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FOSTERING AUTHENTIC LEARNING MOTIVATIONS THROUGH GAMIFICATION: A SELF-DETERMINATION THEORY (SDT) APPROACH

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Abstract

Gamification is the use of game design elements in non-game contexts. It has been enthusiastically employed in various fields such as web-based businesses, health, wellness, and has been widely researched in the field of education. While many of the pioneer studies revealed positive effects of gamification for learning, more inconclusive and even negative effects have been reported in subsequent research. It is also uncertain whether the positive outcomes are sustainable and not limited to just novelty effects. Studies in this field continue to mature and the thrust is to move beyond the preliminary and often vague question of "Does gamification work?" to more specific inquiries like "Why does gamification work?", "What is gamification's effect?" or "How to make gamification work?" In order for the knowledge gains from research studies to be synthesizable, there has been a call for gamification approaches to be based upon established psychological, behavioural or learning theories instead of ad hoc methods. This paper responds to this need by presenting a gamification framework that is based on the well-established motivational theory, the Self-Determination Theory (SDT). The SDT addresses motivation through the distinction of intrinsic and extrinsic motivation. In order to foster authentic learning motivations, gamification should be designed to affect intrinsic motivation for the learning activity itself. This paper outlines how this can be achieved by strategically employing game dynamics and components to meet the psychological needs that support intrinsic motivation.

Keywords: Autonomy, Competence, Gamification, Motivation, Relatedness, Self-Determination Theory.

1. Introduction

One of the most prevalent challenges in education is how to motivate the academically unmotivated. This question becomes increasingly pressing for the current generation of learners as online entertainment, mobile technology, social networks and digital gaming provide competing interests for student attention. Video and digital games appeal strongly to this generation. Students often spend extended time on playing such games to gain mastery over the challenges posed and to progress to higher levels of the game. Such behavioural persistence, however, is not commonly observed in school. In comparison, the school has several game-like elements that could be seen as analogous to common gaming elements. Students are faced with challenges in school assignments or tests (analogous to game quests) and score marks (analogous to game points) for their achievement. Marks gained translate to grades (analogous to badges) and academic standing (analogous to leaderboard ranks) allow students to progress to the next level at the end of the academic year. Since school systems share common elements with game structures, why does it not have the same motivating effect? Instead of persistence to achieve, disinterest and disengagement are common attitudes among students when it comes to school work.

The recognition that games have motivating potential and that school consists of structures and elements that are common to that of games have inspired the application of gamification in education. Gamification uses game elements like story-telling, avatars, challenges, achievements, progression levels, rewards and leaderboards to enhance user interest and increase user participation in non-game environments. Gamification research reviews reported that the top field for gamification application and research is education, followed by other sectors such as health and wellness, social networks and crowdsourcing [1]. The practice of gamification gained momentum since 2010 and was given a place in the 2011 Gartner Hype Cycle as an emergent technology. Initial research studies reported positive effects of gamification in terms of increasing engagement, motivation, enjoyment and performance in education [2]. However, many of the gamification approaches were ad hoc and the outcomes were dependent on factors such as the learning context, the activities that were gamified and the game elements that were used.

More inconclusive and negative effects began to emerge in subsequent research [3]. These studies reported either no significant difference in intended outcomes between gamified and control groups or negative effects like a decrease in motivation, satisfaction and poor participation. By 2015, gamification had passed the "Peak of Inflated Expectations" and was sliding on the "Trough of Disillusionment" of the Gartner Hype Cycle for education [4]. Many experts in education and game design concur that more studies are necessary to demonstrate the connection between games and learning. Another concern that was raised was that the synthesizability of research findings were limited as the gamification approaches were not grounded on established theories or did not demonstrate the inferred relationships [5]. The maturing of this research area sees a shift in research directions from asking broad questions like "Does gamification work?" to mechanistic perspectives like "What is gamification's effect?" and "How to make gamification work?". This paper contributes to this progression of gamification literature by outlining a gamification framework that is grounded in the well-established Self Determination Theory (SDT) [6]. The framework maps game

elements to the psychological mediators of autonomy, competence and relatedness in order to foster authentic learning motivations.

2. Literature Review

2.1. Gamification

Gamification has been defined in a variety of ways. Deterding et al. [7] defined gamification as "the use of game design elements in non-game contexts". This definition is the one that is most often cited and widely used as the academic definition for the concept of gamification [1]. Huotari and Hamari [8] defined gamification from a service marketing perspective as "a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation". Werbach [9] proposed that defining gamification as "the process of making activities more game-like" best captured the essence of the practice [9].

From these definitions, some key characteristics of gamification may be gleaned. Werbach [9] definition described that gamification is a process in which, elements are intentionally weaved into selected environments or activities, to produce an experience that typify games [9]. Deterding et al. [7] proposed the use of "game design elements" to evoke the game-like experiences. There is generally a lack of agreement in the classification of "game elements" [7]. For example, a popular game element such as the badge was categorized differently by different researchers. It was labelled a "game mechanic" [10], a "game interface design pattern" [7] and a "game component" [9].

To date, an agreement on gamification terminology has yet to be established [11]. In this paper, game elements are differentiated under two broad categories. Elements that describe gameplay characteristics, such as challenge, competition, repeatability, level progression and feedback are referred to as "game dynamics" whereas elements that are considered to be concrete artefacts that players interact directly with, such as points, badges, rewards, progress bars and leaderboards are referred to as "game components". Huotari and Hamari [8] definition of gamification describes additionally the intentions of applying gamification. In the service marketing context, the intention is to support the user's overall value creation. In the case of education, the concept of value creation is still relevant for learning activities, nevertheless, the predominant goals are to increase motivation, engagement and learning performance.

2.2. Role of gamification

Although some gamification studies evaluated the efficacy of gamification approaches in terms of learning performance such as course grades, the aptness of such assessments could be contended. When applied to learning activities, the intention is to influence the learner's motivation or interaction with pre-existing instructional content. It is important to distinguish that the purpose of gamification is not to directly affect a learning outcome, but instead to change a target behaviour that can lead to that outcome [12]. Huang and Soman [12] pointed out that gamification itself is separate from knowledge or skills. Instead, it affects factors such as motivation, which indirectly leads to acquiring more knowledge and skills. The goal of gamification is that by influencing a learning-related behaviour, such as engagement with the instructional content, it will, in turn, increase the realization

of the learning outcomes. If the instructional content or learning activity is not helpful towards the learner's attainment of the intended knowledge and skills, then even if gamification succeeded in increasing participation and effort, an increase in learning outcome achievement or performance would not follow.

The consideration of how gamification should be evaluated is important as it clarifies the role of the game elements. Gamification's role is to affect psychological factors that mediate the learning outcomes. Landers and Callan [13] proposed an idealized model (shown in Fig. 1) to describe the determinants of course performance in relation to games. As shown in the model, a psychological factor mediates the relationship between the experience of game properties and the resultant observable outcomes or behaviours. This paradigm clarifies gamification's role and paves the way for the development of frameworks that would show how game elements could be strategically used to affect identified mediating factors that could lead to proximal outcomes like better learning motivations and behaviours and hopefully, distal outcomes like better performance.

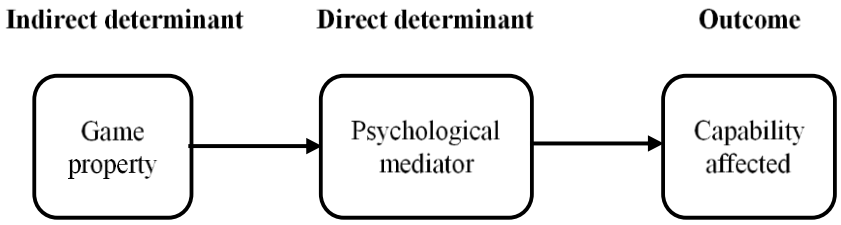

Fig. 1. Idealized model of the determinants of course performance in relation to games (reproduced from Landers and Callan [13]).

Another important consideration is that for the positive learning outcomes to be sustainable, gamification should not be designed to exist on a permanent basis and become essential in order for students to stay engaged. Many gamification approaches tend to engage learners with game elements such as story-telling, avatars, virtual goods and rewards more than the engagement with the learning itself. The game elements perpetuate in on-going cycles and may gain the engagement of participants until the novelty wears off. Some studies have shown that the positive effects of gamification are only for the short term [14]. Learners may engage with gamified course activities without developing authentic learning interest and motivation. For meaningful gamification, game elements should serve to draw the learners' attention to the learning resource or activity. The game experience could gratify unmet psychological needs, such as the sense of competence in order to foster learning motivation. Ultimately, the goal of gamification is to direct learners to engage with real-world learning authentically and internalize its value.

2.3. Self-determination theory (SDT)

Self-Determination Theory (SDT) [6] is a motivational theory, which distinguishes between intrinsic motivation and extrinsic motivation, which could be fostered by different incentives. Intrinsic motivation refers to doing something because it is inherently satisfying while extrinsic motivation refers to doing something because

it leads to a separable outcome. SDT is relevant to the context of learning and games as it outlines the social conditions that could either enhance or diminish intrinsic motivation, through the constructs of psychological needs. Cognitive Evaluation Theory (CET), a sub-theory of SDT posits that interpersonal events and structures that support the basic psychological need for autonomy, competence and relatedness can enhance intrinsic motivation. Intrinsic motivation is an important factor in cognitive, social and physical development because people tend to grow in knowledge and skills through acting on their inherent interests [15]. Research studies have shown that students with intrinsic motivation for learning were more likely to participate and persevere with school work [16].

SDT studies in video game contexts have demonstrated that game properties like choice, repeatability and feedback can contribute to needs satisfaction and enhance intrinsic motivation [17]. Considering that intrinsic motivation is positively related to learning participation and perseverance, and those game elements can enhance intrinsic motivation by supporting the psychological needs outlined by SDT, SDT presents a favourable framework for gamification in the learning context. SDT has been cited in some gamification studies [18] to justify the potential of gamification for learning but often, the studies do not elaborate on how the chosen game elements actually support the psychological needs in their implementation.

3. Framework for Gamification Design

The proposed framework for gamification in this paper is developed by mapping the psychological constructs of SDT into the paradigm that game elements affect psychological mediators of learning. Figure 2 illustrates this framework. This framework proposes that for gamification to effectively foster learning motivations, the game elements that are chosen should be intentionally employed to meet the psychological needs of autonomy, competence and relatedness as outlined in SDT.

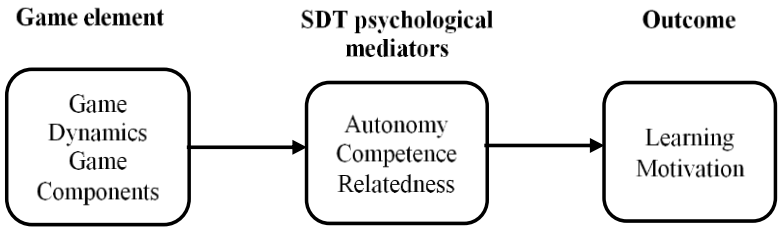

Fig. 2. SDT-based gamification framework.

This framework focuses on designing gamification and utilizing the game elements to affect the identified psychological mediators of motivation. Game dynamics that determine gameplay characteristics such as challenge, repeatability and feedback, and game components such as points, badges and leaderboards (PBL) can be used strategically to satisfy the psychological needs of an individual during a learning activity. If participating in an activity provides the individual with the sense of autonomy and competence as well as the sense that he or she is valued by others, then motivation would be enhanced. Guiding principles on how a gamification system can support each of the psychological needs are proposed in the following sections.

3.1. Psychological need for autonomy

In order for autonomy to be perceived, the individual must experience the opportunity to make decisions and choose his actions [15]. Hence, when gamification is applied in a learning context, the student must be given the choice to participate under his own volition, without coercion or threat of punishment. The gamified activity should be optional to a student and not graded, just as it normally is with video or digital games. The gamification design should also offer the option of multiple attempts so that the participant may engage with it as often as he chooses. The stakes of failure should be low, e.g., points do not affect course marks so that there is "freedom to fail" and participants can develop mastery in a safe environment for taking risks. Making an activity compulsory will thwart the sense of autonomy and undermine intrinsic motivation [19].

These approaches may be implemented through the support of game dynamics and are summarized in Table 1. The examples are not exhaustive but intended to provide the perspective of how gamification can support the sense of autonomy. Participants may also perceive autonomy when they have control over what is displayed on their profile pages such as their avatar character, badges earned and ranks. The examples given are based on features that are likely to be available on Learning Management Systems (LMSs) where gamification activities are often hosted.

3.2. Psychological need for competence

In order for competence to be perceived, the gamified learning activities should pose optimal challenges to the student. The level of difficulty of the challenge or task should match the student's ability so that a sense of mastery or achievement would result from overcoming the challenge. It is often helpful to break down broad learning goals into smaller sub-tasks in which, students can build mastery sequentially. There should be short feedback cycles that provide informational feedback to the participant. Feedback may be perceived as informational if it is positive, and offers meaningful information for improvement. Controlling feedback like negative grades and consequences, on the other hand, thwarts autonomy and competency [20]. Tangible rewards that are non-task contingent may also be experienced as external controllers of behaviour and subsequently, diminish intrinsic motivation.

Studies have shown that rewards that direct attention away from the intrinsic motivation for learning led to reduced engagement once the rewards were removed [21]. Non-tangible rewards like virtual points and badges that are task-contingent may provide informational feedback since they are visible indicators to students on their mastery and achievements [22]. Leaderboards can also afford the sense of competence as they provide the sense of accomplishment, progress and performance relative to others [23]. The examples of how game dynamics and components may support the perception of competence are shown in Table 1.

3.3. Psychological need of relatedness

Relatedness is about feeling connected to others and being valued. Gamification approaches that provide opportunities for participants to compete, collaborate or

share their achievements can support social interaction [24]. Hence, game dynamics that provide competitive elements, such as individual or team competitions, collaborative opportunities that allow group work and sharing of personal achievements on profile pages or social networking sites can support the sense of relatedness. Studies on social gamification have shown that including opportunities for social interaction and building the individual's social status result in better retention rates and skill acquisition [25]. Examples of support for the perception of relatedness through game dynamics and components are shown in Table 1.

Table 1. Mapping game dynamics and game components to need satisfaction.

Psychological need	Support through game dynamics (examples)	Support through game components (examples)
Autonomy	Voluntary participation in activity No negative consequences for non-participation Multiple attempts available Low stakes failure Non-controlling feedback	Personalization of profile page Control of achievement displays
Competence	Optimal challenges Short feedback cycles Informational feedback Competitive elements	Points awarded based on performance Badges awarded for meeting mastery standards Leaderboard display of performance ranking
Relatedness	Competitive elements Compete in teams Collaboration opportunities	Options to share achievements on profile pages or networking sites Leaderboard showing performance in relation to others

It should be reinforced that the given examples of how game dynamics and game components may support the psychological needs of autonomy, competence and relatedness are not exhaustive. The examples considered are those that may be more easily implemented through the tools, e.g., quiz and achievement tools, available in online learning platforms or LMSs. The examples may also be adopted for non-online environments like in-class activities. Also, the gamification approach should not focus on supporting just one of the psychological needs in isolation but all three needs cohesively.

Nonetheless, autonomy takes precedence, as autonomous motivation produces greater psychological health and higher quality learning [26]. Hence the consideration for autonomy should undergird the gamification design. For instance, although the leaderboard may support the sense of competence and relatedness, it should not be implemented in a way that could thwart autonomy, e.g., students have no option but to remain anonymous, or it projects controlling feedback, e.g., inciting feelings of embarrassment for the low-ranking. Lastly, it should be remembered that gamification is only a means to an end and not an end itself. By supporting the psychological needs, the hope is that authentic motivations for the learning activity will emerge as students believe that they have the ability to master the learning task and consequently, internalize its value.

4. Conclusions

In this paper, we have proposed the framework for a gamification approach that focuses on fostering learning motivations through the satisfaction of the psychological needs of autonomy, competence and relatedness, as outlined in the well-established Self-Determination Theory (SDT). The framework maps the use of game dynamics and game components to meet the needs. Future work includes the implementation of this framework in learning environments to evaluate the effect of game elements on needs satisfaction as well as to assess the mediating effect of the psychological factors on learning motivation.

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