1. Introduction on games, serious games, simulation and gamification

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INTRODUCTION

Over the last 20 years, games have arguably become the largest form of entertainment, surpassing the movie industry (Maslow 1954; Isfe 2010). The starest increase in annual revenue for the games industry has occurred in the last year (2020) in which the global pandemic forced us to stay home and entertain ourselves (Perez 2020). AAA titles such as *Call of Duty*, *Assassin's Creed* and *Grand Theft Auto* have budgets of billions and are played by millions of people. For example, *Grand Theft Auto Five* generated more than US\$815 million in worldwide revenue in the first 24 hours of release, surpassing blockbuster movie releases in the same time period (Ejinsight 2020). So we have to wonder, why do people play games and what attracts the players to those games? And what does this tell us about the necessity to bring games and play into our classrooms?

WHY DO PEOPLE PLAY GAMES?

The answer to this question is very complicated and is linked with human evolution. Humans have developed basic needs over the centuries which are closely linked to our survival, existence and continued evolution. Abraham Maslow developed a five-tier model of human needs, often depicted as a pyramid, to make sense of these needs (Maslow 1954).

The bottom four levels of this five-stage model are referred to as deficiency needs; the top level is referred to as a growth need. The pyramid should be read bottom to top; each lower level needs to be met before we progress upward. When the deficiency needs are fulfilled the individual can move to the growth need. Evolution has wired our brains in such a way that it rewards us when we reinforce healthy behaviours (for example, eating when we are hungry, or drinking water when we are thirsty) by releasing dopamine, a neurotransmitter associated with a pleasant feeling and linked with motivation (Gottfried 2011).

Source: Maslow (1954).

Figure 1.1 Maslow's hierarchy of needs

It is as if our bodies are helping us to distinguish positive behaviour by rewarding it with an induction of pleasurable brain chemicals.

However, growth needs do not stem from a lack of something, but rather from a desire to grow as a person. The growth needs are linked with our psychological needs. For example, one individual may have a strong desire to become a famous musician, or a famous athlete, etc. The 'need' or 'desire' is particular to the individual. Thus, if we feel that we are achieving our objective and we are getting good results, our brains will reward us with the release of dopamine. In order to measure our successes, we tend to compare them against a set of metrics (i.e. we tend to measure our success against other people, or against a set of objectives that we set ourselves).

Games in general (either video games or otherwise) are designed to deal with those issues, because they have a set of rules to follow and are played against other people or computers, and the outcome can be easily measured. I still remember the excitement I felt when I was winning at a game of hide and seek. I feel the same excitement as an adult when I complete a mission on *Borderlands 3* or *World of Warcraft*.

Mihaly Csikszentmihalyi, a pioneer in positive psychology, has developed the 'flow state', which according to him is: "being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, like playing jazz. Your whole being is involved, and you're using your skills to the utmost"

(*Wired Magazine* 1996). So, when we play a game or are performing an immersive activity, when we are fully involved and enjoying the activity, and we are completely absorbed by this activity, and ‘in the zone’, we are in the flow state.

The flow state is shown in the figure below, and it provides the ideal condition where we can meet the flow state. Time flies without us noticing when we are in the flow state. People who play games, including me, can strongly relate to that feeling. So it is apparent that this can be beneficial to learners and not only gamers. In this case the ‘gamers’ of the educational platform will be our students. The aim of a game-based ‘education’ is to provide students with knowledge in different subjects and disciplines, and additionally provide them with the skills and digital competences necessary to navigate the digital world (Anette Braun et al. 2020). Carefully aligning the challenge level of the proposed educational tasks with the skill level required for the completion of the task could allow the student to reach the flow state. That will allow the student to be more immersed in the task, and therefore will allow the student to learn by completing the activity.

Source: Csikszentmihalyi 1975; Csikszentmihalyi and Kubey 1981.

Figure 1.2 The flow state

PLEASURE-CREATION AS A PEDAGOGICAL APPROACH

Education is the ultimate mechanism for individual growth. This is even more relevant when we realise that education increases the rate at which a country's GDP increases (Coen Teulings 2008). In a recent study from a high-level expert group involved in the 'Kronberg Declaration', it was identified that traditional education will be revolutionised by radically changing models of knowledge acquisition, the role of teachers and trainers, as well as the institutional framework and methods of assessment (Anette Braun et al. 2020). It has also been reported that "learners would play an increasingly active role in acquiring and sharing knowledge, creating and disseminating content, and that teachers would increasingly act as managers of learning processes and as trainers" (Anette Braun et al. 2020). So it is apparent that playful learning experiences, including games, gamification and simulation in correlation with new technologies such as virtual reality, augmented reality, mixed reality, haptic devices and artificial intelligence will revolutionise the way that we deliver content to our students (Anette Braun et al. 2020).

If we know that games and play lead to pleasurable releases of dopamine, then it makes sense to integrate play and games into our teaching. The 'flow state' is freedom – freedom to achieve some goal but also to get there in your own time and in your own way (Unterhalter 2003). Games and play are thereby potential tools to encourage the use of individual skills towards some ultimate goal and can be applied to training and education. Here, we investigate the recent surge in playful and games-based education, which is linked to technological advancement, the popularity of games and how games are developed.

First, the surge in playful and games-based education is related to advancements in computer hardware and the affordability of such technologies. Today we have powerful PCs that can run high fidelity worlds with increased realism. We can use our mobile phones – which are 30 or 40 times more powerful than a ten-year-old PC – on the go and without any hassle. In the last ten years, novel technologies have transformed the way we interact with our everyday activities. According to Statista, the current number of smartphone users in the world today is 3.5 billion; this means that 44.81% of the world's population owns a smartphone. Games account for 43% of all smartphone use (Bankmycell 2020).

Second, games, video games in particular, are incredibly popular. A recent study from the International Software Federation of Europe (Isfe 2010) revealed that more than 51% of Europeans aged between six and 64 play video games and the average age of video game players in the EU is 31 years old. The survey revealed that 45% of EU video game players are female, and that the

average game play time was 8.6 hours per day, with increases predicted. The popularity of video games, especially among younger demographics, makes them an ideal medium for educational programmes aimed at hard-to-reach demographics (Petridis et al. 2015; Lameris et al. 2017). Non-video games have also seen increased popularity in recent years (Petridis et al. 2015).

The third reason is closely related with the game mechanics. Games are designed in such a way that their main focus is to maximise the amount of pleasure and fun that we get from them. The power of games to immerse, engage and motivate (Garris et al. 2002) and the capabilities of games to foster and facilitate critical thinking, problem-solving skills, innovation, emotional intelligence, awareness and behavioural change have led more games of this nature to be deployed in real-life scenarios. A game's ability (Panzoli et al. 2010; Petridis et al. 2015; Lameris et al. 2017) to change perceptions and views (de Freitas and Neumann 2011) has created a more positive approach to the application of games or the application of 'game elements' in non-entertainment contexts.

Increases in game usage in non-entertainment contexts, such as training (e.g. Mautone et al. 2008), are transforming everyday lives through improving efficiency, increasing knowledge, obtaining new skills (Lameris et al. 2017). The increasing use of multimedia tools in education and training offers the opportunity to present content in multiple formats such as text, images, video, audio, gaming. This provides the educator with more flexibility in how s/he integrates teaching and training strategies, learning outcomes, assessment methodologies and feedback mechanisms. Key aspects are the use of a range of tools, resources and services in a pedagogical manner to enhance the students' experience (Stéphanie Philippe et al. 2020).

WAYS TO PLAY: PLAYFUL LEARNING, SERIOUS GAMES, SIMULATION AND GAMIFICATION

Before I discuss *ways to play*, let's discuss play more generally. Bateson analysed language and play in nonhuman animals. Humans signal to each other and we recognise that a signal is a signal: a handshake, a hug, a cry. These are the precursors of language which, concomitantly, provide us with the opportunity to experience things like empathy. Bateson's research on signals and languages with nonhuman animals brought him to a zoo in San Francisco. Here, monkeys were play fighting. He knew that it was play and not real by the signals provided. (Consider that there is the threat of violence, but no intention for real harm; deception and strategy may be further contributing factors to our understanding of certain interactions as being related to, but not the same as, real interactions and hence stand as play.)

Play actions look like the real actions, but we know that they are not. Bateson further extrapolated from this that a monkey's playful nip at the other's ear "denotes the bite, but does not denote that which would be denoted by the bite" whilst at the same time providing the recipient with an understanding of what was meant (Bateson 1976). As long as the participants continue to play, the play continues. There are no rules about when the goal or learning outcome has been achieved. The monkeys learn whatever it is they want to learn, or don't; play is not hindered by the learning or non-learning.

Play

Play is the heart of games, simulations and any other 'playful' endeavour. Huizinga offers this definition of play: "a free activity standing quite consciously outside 'ordinary' life as being 'not serious', but at the same time absorbing the player intensely and utterly" (Alvarez et al. 2011; Huizinga 2016). Play can exist without games; games cannot exist without play. It is a mechanism of engagement and understanding about the world around us; it consists of people, 'complex interrelations', art, fantasy, etc. (Frasca 2003; Sicart 2014). Sicart argues that play is autotelic: it has the notion of goals and a space within which it takes place (2014). With games, there are rules, winners and losers; with play, there may be rules, but they aren't rigid and they do not need to aim at winning versus losing (Frasca 2003; Sicart 2014). Play is free-form and unbounded: we learn from it what we need to learn without a clear goal in sight (Whitton and Moseley 2019).

The value and importance of 'practising' skills and learning while/as doing is the noted benefit of play. This is hugely important when we consider the best way to learn, practise and test student skills. In general, the mechanism for achieving the learning outcome (games, simulation or play) is as irrelevant as the type of gun used to kill someone in war. What is most important is the learning achieved. We need not only reinforce standard, 'serious' mechanisms for learning if other mechanisms exist. Hence, the analysis herein is intended as a contribution to and a strengthening of our discipline-specific expertise, with a focus specifically on play. Play is not better or more important than games but rather it is an alternative mechanism for improving the quality of learning which can add to the variety and skills adopted of those participating.

Serious Games

Games are closely linked with play. 'Serious games' represent a dramatic convergence of games, e-learning technologies and pedagogical models to provide a rich, immersive virtual environment. By combining sophisticated theories of education with cutting-edge technology, serious games have tackled a wide

range of challenges ranging from corporate training and education through to emergency medical response (Petridis et al. 2015). The broadest definition of a serious game, therefore, is perhaps best defined as a game played for a purpose other than entertainment. Zyda (2005) provides a broad-stroke definition of a serious game as “a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” (Petridis et al. 2015). Serious games are games designed not just to entertain, but also to solve a problem. Referencing Abt (1970), Bogost (1970) includes a definition in his book *Persuasive Games* as games that “have an explicit and carefully through-out educational purpose and are not intended to be played primarily for amusement”.

Well-designed serious games can make learning fun, challenging and rewarding. Serious games designers are faced with the challenge of designing a game which is fun, tied up with pedagogical elements (Petridis et al. 2015). The methodology, then, must safeguard against both these failure conditions: on the one hand, it must ensure the game retains the engaging characteristics that make game-based learning an optimal selection for the learning context; on the other, it must ensure that effective pedagogy is implemented in a synergistic fashion with gameplay elements. Thus the importance of formal design methodologies for serious games is well documented (Petridis et al. 2015). A central challenge in creating a prescriptive approach is being able to sufficiently evidence context independent of development models, since a proven approach for one serious game may not be applicable to another, given the broad range of topic areas and learner demographics (Petridis et al. 2015). Existing e-learning development methodologies have met with limited success when transposed to serious gaming, as they emphasise instructional content with little affordance for the unique way in which games attract and retain learners (Petridis et al. 2015).

In order to create a successful serious game we need to ensure involvement from stakeholders throughout the development process. Therefore, care should be taken to support stakeholder involvement regardless of development context, supporting, where possible, co-location and open channels of communication between all parties (Petridis et al. 2015; Lameris et al. 2017). Ultimately, the design and implementation of effective serious games must be grounded in pedagogy, as well as technology, and therefore future work should address the many issues surrounding the equation of learning requirements to these identified technical features. Towards this end, future studies will focus on the analysis of the impact of the various engines and their functionalities on targeted learner groups (Petridis et al. 2015).

Simulation

Simulation sits at the intersection between serious games and play because of its situation between reality and fantasy (Pelletier and Kneebone 2016). Simulation aims at realness, and hence is devoted to the ‘seriousness’ of that which is being modelled, allowing for the reality of emotion and human behaviour (Frasca 2003). By opening the space, and relaxing a sense of rules, real play is possible. *Hutspiel*, *T.E.M.P.E.R.*, *ARPA-AGILE COIN GAME* were early video games – and, more recently, we would include *Call of Duty* – which helped players understand aspects of war, conflict, strategy and response (Alvarez et al. 2011). These high fidelity/immersive simulations contribute to an understanding of the tasks performed instead of simply the completion of the tasks outlined in the rules (Pelletier and Kneebone 2016). Some argue that simulation provides an opportunity to dissect process (Murray 1997, in Pelletier and Kneebone 2016) and in this way it leans towards the trial and error or the player’s ability to question realities and activities that are possible in play (as opposed to serious games).

Likewise, an activity may be considered a ‘simulation’ if it gives the player/learner an opportunity to be fully immersed in the game and, in addition to being able to work within rules, towards a goal; the player/learner can also engage with what doing this activity ‘feels like’ (Hamari and Koivisto 2014). The immersive experience, and hence ‘flow’, that a simulation creates means that we can start to see the activity as a ‘cultural practice’ which is about building relationships in addition to knowledge delivery or outcomes (Pelletier and Kneebone 2016). The use of fictional scenarios provides the moderator with the opportunity to guide what is learned by players (Pelletier and Kneebone 2016). Video games – as simulation or ‘serious play’ – have been used by military and political bodies for decades. (Typical examples of a serious game used for training are *America’s Army* and *Full Spectrum Command* (Wray et al. 2004).) This leads to more intense gameplay, higher levels of pleasure and, at the same time, more opportunities for learning.

Gamification

There are several definitions of gamification; however, the most established one is provided by Deterding, who defines gamification as using game elements in non-gaming contexts (Deterding 2012, 2015; Deterding et al. 2011). Another popular definition of gamification was provided by Zichermann and Cunningham (2011) and Zichermann and Linder (2010), and states that gamification is the use of game mechanics and ‘thinking’ to motivate individuals to perform an action, which could be workers solving tasks or customers engaging

Table 1.1 *Most commonly used gamification elements*

Term	Definition	Alternatives
Points	Numerical units indicating progress	Experience points, score
Badges	Visual icons signifying achievements	Trophies
Leader boards	Display of ranks for comparison	Rankings, scoreboard
Progression	Milestones indicating progress	Levelling, level up
Status	Textual monikers indicating progress	Title, ranks
Levels	Increasingly difficult environments	Stage, area, world
Rewards	Tangible, desirable items	Incentives, prizes, gifts
Roles	Role-playing elements of character	Class, character

Source: Andrews et al. (2017); Lameris et al. (2017); Shi et al. (2017).

with products or services. The common denominator of these definitions is the ‘use of game mechanics’.

The different variety of games and elements associated with them makes the creation of a detailed list of the elements/mechanics that form the content of games impossible (Dorling and McCaffery 2012; Downes-Le Guin et al. 2012; Andrews et al. 2017; Shi et al. 2017). Nevertheless, there is a selection of game elements that are commonly used with gamified applications such as points, badges, leader boards, levels, progress and rewards (Table 1.1).

The application of game content and mechanics within non-game contexts provides benefits unachievable using traditional learning approaches.

On engagement, the application of gamification can increase the engagement of the participants due to the strong relationship created between participant and content. This is linked with Csikszentmihalyi’s (1990) theory of ‘flow’ (Csikszentmihalyi 1975; Csikszentmihalyi and Kubey 1981). As discussed previously, ‘flow’ is the optimum state that players of games experience, and it occurs when the content and mechanics of games are perfectly balanced with the players’ skills and their potential to progress through the game’s challenges, objectives or goals (Terlutter and Capella 2013; Liu et al. 2011). Gamification tries to create an emotional link between the participant and the context, in order to result in an emotional response. Gamification applications aim to exploit this state in contexts not associated with games, resulting in higher engagement of the participants. Therefore, in the classroom, gamification leads to higher engagement – we have the students’ attention, they are ready and eager to learn, and are in a position to realise their goals.

Gamification can also increase the motivation of the participants through the potential rewards that the user can get through the application (Andrews et al. 2017; Shi et al. 2017). According to the literature, motivation can be divided into intrinsic and extrinsic motivation (Yu-kai Chou 2015). Intrinsic motiva-

tion occurs when the output is a direct consequence of performance and action. A typical example of intrinsic motivation is an athlete who plays basketball for the experience rather than the reward. So this action is driven by hedonic motives: the action is done simply for the enjoyment of doing (i.e. playing basketball). An extrinsic motivation refers to our tendency to perform actions/activities for the external rewards, whether they are tangible (i.e. money or grades) or psychological in nature. For example, taking part in online competitions with the sole purpose of winning is an extrinsic motivation. This is driven by our pleasure maximisation motives and depends upon the use or value of the outcome or the action (Malone 1981; Malone and Lepper 1987). Related to the above, game elements such as points, badges and leader boards could be extrinsic motivators, whilst the challenge of progressing through levels or the fantasy of taking on different roles would be intrinsically motivating.

Increased levels of engagement, enjoyment and motivation are all benefits that can build towards increased levels of performance associated with the flow state, due to increased immersion and concentration in an activity (Eickhoff et al. 2012; Hamari and Koivisto 2014; Long and Aleven 2014). Based upon its potential in contexts not normally associated with games, it is unsurprising to find that gamification has a wide range of applications (Roth et al. 2015). Gamification has been implemented in the following contexts: work training, education, crowdsourcing, data collection, health, marketing, social networks and environmental protection (Michael Sailer et al. 2017). Differentiating aspects of these applications can be related to the specificity of the approaches taken and who would benefit from them. Overall, general applications of gamification incorporate extrinsic motivators, whilst specific applications employ a complex combination of intrinsic and extrinsic motivators.

CONCLUSIONS

From an evolutionary standpoint, we have a 'need' to grow as a person. Play, and games in particular, gives us the opportunity to achieve goals, which in turn releases dopamine, making us happy. We come back for more of that happy feeling and in the process practise a skill. We grow. The more 'flow' we feel, the more we practise and the more we grow.

It is this growth through pleasure creation that playful and games-based pedagogy harnesses. As computers advance and the popularity of certain games (i.e. video games) increases, the more obvious a choice for pedagogical approach this becomes. We want students to increase their engagement with and enjoyment of their learning. We want students to be motivated to practise. Play, games, simulation and gamification are ideal ways of creating this kind of learning environment and ultimately improving performance.

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