the paper in [4] “Juul’s definition to explain why difficulty scaling is so important in game design ‘A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached

to the outcome, and the consequences of the activity are optional and negotiable". Understanding this point, the question then comes to mind on how we should implement difficulty scaling. According to [4] "There are two ways to control the difficulty: the progression of skills and the mix of challenges. The progression of skills relates the difficulty of a given challenge according to a set of parameters. This notion of difficulty is related to an idea of complexity: what type of problem a human "processor" is able to face taking into account his level of practice.". This is to say, the first way to manage difficulty is to test out the measurement of how a student or player will be able to "react" to a situation given by the simulation. A second way to control difficulty is by "mix of challenges". This is defined by [4] as "The solution of many game challenges relies on mastering a set of basic techniques and then to try to combine them. In strategy games, you master first the strength and movements of units, then the position of production units, then the technological evolution. At each level of a game, the player understands new mechanisms, then slowly combines them.". This is to say, another way to scale difficulty is through controlling the obstacles, challenges and/or puzzles a student must encounter. Combining these methods to control difficulty can prove to be a very effective tool. However, in addition to using these tools, the true way to measure its effectiveness is only by testing. One must first test out these scaling difficulties to a set of players and gather data on how they perform.

4 Conclusion

The positive effects of gamification, games, and simulation can be significantly enhanced by incorporating game design theories into their development. Further research and testing are warranted to assess the effectiveness of integrating these principles into the design of gamification, games, and simulation tools. The current study highlights key game design principles and their implementation strategies, including catering to different player types, implementing player retention mechanisms, and scaling difficulty levels. For instance, addressing various player motivations such as achievement, exploration, socialization, and competition can enhance engagement and satisfaction. Additionally, employing core retention methods, advanced retention strategies, and difficulty scaling mechanisms can contribute to maintaining player interest and facilitating skill development over time. Recommendations for future research include conducting empirical studies to evaluate the impact of these principles on user engagement, learning outcomes, and overall user experience. By leveraging insights from game design theory, developers can create more effective and engaging business simulation games for learning and mastery purposes.

5 Declarations

5.1 Competing Interests

The author declares no conflict of interest regarding the publication of this paper.

5.2 Publisher's Note

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