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The Psychology of Rewards in Digital Game-Based Learning: A Comprehensive Review

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ABSTRACT

A significantly accelerated speed in the growth and acceptance of new technology has been observed in recent decades. This rapid technological transition has affected almost every economy, environment, culture, and education. The rapid technological evolution has led to the frequent use of Digital Game-Based Learning (DGBL), where users learn and play simultaneously. DGBL has been implemented to supplement formal classroom lessons. Despite the extensive use of DGBL and other implementation methodologies, no study has yet synthesised the use of the "reward system" and its associated components. This study reviewed over fifty scientific publications on the forms of rewards in DGBL and their effects on learners, published between 2000 and 2021.

Keywords: digital game-based learning, educational technology, reward system, extrinsic reward, gamification

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1 INTRODUCTION

Technology has developed tremendously in recent years, especially the internet, web-based, and mobile-based applications. It has since taken over many tasks and given new breaths to many sectors all over the globe. According to Furió et al. (2015), the new generation's children have grown up playing computer games, using smartphones and other electronic devices. Children have since established distinct attitudes and aptitudes, which may have produced a disconnection between their perceptions and the conventional classroom's learning environment (Furió et al., 2015). Many of the reasons for this setback are that old techniques are being used to educate the new generation's children (Beck & Wade, 2006).

Consequently, Digital Game-Based Learning (DGBL) has been incorporated into education worldwide to replace traditional classroom lessons. DGBL seems to engage the children better and more effectively than traditional learning methods (Bai et al., 2020; Hwa, 2018). According to Dickey (2005), there are three essential components in most digital games: goal-oriented activity, reward system, and progress monitoring. To effectively engage a player's attention and interest, a game needs to maintain an adequate difficulty level. For instance, the degree of difficulty increases through the progression of level, which targets to keep the game adequately challenging while maintaining a high success rate of 80 per cent, regardless of the player's current skill level (Ronimus et al., 2014). Virtual rewards, such as points, badges, and leaderboards, are used in digital games to acknowledge players' effort to complete a task regardless of performance and effort and motivate players (Preist & Jones, 2015).

Using extrinsic rewards in education, however, is highly controversial. Extrinsic rewards such as cash, awards, and prizes, according to Deci et al. (1999), hampered intrinsic drive. Extrinsic benefits, according to Deci and Ryan (2010), can "guide individual's behaviour into participation in activities" that they did not intend to participate in at first (p. 1). As a result, people may lose interest and persevere less as time goes on. On the other hand, extrinsic rewards have been shown to have a favourable impact on learners, particularly in terms of creating brain dopamine in the human memory system and increasing memory consolidation. When learners are given extrinsic rewards, the human brain produces dopamine, which causes them to have positive emotions (Reeve, 2006). Extrinsic rewards also foster the storage of newly learned information into learners' long-term memory when presented in the learning process, thus increasing learning (Behnamnia et al., 2020; Park et al., 2019). The importance of the rewards system in DGBL on the human brain discussed above emphasises the necessity to examine the types and effects of rewards utilised in DGBL in greater depth.

Hitherto, little is known about the psychology underlying the DGBL reward systems, the impacts of rewards on the learner, and how rewards in DGBL engage learners in their learning process. Although the literature on extrinsic rewards used in DGBL is extensive, the types of rewards and their effect on learners have yet to be clarified. Thus, this review focuses on the types of rewards in DGBL and their effect on the learners. This comprehensive review aims to examine the following:

i. The types of rewards used in digital game-based learning solutions
ii. The effects of rewards in a digital game-based learning solution in the learning process

2 METHOD

Articles were found with a search using the most reliable research search engines such as EBSCOhost Complete, PubMed, Research Gate, Science Direct, APA PsycInfo, and Google Scholar using the following keywords: 'Digital Game-Based Learning', 'DGBL', 'mobile-game based learning', 'educational technology', 'gamification', 'reward system', 'extrinsic reward', 'intrinsic motivation', and 'learners' engagement'. Bibliographies from selected articles were consulted to identify additional studies. Articles were separated into findings and conclusions to evaluate trends or gaps in the literature. Specific articles on the reward system not within the DGBL environment were excluded from providing a complete overview of the rewards found exclusively in DGBL. Furthermore, over 50 articles published between the year 2000 to 2021 were carefully selected in line with the research objectives, and they were categorised and organised into two comprehensive tables (Table 1 and Table 2). Table 1 (Types of rewards used in a digital game-based learning solution) is divided into six categories: achievement, leaderboards, level, new features, points, and prizes. Meanwhile, Table 2 (Effects of rewards in digital game-based learning) was divided into six categories: better concentration, better knowledge retention, engaging the learners, enhanced memory consolidation, enhanced motivation, and enhanced positive emotions.

Table 1. Types of rewards used in a digital game-based learning solution.

Articles	Methodology	Age	N	Types of rewards					
				Achievements	Leaderboards	Levels	New Features	Points	Prizes
Behnamnia et al. (2020)	Case study	3-6	7						✓
Charles et al. (2010)	Framework	All		✓				✓	
Glover (2013)	Meta-analysis	All		✓	✓				✓
Huang et al. (2018)	Experiment	Undergraduate student	96		✓	✓			
Kazimoglu et al. (2012)	Framework	11-16	25				✓		
Lister (2015)	Analysis	All		✓	✓	✓		✓	✓
McKernan et al. (2015)	Experiment	College student	242				✓		✓
Mekler et al. (2013)	Experiment	17-68	295		✓	✓		✓	
Nicholson (2015)	Meta-analysis	All		✓	✓	✓		✓	✓
Pinter et al. (2020)	Experiment	Higher education student	570		✓			✓	
Richardson and Lyytinen (2014)	Mixed methods	All							✓
Richter et al. (2014)	Meta-analysis	All		✓	✓	✓		✓	✓
Yang et al. (2016)	Experiment	8-9	50						✓

Table 2: Effects of rewards in digital game-based learning.

Effects	Articles	Methodology	Age	N	Findings
Better concentration	Ronimus et al. (2014)	Experiment	3-10	138	Parents whose children used the reward versions of GraphoGame reported that their children concentrated better during the play sessions than parents whose children did not use the reward system.
Better knowledge retention	Ge (2018)	Experiment	Adults	180	The presence of a reward or punishment pattern enables the learner to retain the knowledge in their mind, which calls for a deeper understanding of learning motivation and learning anxiety.
Engage the learners	Chen (2012)	Experiment	10-11	57	Incorporating rewards in virtual coins could motivate players to take care of their virtual pets, indirectly facilitating learning.
	Khan et al. (2017)	Experiment	12-15	72	Incorporating game elements such as challenge, progression, point, and level in DGBL to achieve desired learning goals can boost student engagement.
	Leftheriotis et al. (2017)	Empirical study	15-18	16	Gamifying in interaction display (ID) enhance students' mental exercise. Moreover, fantasy promotes student engagement through rewards and collaboration.
	Moon et al. (2011)	Theoretical Framework	Student	40	The reward mechanism could engage players to continue playing the game and encourage learning.
	Nicholson (2015)	Meta-analysis	All		Some gamification systems focus on introducing scores, levels, leaderboards, accomplishments, or medals to real-life settings to enable users to engage with the real world to gain these rewards.
	Przybylski et al. (2010)	Meta-analysis	All		Rewards were effective motivators of engagement in digital games because they provided learners with immediate feedback on their performance, thereby maintaining participation in-game activities.
	Yang et al. (2016)	Experiment	8-9	50	In the presence of rewards (virtual stars and digital badges) in DGBL, learners' self-efficacy and learning performance were positively impacted.
Enhance memory consolidation	Düzel et al. (2010)	Theoretical Framework	55-77	21	The anticipation of an extrinsic reward could facilitate memory consolidation by triggering the mesolimbic reward system, enhancing the release of phasic dopamine in the hippocampal memory system.

	Murayama and Kitagami (2014)	Experiment	Graduate students	33	Research participants might recall task-related materials better simply because they are motivated by the rewards.
	Shohamy and Adcock (2010)	Mixed methods	All		The dopaminergic memory consolidation hypothesis suggests that the reward system would explicitly modulate memory consolidation inside the hippocampal memory system. Thus, extrinsic rewards enhance memory consolidation even without motivational and attentional processes.
Enhance motivation	Abramovich et al. (2013)	Experiment	11-12	51	Learner motivations may drive rewards earned in the form of a badge. The system with badges may have a positive impact on critical learner motivations.
	Alhebshi and Halabi (2020)	Quantitative	18-20	35	Students are motivated to reach the top level when their points appear on the scoreboard.
	Arifudin et al. (2020)	Mixed methods	All		The feedback system (points, levels, scores, or progress bars) motivates the participants to continue playing.
	Barata et al. (2013)	Experiment	College students	N/A	Apart from an evening out the challenge distribution over the term, fairly rewarding students could significantly improve their participation and performance.
	Behnamnia et al. (2020)	Case study	3-6	7	Feedback and rewarding the child's performance is also a practical approach to improving his or her skills and increasing the level of learning. Thus, making the child motivated to continue playing.
	Cameron et al. (2005)	Experiment	University students	119	Rewards can improve learning outcomes by motivating people to pursue complex tasks or goals that they would otherwise be less interested in or attempt less diligently.
	Chen et al. (2017)	Experiment	10-11	172	In-game cards as educational rewards motivate learners to use the vocabulary learning system and boost their learning outcomes.
	Constantin et al. (2017)	Experiment	11-15	15	Children were positively motivated to continue participating in their learning tasks when given computer-based rewards.
	Cruz et al. (2017)	Experiment	18-38	36	When participants consider the badge a reward for hard work, they interpret this as positive feedback and are driven to keep playing.
	Dicheva et al. (2015)	Systematic mapping study	All		The presence of reward in a game would allow the players to desire to win and enhance their motivation.

DomíNguez et al. (2013)	Experiment	University students	211	Rewards and competition mechanisms increase the students' motivation to complete optional exercises.
Filsecker and Hickey (2014)	Experiment	Fifth-grader	106	The use of external rewards is one of the efforts to motivate learning.
Garris et al. (2002)	Theoretical Framework	All		In-game scorekeeping may encourage players to replay the game to improve their performance.
Glover (2013)	Meta-analysis	All		Different rewards would offer different degrees of motivation to different learners, and thus the reward(s) should be deliberately designed to ensure that they motivate all. For example, points could be earned, and a 'price list' of various prizes could be used so that users could strive for something that interests them.
Hoffmann et al. (2009)	Mixed methods	Adult teachers	86	Rewards would motivate learners to do more activities directly affiliated with the learning outcomes.
Huang et al. (2010)	Qualitative Survey	Undergraduate students	264	Rewards positively increased learners' motivation and sustained the game playing and learning cycle in DGBL.
Leftheriotis et al. (2017)	Empirical study	15-18	16	When a reward is involved in a game, players will usually have more desire to win, and therefore their motivation will be increased.
McDaniel et al. (2012)	Survey Research	University students	200	Rewards in the form of badges and achievements "still had the motivational effect that was desired".
Park et al. (2019)	Experiment	University students	64	The desire of the user to receive such rewards will motivate users to engage more in the learning task through rewards that make the game experience more pleasant and thus increase the level of learning.
Skinner et al. (2004)	Meta-analysis	All		Rewards can improve learning outcomes by motivating people to pursue complex tasks or goals which they might otherwise be less interested in or attempt less diligently.
Tan et al. (2007)	Theoretical Framework	All		Rewards must be given to the learners in the game. It allows the learners to evaluate their performance. Learners would be motivated to obtain rewards and confidence in the next task. On the other hand, if little or no rewards are obtained, learners would attempt to perform the same task again to attain higher achievement.
Yang et al. (2018)	Experiment	11-12	43	Learners keen to perform more tasks have better chances of earning rewards in the game-based English learning system. Thus, making them

					more motivated to proceed with another form of task. Consequently, learners' language performance could be improved through gameplay.
	Zin et al. (2009)	Theoretical Framework	All		Reward/award is one way to motivate learners to continue the gameplay and overcome the difficulties of each game level.
Enhance positive emotions	De Wet and Venter (2019)	Mixed methods	8-12	60	The rewards constructed elicited strong positive emotions in learners and were closely connected to the mobile mathematical learning games.
	DomíNguez et al. (2013)	Experiment	University students	211	A virtual reward system could elicit positive emotions upon task completion, motivating students to complete more tasks.
	McKernan et al. (2015)	Experiment	College student	242	Regardless of how many reward features are present, players respond positively to the game when they feel rewarded while playing.
	Reeve (2006)	Meta-analysis	All		Extrinsic rewards stimulate positive emotion and facilitate behaviour by signalling a forthcoming opportunity for personal gain.

3 FINDINGS

The use of rewards in the education sector is not a new phenomenon, as educators have been utilising rewards in various stages of education, such as early childhood education (Behnamnia et al., 2020; Ronimus et al., 2014), primary education (Abramovich et al., 2013; Chen, 2012; Yang et al., 2016), secondary education (Kazimoglu et al., 2012; Khan et al., 2017; Leftheriotis et al., 2017), and tertiary education (Barata et al., 2013; Cameron et al., 2005; DomíNguez et al., 2013; Huang et al., 2010; McDaniel et al., 2012; McKernan et al., 2015; Murayama & Kitagami, 2014; Park et al., 2019). In a traditional classroom setting, teachers usually reward students who achieve outstanding academic performance to recognise their efforts and accomplishments (Souza et al., 2017). Students with low academic performance, on the other hand, are also rewarded for boosting vital student motivation (Pinter et al., 2020). Some everyday rewards offered in a traditional classroom include "praise, attention, stickers, gold stars, privileges, good grades, tokens, approval, scholarships, candy, food, trophies, checkmarks and points, good citizen certificates, awards, money, smiles, positive feedback, public recognition, pats on the back, prizes, special materials, free time, incentive plans, and honour rolls" (Reeve, 2006, p. 3).

Generally, rewards are divided into two main types: intrinsic and extrinsic. Šajeva (2014) defined intrinsic rewards as psychological or internal rewards that an individual receives directly from completing a task, while extrinsic rewards, on the other hand, are tangible rewards that organisations offer to individuals. Additionally, according to Magerko et al. (2008), intrinsic rewards derive from the learning and playing process, while extrinsic rewards derive from grades, points, winning, and approval. From psychologists' point of view, rewards are provided in exchange for something else that is compensation under an outsider's control (Hidi, 2016), while neuroscientists perceive rewards as constructive reinforcements that boost the likelihood of repetitive actions associated with them (Schultz, 2010). Statistically, behaviour frequently associated with rewards such as food and money is 65 times more likely to be repeated than actions that have not been rewarded (Berridge & Robinson, 2003; Correa, 2018).

Glover (2013) states that rewards in DGBL are presented differently and vary depending on the game's context and concept. Nevertheless, there are six significant rewards categories represented in DGBL: achievement, leaderboards, level, new features, points, and prizes. As shown in Table 1, rewards in the form of achievement were examined in five out of thirteen studies (Charles et al., 2010; Glover, 2013; Lister, 2015; Nicholson, 2015; Richter et al., 2014). Achievement is a type of "symbolic award for any skill, knowledge, or achievement", which can be shown by the learners to "let others know of their mastery or knowledge" (Abramovich et al., 2013, p. 218). Similarly, Glover (2013) defined 'achievements' as a symbol displayed publicly on online profiles that draw attention to the accomplishments of an individual, which allows individuals to keep track of their progress and boast to third parties (p. 2001). Badges and gold stars also fall under this reward category (Abramovich et al., 2013; Glover, 2013).

Leaderboards imply that players' rank is displayed according to their in-game performance. Conventionally, leaderboards are commonly used in sports to show where a team stands relative to its opponent. However, the same concept is also integrated into DGBL and is prevalently used

in multiplayer games, particularly games with fixed times and objectives (Glover, 2013, p. 2001). O'Donovan et al. (2013) mentioned that using a leaderboard in DGBL would foster a sense of rivalry and belonging to like-minded groups. Seven of the thirteen studies were reported to have used leaderboards to reward players (Glover, 2013; Huang et al., 2018; Lister, 2015; Mekler et al., 2013; Nicholson, 2015; Pinter et al., 2020; Richter et al., 2014).

Levels split a game into tiny, separate, and feasible chunks and progressing to the next level is frequently a powerful motivator for deliberate attempts (Gåsland, 2011). According to Zagal et al. (2005), levels are goal metrics since they evaluate and offer feedback on players' game performance. Rewards in the form of levels were reported in five out of the thirteen studies. (Huang et al., 2018; Lister, 2015; Mekler et al., 2013; Nicholson, 2015; Richter et al., 2014).

There have been 'new features' in DGBL in engaging the learners to continue playing. These new features refer to features that are unavailable at lower levels and can only be obtained after learners have performed certain tasks or have achieved a specific objective. Two studies reported new features as one of the types of rewards presented in DGBL (see Table 1; Kazimoglu et al., 2012; McKernan et al., 2015). For instance, Kazimoglu et al. (2012) reported that the rewards presented in a technical game prototype such as '*Program Your Robot*' are new features to the game, namely new collectable pieces, slots and enemy robots to avoid while players progress through the game. Moreover, McKernan et al. (2015) further clarified that new game features such as unlocking new tasks, earning items to personalise their avatar, or winning trophies are some in-game features that players find appealing.

Rewards, which are presented in the form of points similar to the conventional 'marks' or 'scores' that a student receives in a classroom, are among the three most basic reward elements found in DGBL (Zagal et al., 2005). Six out of thirteen studies reported that rewards in the form of points were constantly used in DGBL (Charles et al., 2010; Lister, 2015; Mekler et al., 2013; Nicholson, 2015; Pinter et al., 2020; Richter et al., 2014). Furthermore, Gåsland (2011) reported that gamification uses a point-based reward system that is both motivating and enjoyable.

Prizes in DGBL exist in many forms, such as game tokens, trophies, medals, coins, and virtual stickers. Prizes are the most widely used reward component found in DGBL, which are reported in eight out of the thirteen studies that are listed in Table 1 (Behnamnia et al., 2020; Glover, 2013; Lister, 2015; McKernan et al., 2015; Nicholson, 2015; Richardson & Lyytinen, 2014; Richter et al., 2014; Yang et al., 2016). For example, the educational DGBL mobile application on a reading DGBL 'GraphoGame' presents extrinsic rewards in the form of game tokens and virtual stickers to reward the learners for their performance (Richardson & Lyytinen, 2014). The reward system is controlled by a personal avatar created at the beginning of the game (Thomson et al., 2020). Moreover, McKernan et al. (2015) added that tokens and rewards gained by the players along the game's storyline would be used to purchase the components needed to complete a task (e.g., repair the ship) and promote a sense of game progression.

Regardless of the types of rewards presented in DGBL, the effects of rewards on learners' learning process are consistent. Apart from the positive emotions that learners experience after receiving

rewards, DGBL also helps engage the players and thus increases learners' motivation, enhances concentration, enhances memory consolidation, and elicits better knowledge retention.

According to Stevens and Bavelier (2012), attention is vital in many cognitive functions as it regulates the flow of information between individuals and their surroundings. The ability to concentrate selectively determines successful learning and impacts academic performance. Therefore, incorporating DGBL in learning would facilitate learners to concentrate better. It is said so because when learners are presented with rewards while they are playing, they tend to pay full attention and concentrate fully on the content of the game to obtain more rewards (Ge, 2018). In a study conducted by Ronimus et al. (2014), it was reported that parents whose children used the rewards version of GraphoGame reported that their children seemed to concentrate better during the play sessions than those who used the non-reward version of GraphoGame. They also added that fantasy elements and a more comprehensive range of learning activities in GraphoGame might have enhanced the children's attention while gaming (Ronimus et al., 2014).

DGBL has also demonstrated promising effects in better knowledge retention among players. For example, Cooper (2014) revealed that one of the ways to move up to another level of the pyramid is by asking questions frequently. The answers obtained from asking questions would enrich the information with meaning and context (Cooper, 2014). Additionally, Nuthall (2000) suggests that an elaborative rehearsal strategy should be used for a learner to retain knowledge effectively. When a learner elaborates on a piece of information, they are more likely to remember it for a longer time. Learners will recall new information more readily when they link the unfamiliar information to the information they already know (Nuthall, 2000). In an experiment by Ge (2018), the presence of a 'reward or punishment' pattern in DGBL enabled the learners to better retain the knowledge in their minds as compared to another two control groups that employed the 'only reward' strategy and 'no reward nor punishment' pattern.

Learner engagement can be described as "behavioural engagement, cognitive engagement, and motivational engagement" (Linnenbrink & Pintrich 2003, p.122). Learners who are behaviourally engaged would persevere and seek assistance compared to those who are not (Linnenbrink & Pintrich, 2003). To be genuinely cognitively engaged, a learner must be immersed in detailed thoughts about the materials learned and distinguish between what they understand and what they do not understand. In contrast, motivational engagement refers to the learners' interests, values, and affect (Linnenbrink & Pintrich, 2003).

As DGBL is integrated into conventional classrooms, educators no longer bear the sole responsibility of engaging learners since the rewards component in DGBL is proven to effectively engage the learners (Chen, 2012; Khan et al., 2017; Moon et al., 2011; Przybylski et al., 2010; Yang et al., 2016). According to Nicholson (2015), many reward-based gamification technologies are causing an immediate upsurge of engagement as users continue to experience this promising approach. It provides learners with immediate feedback on their performance, thereby maintaining participation in-game activities. Moreover, Przybylski et al. (2010) also added that rewards were effective motivators of engagement in digital games.

Regardless of the types of rewards used in DGBL, the impact on learners' engagement remains the same. For instance, rewards in virtual coins could motivate players to take care of their virtual pets, indirectly facilitate learning (Chen, 2012). Furthermore, rewards in virtual stars and digital badges also help engage learners' self-efficacy and learning performance. (Leftheriotis et al., 2017; Yang et al., 2016). Khan et al. (2017) added that challenge, progression, points, and levels in DGBL to achieve desired learning goals could boost student engagement.

Above all, Ronimus et al. (2014) mentioned that fantasy elements and novel task types might increase learners' engagement in DGBL. However, this effect may not be durable if there are drawbacks in the game design. Behaviour caused by the rewards is directly proportional to the rewards provided. Termination of the rewards will also lead to stopping the behaviour (Nicholson, 2015). Therefore, every game designer should design games so that the players do not obtain rewards too quickly. As stated by Glover et al. (2013), "Rewards should be desirable by the learners, and one of the ways to ensure desirability is through the creation of artificial scarcity" (p. 7).

Memory consolidation refers to transforming a "temporary, labile memory into a more stable and long-lasting form" (Squire et al., 2015, p.1). It is the process of converting newly learned information and experience into long-term memory (Urcelay & Miller, 2008). Memory consolidation is a time-dependent process that transforms the present-day experience into long-term memory, possibly due to structural and chemical changes in the nervous systems (Urcelay & Miller, 2008). Rewards in DGBL are reported to enhance the memory consolidation of learners. Several studies have demonstrated that extrinsic rewards boost memory consolidation in individuals. A neuroscientific study by Düzel et al. (2010) found that the anticipation of an extrinsic reward could facilitate memory consolidation by triggering the mesolimbic reward system, enhancing the release of phasic dopamine in the hippocampal memory system. Thus, extrinsic rewards enhance memory consolidation even without the accompanying motivational and attentional processes (Shohamy & Adcock, 2010).

Nevertheless, the idea that rewards have strong motivational properties ultimately induces individuals to participate in learning activities and pay attention to them. For this reason, most previous findings of the effects of extrinsic reward expectation on memory enhancement can be explained in terms of enhanced motivation and attention. Research participants might recall task-related materials better simply because they are motivated by the rewards (Murayama & Kitagami, 2014). Furthermore, reward-associated items were more recalled and more fixated during encoding, demonstrating that the rewards might enhance the player's focus on some stimuli more than others, making them more noteworthy and memorable (Loftus, 1972). In addition, Erhel and Jamet (2013) also found that including feedback in DGBL helps improve memorisation, which follows the cognitive load theory.

Motivation can be categorised into intrinsic and extrinsic motivations (Deci & Ryan, 2010). Intrinsic motivation is a form of motivation that arises from people's innate interest in activities that brings novelty and challenge. With that being said, "individuals who are intrinsically driven do not require external rewards to act, but it reflects an individuals' sense of who they are and what interests them" (Deci & Ryan, 2010, p. 1). In contrast, extrinsic motivation involves engaging in

an activity for external reasons and achieving a different goal. Consequently, individuals are extrinsically motivated when they perform an activity to earn money, avoid punishment, or conform to societal standards (Deci and Ryan, 2010). When individuals receive monetary prizes or awards for engaging in an activity, they find it less enjoyable. They are less likely to partake in it willingly than before they were paid (Deci et al., 1999). Although their findings may be valid, other studies indicate otherwise.

The impact of rewards in DGBL on the learners' motivation is constant even when presented in various forms. For example, the feedback systems in DGBL systems, in various forms (i.e., points, levels, scores, or progress bars), all have the same motivational effect in encouraging the learners to continue playing (Arifudin et al., 2020). Furthermore, learners are motivated to reach the top level when their points appear on the scoreboard (Alhebshi & Halabi, 2020). When rewards are presented to the learners upon completing an activity or reaching a particular objective, their motivation will be increased (Abramovich et al., 2013; Behnamnia et al., 2020; Constantin et al., 2017; Dicheva et al., 2015; Domínguez et al., 2013; Huang et al., 2010; Leftheriotis et al., 2017; McDaniel et al., 2012) and their game playing and learning cycle will be sustained (Huang et al., 2010). As a consequence, their learning outcome will be improved (Behnamnia et al., 2020; Hoffmann et al., 2009; Huang et al., 2010; Park et al., 2019; Skinner et al., 2004) as the learners would keep replaying the game to improve their performance (Behnamnia et al., 2020; Garris et al., 2002; Tan et al., 2007; Yang et al., 2018). In summary, the use of external rewards in DGBL is one of the ways to motivate learners to continue the gameplay and overcome the difficulties of each game level (Zin et al., 2009) and motivate learning (Filsecker & Hickey (2014).

The natural response towards the anticipation of rewards is generally favourable. Excitement, happiness, joy, and gratitude are the typical emotions students show when rewards are offered to them in return for positive behaviours. Like every other human being, students are naturally responsive to the signal of attaining and pleasure (Reeve, 2006). When the neural activity increases, the individual would feel positive emotions such as hope and interest as a specific part of the brain known as the behavioural activation system (BAS) is in charge of generating intrinsically positive emotions. The BAS activation would literally and physically motivate the individual to shift towards environmental signals of personal gain, further facilitating actions (Reeve, 2006). Additionally, virtual reward systems can elicit positive emotions upon task completion, motivating students to complete more tasks (DomíNguez et al., 2013). Ultimately, regardless of the number of reward features, players respond positively to the game when they feel rewarded while playing (McKernan et al., 2015).

4 DISCUSSION

Rewards play a massive role in an individual's learning process. Apart from the positive emotions that learners experience after receiving rewards, rewards facilitate learner engagement, increase motivation, elicit better knowledge retention, foster better learner concentration, and improve memory consolidation. This review provides an overview of the literature about the types of rewards used in DGBL and the effects of rewards in DGBL on the learning process of individuals. Rewards in DGBL are presented differently and vary depending on the game's context and concept.

Generally, there are six main categories of rewards represented in DGBL: achievement, leaderboards, level, new features, points, and prizes.

According to the self-determination theoretical perspective, DGBL that provides a reward system and feedback in the form of points could help fulfil the learners' need for competence (Sailer et al., 2017). The reward system in DGBL provides feedback on the learner's performance and thus facilitates educators' evaluation of the learner's performance (Bai et al., 2020). Learners tend to compare themselves to their peers to evaluate their performances (Baldwin & Mussweiler, 2018). Consequently, learners may strive to perform better in games once they know that their peers have won certain game elements or have achieved a high position on the leaderboard (Huang & Hew, 2018).

Bai et al. (2020) also added that rewards in DGBL can meet learners' desire for recognition as learners like to have their effort appreciated by others. Satisfying an individual's need for recognition can be viewed as a form of positive reinforcement in operant conditioning theory (Garren et al., 2013). Hence, once a learner completes a task and receives positive reinforcement (rewards), the probability of the target response occurring again increases (Landers et al., 2014). Bai et al. (2020) further argue that rewards in DGBL could encourage the learners to set goals. In line with the goal-setting theory, setting a goal before performing an activity could fixate an individual's attention on the target and thus increase their perseverance (Kapp, 2014).

Several important limitations arose regarding this comprehensive review, which affects the findings. Although all age groups use DGBL, limited research is available on a specific age group. Secondly, many studies were omitted from the findings due to the irrelevance of the studies to the research questions. To elaborate, the rewards mentioned in some studies did not specifically refer to the rewards found in DGBL but to extrinsic rewards in general. Finally, due to the time constraint to search for relevant research articles that fit the research questions, there might be publications that have yet to be explored through hand searching.

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