Using Gamification to Support Users' Adoption of Contextual Achievement Goals

Jian Tang
School of Information
Central University of Finance
and Economics
jiantang@cufe.edu.cn

Ping Zhang
School of Information Studies
Syracuse University
pzhang@syr.edu

Yilin Jia
School of Information Studies
Syracuse University
yjia07@syr.edu

Abstract

Gamification is a promising approach for motivating and engaging users in nongame tasks. However, theoretical support on why and how gamification enhances users' motivation or behavior is limited. Considering the concepts of goal orientation and goal structure suggested by achievement goal theory, we prescribe gamification design as purposely creating goal structures to support users' goal adoption and achievement behaviors. This conceptual work addresses the question: what types of achievement goals can be associated with gamification design? Particularly, how can the use of gamification design help construct goal structures to support users' goal adoption? Adapting achievement goal theory, we identify three sets of achievement goals, namely, cognitive competence, social competence, and social purpose, and develop six propositions on gamification design. Each proposition is illustrated with empirical examples from the literature. This research contributes to the theoretical advancement of gamification design and provides additional insights into the motivational design of information systems.

1. Introduction

Researchers of human–computer interaction and information systems have become increasingly interested in the design for enjoyable, motivating, and immersive experiences [1]. The idea that game design can inspire enjoyment and motivation has been well recognized [2], [3]. As a result, gamification has been used in many contexts, such as learning [4], healthcare [5], knowledge management [6], citizen science [7], governance [8], sustainability [9], production and logistics operations [10], and crowdsourcing [11], to enhance users' motivation, engagement, performance, and attitude.

With the proliferation of gamification research in various contexts, researchers have stressed the significance of enhancing theoretical foundations in gamification research [11]–[13]. Among the few theories applied to explain or justify the effect of gamification design are self-determination theory (SDT) [14], goal-setting theory (GST) [15], [16], and motivational affordance theory (MAT) [17], [18]. SDT is often applied to guide research on the relationships between gamification design and the satisfaction of three basic human needs, namely, autonomy, competence, and relatedness [19]–[21]. GST focuses on the effect of specific goal design (i.e., the predetermined desirable end states) on performance improvement, and gamification is an effective design option to operationalize goal setting [12], [22]. From the perspective of positive technology design, game elements were found to be associated with eight human needs, as identified in MAT [23]. In general, SDT and MAT primarily guide the investigations of the motivating effect of gamification design, whereas GST is often used to guide the setup of goal requirements for improving behavioral performance. Limited effort has been exerted to explain why and how gamification design could be applied to shape or magnify behavioral conditions to achieve better outcomes, such as enhanced motivation or improved behaviors with regard to instrumental purposes.

Gamification design applies game elements to improve motivation or change users' attitudes, such as using badges to award the completion of optional learning tasks and make users happy. Researchers have stated that such motivation or attitudes may directly or indirectly help users achieve ultimate outcomes, such as learning improvement [24]. Although the term "goal" is one of the common elements of gameful implementations [25], the conceptual clarity and

theoretical basis for supporting goals with gamification design require additional attention.

AGT can offer additional insight into gamification design. This theory originated from the field of educational psychology [26] and has been extended and applied to many other disciplines, including organization science [27], sports [28], and human resource management [29]. AGT indicates that goals can be influenced by a purposely designed environment (i.e., goals are contextual and induced by users' behavioral setting) or be part of one's personal traits (the dispositional view). We posit that the contextual view of achievement goals can provide a strong theoretical lens for understanding why and how gamification design can set up an environment to influence users' adoption of intermediate goals (i.e., the contextual achievement goals). Hence, we formulate a research question: what types of contextual achievement goals can be associated with gamification design? In other words, to what extent can the use of gamification design construct an achievement setting to influence users' adoption of contextual achievement goals?

This paper aims to broaden the theoretical advancement of gamification research. By adapting and expanding AGT, we present a more refined conceptualization of types of contextual goals than GST does to address competence need further. In the remaining parts of this paper, we first summarize existing theoretical works in gamification research, including several important limitations. Then, we review various goals studied in the AGT literature, followed by articulating six propositions on gamification design and illustrating them with empirical examples from the gamification literature. Finally, we conclude our contribution and provide potential future research directions.

2. Existing Theoretical Work in Gamification

Gamification has gained increasing attention from researchers and practitioners [2], [12], [13], [25]. Early on, gamification was defined as the use of game elements in nongame context [30]. This early definition viewed gamification from the design perspective and without consideration for the broader effects of gamification design. Huotari and Hamari [31] developed the notion of gamification as a process of enhancing services and affording gameful experiences to support value creation. They emphasized the contribution of users in the process and regarded such value creation as an individual-based subjective process. Liu et al. [13] defined gamification as incorporating game elements into a target system while keeping the system's instrumental functions. They argued that gamification design should consider not only game elements but also gamification principles to guide the design and application for fulfilling the target system's overall goals. Empirical studies examined gamification design at different granularity levels, some of which focused on specific design elements [19], whereas others regarded gamification design as a dynamic system [4] or generated gameful experiences that can drive customer commitment [32]. These studies generated inconsistent findings regarding the influences of gamification design, thereby complicating the illustration of its mechanisms or the justification of its influence on user behaviors [13]. Efforts have been exerted to explore the theoretical lenses of gamification research [12], [13], [33], [34]. The commonly found theoretical foundations in current gamification research focus on three relatively well-known theories.

Self-determination theory (SDT) posits the importance of innate psychological needs as predictors of various outcomes, such as performance, relational, and well-being outcomes [14]. In gamification research, Mekler et al. [19] found that game elements, such as points, levels, and leaderboards, vary in affecting the satisfaction of intrinsic needs and the subsequent behavioral performances of participants. Xi and Hamari [21] categorized specific game elements into three groups, namely, immersion, achievement, and social-related features; they found that these groups affect intrinsic needs differently. These studies have presented the advantage of using SDT to understand the motivational effect of gamification design, but we should also recognize that the focus of innate psychological needs is generic and less context based. Many other factors, such as users' utilitarian tasks or goals, are involved in various situations of gamification applications.

Goal-setting theory (GST) [15], [16] is a motivation theory for understanding the relationships between conscious goals and intentions and task performances. This theory posits ways of improving employees' task performance in organizational contexts by specifying goal requirements and setting up optimal difficulty levels. GST specifically stresses that continuous monitoring of progress toward the predetermined goals is a crucial motivation of human behaviors. In gamification research, the most studied aspects of GST are goal attributes (difficulty and specificity) and goal orientations (mastery, proving, and avoidance), which are considered personal traits. We believe that GST is a practical theory to help set up goals.

Motivational affordance theory (MAT) posits that technology can be designed in a way that affords

possibilities to satisfy human needs [17], [18]. MAT is rooted in motivation theories, which speculate the sources and roles of motivation on behavior. In gamification research, the lens of motivational affordances has been used to develop the influencing path of gamification design on critical psychological states [11].

The aforementioned theories have their own strengths to contribute to the theoretical advancement of gamification research. These theories also have certain limitations. Some focus on motivation at a generic level of basic needs. Others investigate goal-setting without further illustrating the association between goal design and human motivation. In this paper, we propose to use another theory, namely, achievement goal theory (AGT), to guide an in-depth exploration of the motivational nature of goal design and then adapt this theory to the gamification design context.

3. Review on Achievement Goals

3.1. Different Types of Goals

The term goal reflects multiple levels of conceptualization when it is used to describe reasons or purposes for human activity [35], [36]. A goal distills five basic features, namely, "focused on an object, used to direct or guide behavior, focused on the future, internally represented (cognitively or otherwise), and something the organism is committed to approach or avoid" [37, p. 423].

AGT was initially proposed to understand students' purposes for learning in educational contexts, and the early definition of achievement goals emphasized academic achievement purpose [26], [38]. Elliot [39] defined achievement goals as competence-based strivings used to guide behavior. Hulleman et al. [37] described an achievement goal as "a future-focused cognitive representation that guides behavior to a competence-related end state that the individual is committed to either approach or avoid" (p. 423) AGT has since received considerable attention in order to understand individuals' motivations and psychological well-being in other settings beyond the academia [27].

Individuals have different goals when participating in an achievement activity [24], [26], [38], [40]. Achievement goals may originate from one's personal traits or be purposely built into environmental conditions, such as classrooms or work settings. Some studies stated that achievement goals can be dispositional or contextual [35], but a majority of research focused on developing the typology of achievement goals, thereby neglecting the dispositional or situational distinction. In the present research, we investigate why and how the gamification approach can be used to establish contextual achievement goals.

Goals on Cognitive Competence Achievement. Early research has distinguished two types of goals for achievement behaviors: mastery and performance [26]. Mastery goals, sometimes referred to as task [41] or learning [27] goals, focus on individuals' competence in completing tasks, thereby leveraging the goal for self-improvement and self-growth. Performance goals, sometimes referred to as ability [41] or outcome [27] goals, emphasize goal achievement for meeting an externally referenced standard. Therefore, mastery goals refer to goals of developing competence, whereas performance goals refer to goals of demonstrating competence [38].

Mastery goal is further bifurcated by approach and avoidance [40]. Approach refers to a promotion focus that seeks gains, whereas avoidance is a prevention focus that averts loss. Elliot et al. [40], [42] noted that the previous definition of achievement goals lacks precision; thus, they proposed to focus on the intended result or aim of achievement behaviors, leading to the development of competence-based aims that guide behaviors. A 3×2 achievement goal model presents a precise means of differentiating achievement goals on the basis of competence referents and the valence of goals [43]. Competence referents can be based on self (intrapersonal), task (absolute task requirements), and others (interpersonal). Self- and task-based achievement goals relate to one's capabilities of completing tasks in comparison to previous progress or some absolute standards of a task, and both goals involve developing one's competence. Therefore, they are mastery goals. By contrast, other-based goals refer to performing efficiently or poorly relative to others, which show one's cognitive competence in comparison with others. Thus, they are performance goals.

Goals on Social Competence Achievement. The frameworks of achievement goals predominantly focus on cognitive competence, sometimes referred to as academic competence [44], [45]. Several researchers have highlighted other important goals, such as social goals [46]–[48]. The term "social goals" has been linked to two distinctive aspects: focusing on what users are attempting to achieve and why users participate in an achievement activity. Studies on the "what" aspect of social goals relate to users' competence in social life [45]. To avoid confusion, we rename this type of social goals as "social competence goals." Studies on the "why" aspect of social goals often focus on the social purposes for achieving cognitive competence [41]. Therefore, we regard them as "social purpose goals."

Cognitive competence and social competence represent one's capabilities and skillfulness in cognitive and social aspects, respectively. Social competence refers to social skillfulness and capabilities that allow one to receive positive judgments from others and become socially desirable [45]. The identification of some social goals raises discussions about the social competence goals that drive social motivation in various contexts. This group of social goals includes social development, social demonstration-approach, and social demonstration-avoid goals [45]. A social development goal focuses on the development of social competence, such as learning new social skills, deepening the quality of social relationships, or developing one's own social life. A social demonstration-approach goal is concerned with demonstrating social competence and being socially desirable. A social demonstration-avoid goal focuses on showing that one does not lack social competence. The three-factor structure of social competence goals has been empirically tested and supported in several studies [44], [49], [50].

Social Purpose Goals. Social purpose goals relate to the social consequences that people want to accomplish by striving for cognitive achievements [41], [46]. For instance, Wentzel [51] discovered social interaction goals (e.g., attempting to make or keep friends and attempting to have fun with friends) and social responsibility goals (e.g., being dependable and responsible, finishing tasks on time, and helping others) by studying the concerns of students in the classroom setting for their academic achievements. Urdan and Maehr [41] identified several social purpose goals resulting from cognitive competence achievement, including social approval (academic achievement or underachievement for gaining approval from others), social solidarity (academic achievement for bringing honor to one's group), and social compliance (academic achievement for demonstrating that one is a good person).

Social purpose goals relate to the consequences or results of achieving cognitive competence, and sometimes may raise questions about whether these goals should be paired with social competence goals. One useful way to differentiate social purpose goals from social competence goals is that social purposes appear to be the results of being cognitively competent within a group or in a social setting.

3.2 Goal Structure and Goal Orientation

In the AGT literature, several researchers discussed contextual vs. dispositional achievement goals [52], [53]. Goal structure refers to the type of achievement goals emphasized by the prevailing instructional practices and policies within a classroom, school, or other learning environments [53]. Goal structures are environmental conditions that can be manipulated through design and then can influence individuals' goal orientations. AGT argues that the goal structures of an environment may influence an individual's motivation, cognitive engagement, or achievement within that setting [54]. Therefore, goal structures correspond to the contextual aspect of achievement goals.

Another important feature is the personal or dispositional aspect of achievement goals, which is termed as goal orientation or personal goal orientation in the literature. Goal orientation refers to dispositional propensities [37], [53] and corresponds with the personal aspect of achievement goals. Several studies attempted to identify the connection between goal structures and goal orientations and concluded that goal structure emphasized in a classroom can positively affect the analogous personal goal orientation adopted by students in that environment [53], [55], [56].

The relationship between goal structures and orientations supports our argument that individuals' adoption of goal orientations can be shaped by the surrounding goal structures. The notion of goal structures suggests the various possibilities in the realm of human–computer interaction design for purposely guiding human motivation or engagement by setting up certain environmental conditions. We believe that this is why a gamification approach can come into play and may encourage people to adopt certain goal orientations and eventually promote desirable behaviors or attitudes.

4. Gamification Design to Support Goals

Table 1 summarizes a taxonomy of six types of achievement goals we identified by drawing upon the conceptual development of achievement goals. These six types, in terms of cognitive competence, social competence, and social purposes, can be determined by one's personal traits or induced by the encountered environment, where gamification design can make an effect.

In the rest of this section, we present corresponding propositions to prescribe gamification design as creating goal structures to guide subjects' adoption of achievement goals. We use examples in empirical studies from the gamification literature to illustrate our propositions. To provide guidelines for how researchers can best understand the achievement goal taxonomy and its application in gamification design, we present possible design strategies that suit each proposition.

Table 1. Achievement goals and gamification design propositions

Goal type	Definition	Proposition
Task-based goal	Uses the absolute demands of the task (e.g., obtaining a correct answer and understanding an idea) as the evaluative referents. For this goal, cognitive competence is defined in terms of performing efficiently or poorly relative to the task requirement [43].	**Proposition 1a.** A gamification design can show referents to support users' task-based cognitive competence achievement.
Self-based goal	Uses one's intrapersonal trajectory as the evaluative referent. For this goal, competence is defined in terms of performing efficiently or poorly relative to how one has performed in the past or potential to do in the future [43].	**Proposition 1b.** A gamification design can show referents to support users' self-based cognitive competence achievement.
Other-based goal	Uses an interpersonal evaluative referent. For this goal, competence is defined in terms of performing efficiently or poorly relative to others [43].	**Proposition 1c.** A gamification design can show other-based referents to demonstrate users' cognitive competence achievement.
Social competence development goal	Focuses on learning new things, growth, and improvement in regard to social competence. Success is judged by whether one is "improving in social skills, deepening the quality of relationships, or developing one's social life in general" [45, p. 1247].	**Proposition 2a.** A gamification design can create a socially interactive venue to help users develop their social competence.
Social competence demonstration goal	Focuses on demonstrating social competence, which can be divided into approach and avoidance orientations. Approach direction intends to gain positive judgments from others that one is socially desirable; avoidance direction intends to demonstrate that one does not lack social competence [45].	**Proposition 2b.** A gamification design can create a socially interactive venue to help users demonstrate their social competence.
Social purpose goal	Focuses on social consequences of achieving cognitive competence [48]. Examples include social affiliation (wanting to achieve a sense of belonging to a group or groups and/or to build or maintain interpersonal relationships), social approval (wanting to gain the approval of peers, teachers, and/or parents), social concern (wanting to be able to assist others in their academic or personal development), social responsibility (wanting to maintain interpersonal commitments, meet social role obligations, or follow social and moral rules), and social status (wanting to attain wealth and/or position in school and/or later life) [46].	**Proposition 3**. A gamification design can support social consequences resulting from developing and demonstrating users' cognitive competence.

4.1 Supporting cognitive competence goals

Achievement goals on cognitive competence are associated with the establishment of competence-based referents. Competence-based referents could be designed in various forms, such as points, virtual money, user profiles, leaderboards, and progress bars. One common use of referents in learning environments is points. Gamification design can be integrated with the referents to provide feedback information and set up goal structures, which motivate users' adoption of cognitive competence goals. A gamified design based on such referents is likely to magnify its effect to support users' adoption of goals. Therefore, we have the following propositions in responding to support cognitive competence goals:

Proposition 1a. A gamification design can show referents to support users' task-based cognitive competence achievement.

Proposition 1a can be demonstrated by existing gamification studies. In a technology-mediated training setting [4], researchers investigated how gamification affects users' experience and learning outcome. In a gamified database training session, students played a

game similar to "Who Wants to Be a Millionaire," wherein virtual money is earned when players answer database-topic-related questions displayed in the lower right corner of the screen.

In a study on peer response system in educational contexts [57], students completed writing assignments and provided comments on each other's work. A student's feedback on other's performance would be assessed regarding its usefulness. Researchers compared the effects of joyful peer response (JPR; gamified group) with ordinary peer response (control group). In the JPR system, points were used to measure the quality of tasks completed by students. The results showed that the gamified version of peer response generally leads to a better writing performance than the ordinary peer response.

Gamification design augmented the task referent and guided users' adoption of task-based cognitive competence goals, promoting their task behavior by reflecting their task performance.

Proposition 1b. A gamification design can show referents to support users' self-based cognitive competence achievement.

In a study about a gamified learning tool [58], gEchoLu was designed to improve student engagement in online discussions. Two game elements, experience points (XPs) and a progress bar, were integrated in this gamified system. Each student's collected XPs would be displayed in the progress bar. Four levels of achievement, namely, "Novice," "Skilled," "Senior," and "Guru," allowed students to track their achievements in the past, their current progress, and the next level. This gamification design guides students' adoption of self-based cognitive competence goals and reflects their current performance in comparison with past performance.

Proposition 1c. A gamification design can show other-based referents to demonstrate users' cognitive competence achievement.

In the abovementioned gEchoLu study [58], a leaderboard was designed to show the top five students on the basis of the XPs earned from a specific discussion. "The inclusion of a leaderboard aims to allow students' work to be recognized by their peers" (p. 130). Recognition of individuals' contributions to a community could demonstrate their competence. To decrease anxiety caused by comparing oneself to peers, the leaderboard displayed only the top five students' XPs, and it changed weekly. This gamification design supported users who want to avoid being shown as incapable of performing efficiently.

Several other studies have also used gamification design to show one's cognitive competence in comparison with others. Pe-Than et al. [59] deployed a reward system to publicize users' accomplishments during information sharing tasks. Santhanam et al. [4] utilized periodic on-screen feedback of the competitor's performance to create an environment of competitive play.

Propositions 1a, 1b, and 1c suggest using gamification design to establish and augment three types of referents to bring about desirable adoption of cognitive competence goals. These propositions guide designers and practitioners in narrowing down the focus of their design and prioritizing their choices of three types of referents if they intend to promote users' cognitive competence achievement. For instance, in a single-person gamified learning environment, the gamification design of task-referents or self-based referents can lead to more desirable outcomes than the use of gamification for other-based referents. Under the condition of learning in a group, gamifying the other-based referent may outperform the other two types of referents for some users. Importantly, when applying game elements in contexts wherein cognitive achievements are needed, designers and practitioners should consider using elements that are suitable as referents.

4.2 Supporting social competence goals

Social competence should be developed and demonstrated in a socially interactive environment, that is, users are not by themselves, but they need to interact with others. Gamification design can create such social environments by implementing role play and team formation to support the development and demonstration of social competence. Therefore, we present the following propositions:

Proposition 2a. A gamification design can create a socially interactive venue to help users develop their social competence.

In a study on gamified fitness services [60], an online service, namely, Fitocracy, uses badges, levels, and points to gamify exercise. This fitness service rewards users with points by collecting their self-reported exercise data. Fitocracy includes a social network design wherein users commented and gave "likes" similar to Facebook. "…it offers a venue for social activity such as group-forming and communication, incorporates profile-building and also the possibility of sharing content" (p. 423).

In a college classroom setting [61], researchers used a bullet screen (where students can post their questions/comments and share them with their

classmates in screens simultaneously) to create a social space. Through this design, students were encouraged to develop skills for expressing and communicating with others. This approach is especially helpful for students who "were ashamed of expressing or hardly knew how to express questions" (p. 3733).

Proposition 2b. A gamification design can create a socially interactive venue to help users demonstrate their social competence.

In another study on Fitocracy [62], researchers introduced the fitness service by applying achievement badges to reward social activities, such as posting comments and receiving "likes." Users of this service have acquaintances, friends, and other people in their networks, and the achievement badges demonstrate their social skillfulness.

In a gamified social networking service named Empire Avenue [63], each player has a personal account to show their social interaction on a range of social media networks. Members can earn badges and virtual currencies for performing various social interaction activities, such as communication, creation of groups, building personal or corporate profiles, sharing content, and so on. Leaderboards are used to rank players' virtual sharing performance and social networking scores.

Propositions 2a and 2b focus on using gamification design to support people's needs for social competence development and demonstration. Social competence is a crucial type of human motivation that has not been substantially studied in gamification research. For designers and practitioners, recognizing this aspect of competence will guide them to use gamification design to support social activities and cater to individuals' social competence achievement. For instance, using gamification design to magnify group-forming, role-playing, or profile-building will present a service with additional social flavor and thus support participants to reach a desirable level of social competence.

4.3 Supporting social purpose goals

The social purpose for achieving cognitive competence, such as impressing others, gaining social status, receiving social approval, and demonstrating social affiliation, can also be supported by gamification design. Many gamification studies have discussed the social consequences of being cognitively competent (e.g., [29], [59]). In a gamified information system, gamification design not only addresses the issues of showing cognitive referents but also allows users to make a social influence. Therefore, we have the following proposition:

Proposition 3. A gamification design can support social consequences resulting from developing and demonstrating users' cognitive competence.

In the abovementioned gamified fitness service example, Fitocracy was designed as an online service that used badges, levels, and points to gamify exercise. Users could receive others' encouragement on their exercise reports, achievements, and level-ups. Users' attitude toward Fitocracy was influenced by friends or people who were important to them, "because they wanted to be perceived positively through using this service," [60, p. 428]. These social consequences relate to the users' social approval goal.

In the abovementioned JPR study [57], students could vote for the ranking of the feedback giver's performance. "The leaderboards and trophies were employed to represent participants' social reputation based on their feedback performance," [57, p. 434]. This system allowed subjects to be recognized for their cognitive competence (providing useful comments) and seek social status (social purpose goals) for being cognitively competent. This case is an example of supporting social status goal with gamification.

Although social competence and social purpose goals both focus on the social aspect, they are not always promoted together, depending on the broad context of a research setting. For instance, in the second example of Proposition 2a, gamification design was only used to support social competence development, and no social purpose goals were presented. In the gEchoLu example of Proposition 1c [58], students received thumbs-ups from peers because of their academic achievements, and the learning environment was designed to satisfy their need for social affiliation, which is regarded as the social purpose goal. In this case, social competence was not promoted by gamification design.

Proposition 3 states another important social aspect of gamification design, that is, social influences or results of being cognitively competent within a group. Unlike the previous propositions, this proposition suggests that designers and practitioners should consider the consequential effect of being cognitively competent. The idea of consequential effect suggests a new dimension for designers and practitioners to apply gamification design to make an impact.

5. Summary and Conclusion

In this study, we adapted AGT to understand the effect of gamification design for supporting users' goal adoption and achievement behaviors. This research contributes to the theoretical advancement of gamification research. Specifically, we developed three

sets of achievement goals, namely, cognitive competence, social competence, and social purpose. An achievement goal can be a person's dispositional goal orientation or a contextual goal affected by a purposely designed environment. The contextual aspect of achievement goals provides a theoretical lens for explaining why and how gamification can influence a person's motivation and behavior. We developed six gamification design propositions that corresponded to the three sets of achievement goals (three for cognitive competence, two for social competence, and one for social purpose). We illustrated each proposition with empirical examples from extant gamification literature. It is worth noting that the authors of the selected papers have their own research agendas and objectives, which are not necessarily aligned with the adapted achievement goal perspectives. However, our identification of these empirical examples suggests that the adapted AGT can explain or justify the effect of gamification design. Our examples showcase that gamification design can construct one or multiple achievement goal structures, depending on the specific requirements of researchers or practitioners.

This conceptual work is limited by its focus on gamification as an overall design approach. One possible future research direction is to link users' existing goals before using gamified systems to adopted contextual goals afforded by the gamified systems. Another major future area of research will be to establish the connection between the three sets of goals and the specific gamification design considerations, which is beyond the scope of this study. Prior research has presented multilevel conceptual notions of gamification design, such as game elements, attributes, objects, and mechanisms [11], [13], [64], [65]. Researchers have agreed with the importance of developing and clarifying the taxonomies of game elements, yet none of the extant taxonomies is definitive or in common agreement [34]. Determining a precise level of gamification design to guarantee a definitive consensus of game elements is challenging. Additional effort is needed to develop and validate game element taxonomy. Once such taxonomy is validated, design propositions can be further developed to uncover how specific design objects or mechanisms can create goal structures to influence users' adoption of contextual achievement goals.

6. Acknowledgments

7. References

[1] P. Zhang, "The affective response model: A theoretical framework of affective concepts and their relationships in the ICT context," *MIS Quarterly*, vol. 37, no. 1, pp. 247–274, 2013.

[2] S. Deterding, "The lens of intrinsic skill atoms: A method for gameful design," *Human-Computer Interaction*, vol. 30, no. 3–4, pp. 294–335, 2015.

[3] L. Hassan, A. Dias, and J. Hamari, "How motivational feedback increases user's benefits and continued use: A study on gamification, quantified-self and social networking," *International Journal of Information Management*, vol. 46, pp. 151–162, Jun. 2019.

[4] R. Santhanam, D. Liu, and W.-C. M. Shen, "Research Note—Gamification of Technology-Mediated Training: Not All Competitions Are the Same," *Information Systems Research*, vol. 27, no. 2, pp. 453–465, Jun. 2016.

[5] L. D. Kaczmarek, M. Misiak, M. Behnke, M. Dziekan, and P. Guzik, "The Pikachu effect: Social and health gaming motivations lead to greater benefits of Pokémon GO use," *Computers in Human Behavior*, vol. 75, pp. 356–363, Oct. 2017.

[6] A. Suh, C. M. K. Cheung, M. Ahuja, and C. Wagner, "Gamification in the Workplace: The Central Role of the Aesthetic Experience," *Journal of Management Information Systems*, vol. 34, no. 1, pp. 268–305, Jan. 2017.

[7] N. R. Prestopnik and J. Tang, "Points, stories, worlds, and diegesis: Comparing player experiences in two citizen science games," *Computers in Human Behavior*, vol. 52, pp. 492–506, Nov. 2015.

[8] L. Hassan, "Governments Should Play Games: Towards a Framework for the Gamification of Civic Engagement Platforms," *Simulation & Gaming*, vol. 48, no. 2, pp. 249–267, Apr. 2017.

[9] S. Albertarelli *et al.*, "A Survey on the Design of Gamified Systems for Energy and Water Sustainability," *Games*, vol. 9, no. 3, p. 38, Jun. 2018.

[10] H. Warmelink, J. Koivisto, I. Mayer, M. Vesa, and J. Hamari, "Gamification of production and logistics operations: Status quo and future directions," *Journal of Business Research*, Sep. 2018.

[11] B. Morschheuser, J. Hamari, J. Koivisto, and A. Maedche, "Gamified crowdsourcing: Conceptualization, literature review, and future agenda," *International Journal of Human-Computer Studies*, vol. 106, pp. 26–43, Oct. 2017.

[12] J. Hamari, L. Hassan, and A. Dias, "Gamification, quantified-self or social networking? Matching users' goals with motivational technology," *User Modeling and User-Adapted Interaction*, vol. 28, no. 1, pp. 35–74, Mar. 2018.

[13] D. Liu, R. Santhanam, and J. Webster, "Toward Meaningful Engagement: A Framework for Design and Research of Gamified Information Systems," *MIS Quarterly*, vol. 41, no. 4, pp. 1011–1034, Apr. 2017.

[14] R. M. Ryan and E. L. Deci, "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being," *American Psychologist*, vol. 55, no. 1, p. 68-78, 2000.

[15] E. A. Locke and G. P. Latham, "Building a practically useful theory of goal setting and task motivation: A 35-year odyssey.," *American Psychologist*, vol. 57, no. 9, pp. 705–717, 2002.

[16] E. A. Locke and G. P. Latham, "The development of goal setting theory: A half century retrospective.," *Motivation Science*, vol. 5, no. 2, pp. 93–105, Jun. 2019.

[17] P. Zhang, "Motivational affordances: reasons for ICT design and use," *Communications of the ACM*, vol. 51, no. 11, p. 145, Nov. 2008.

[18] P. Zhang, "Toward a positive design theory: Principles for designing motivating information and communication technology," in *Designing Information and Organizations with a Positive Lens*, vol. 2, 0 vols., Emerald Group Publishing Limited, 2008, pp. 45–74.

[19] E. D. Mekler, F. Brühlmann, A. N. Tuch, and K. Opwis, "Towards understanding the effects of individual gamification elements on intrinsic motivation and performance," *Computers in Human Behavior*, vol. 71, pp. 525–534, Jun. 2017.

[20] M. Sailer, J. U. Hense, S. K. Mayr, and H. Mandl, "How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction," *Computers in Human Behavior*, vol. 69, pp. 371–380, Apr. 2017.

[21] N. Xi and J. Hamari, "Does gamification satisfy needs? A study on the relationship between gamification features and intrinsic need satisfaction," *International Journal of Information Management*, vol. 46, pp. 210–221, Jun. 2019.

[22] R. N. Landers, K. N. Bauer, and R. C. Callan, "Gamification of task performance with leaderboards: A goal setting experiment," *Computers in Human Behavior*, vol. 71, pp. 508–515, Jun. 2017.

[23] J. Tang and P. Zhang, "Exploring the relationships between gamification and motivational needs in technology design," *International Journal of Crowd Science*, vol. 3, no. 1, pp. 87–103, May 2019.

[24] R. N. Landers, "Developing a theory of gamified learning: Linking serious games and gamification of learning," *Simulation & Gaming*, vol. 45, no. 6, pp. 752–768, 2014.

[25] G. Tondello, H. Premsukh, and L. Nacke, "A Theory of Gamification Principles Through Goal-Setting Theory," in *51st Hawaii International Conference on System Sciences (HICSS)*, IEEE, 2018, pp.1118-1127.

[26] C. S. Dweck, "Motivational processes affecting learning," *American psychologist*, vol. 41, no. 10, pp. 1040–1048, 1986.

[27] D. Welsh, J. Bush, C. Thiel, and J. Bonner, "Reconceptualizing goal setting's dark side: The ethical consequences of learning versus outcome goals," *Organizational behavior and human decision processes*, vol. 150, pp. 14–27, Jan. 2019.

[28] N. Ntoumanis, "Empirical links between achievement goal theory and self-determination theory in sport," *Journal of Sports Sciences*, vol. 19, no. 6, pp. 397–409, Jan. 2001.

[29] G. Hirst, D. Van Knippenberg, and J. Zhou, "A Cross-Level Perspective on Employee Creativity: Goal Orientation, Team Learning Behavior, and Individual Creativity," *AMJ*, vol. 52, no. 2, pp. 280–293, Apr. 2009.

[30] S. Deterding, M. Sicart, L. Nacke, K. O'Hara, and D. Dixon, "Gamification: using game-design elements in non-gaming contexts," presented at the CHI Extended Abstracts on Human Factors in Computing Systems, 2011, pp. 2425–2428.

[31] K. Huotari and J. Hamari, "A definition for gamification: anchoring gamification in the service marketing literature," *Electron Markets*, vol. 27, no. 1, pp. 21–31, Feb. 2017.

[32] T. Wolf, W. H. Weiger, and M. Hammerschmidt, "Gamified services: How gameful experiences drive customer commitment," in *GamiFIN Conference*, Pori, Finland, 2018, p. 75-82.

[33] K. R. Christy and J. Fox, "Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance," *Computers & Education*, no. 78, pp. 66–77.

[34] R. N. Landers, G. F. Tondello, D. L. Kappen, A. B. Collmus, E. D. Mekler, and L. E. Nacke, "Defining gameful experience as a psychological state caused by gameplay: Replacing the term 'Gamefulness' with three distinct constructs," *International Journal of Human-Computer Studies*, vol. 127, pp. 81–94, 2019.

[35] P. R. Pintrich, "An Achievement Goal Theory Perspective on Issues in Motivation Terminology, Theory, and Research," *Contemporary Educational Psychology*, vol. 25, no. 1, pp. 92–104, Jan. 2000.

[36] R. B. Cialdini and N. J. Goldstein, "Social Influence: Compliance and Conformity," *Annu. Rev. Psychol.*, vol. 55, no. 1, pp. 591–621, Feb. 2004.

[37] C. S. Hulleman, S. M. Schrager, S. M. Bodmann, and J. M. Harackiewicz, "A meta-analytic review of achievement goal measures: Different labels for the same constructs or different constructs with similar labels?," *Psychological Bulletin*, vol. 136, no. 3, pp. 422–449, 2010.

[38] C. Ames, "Classrooms: Goals, structures, and student motivation," *Journal of Educational Psychology*, vol. 84, no. 3, pp. 261–271, 1992.

[39] A. J. Elliot, "Approach and avoidance motivation and achievement goals," *Educational psychologist*, vol. 34, no. 3, pp. 169–189, 1999.

[40] A. J. Elliot and H. A. McGregor, "A 2× 2 achievement goal framework," *Journal of Personality and Social Psychology*, vol. 80, no. 3, pp. 501–519, 2001.

[41] T. C. Urdan and M. L. Maehr, "Beyond a Two-Goal Theory of Motivation and Achievement: A Case for Social Goals," *Review of Educational Research*, vol. 65, no. 3, pp. 213–243, 1995.

[42] A. J. Elliot and J. M. Harackiewicz, "Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis.," *Journal of personality and social psychology*, vol. 70, no. 3, p. 461, 1996.

[43] A. J. Elliot, K. Murayama, and R. Pekrun, "A 3 X 2 Achievement Goal Model," *Journal of Educational Psychology*, vol. 103, no. 3, pp. 632–648, 2011.

[44] G. A. D. Liem, "Academic and social achievement goals: Their additive, interactive, and specialized effects on school functioning," *British Journal of Educational Psychology*, vol. 86, no. 1, pp. 37–56, Mar. 2016.

[45] A. M. Ryan and S. S. Shim, "Social Achievement Goals: The Nature and Consequences of Different Orientations Toward Social Competence," *Personality and Social Psychology Bulletin*, vol. 32, no. 9, pp. 1246–1263, Sep. 2006.

[46] M. Dowson and D. M. McInerney, "The Development and Validation of the Goal Orientation and Learning Strategies Survey (Goals-S)," *Educational and Psychological Measurement*, vol. 64, no. 2, pp. 290–310, Apr. 2004.

[47] A. Kaplan and M. L. Maehr, "The Contributions and Prospects of Goal Orientation Theory," *Educational Psychology Review*, vol. 19, no. 2, pp. 141–184, Apr. 2007.

[48] R. B. King and D. A. Watkins, "'Socializing' Achievement Goal Theory: The Need for Social Goals," *Psychological Studies*, vol. 57, no. 1, pp. 112–116, Mar. 2012.

[49] A. M. Ryan and S. S. Shim, "An exploration of young adolescents' social achievement goals and social adjustment in middle school," *Journal of Educational Psychology*, vol. 100, no. 3, pp. 672–687, 2008.

[50] S. S. Shim and A. M. Ryan, "What do students want socially when they arrive at college? Implications of social achievement goals for social behaviors and adjustment during the first semester of college," *Motivation and Emotion*, vol. 36, no. 4, pp. 504–515, Dec. 2012.

[51] K. R. Wentzel, "Adolescent Classroom Goals, Standards for Performance, and Academic Achievement: An Interactionist Perspective," *Journal of Educational Psychology*, vol. 81, no. 2, pp. 131–142, 1989.

[52] C. M. Jagacinski, J. L. Madden, and M. H. Reider, "The impact of situational and dispositional achievement goals on performance," *Human Performance*, vol. 14, no. 4, pp. 321–337, 2001.

[53] C. A. Wolters, "Advancing Achievement Goal Theory: Using Goal Structures and Goal Orientations to Predict Students' Motivation, Cognition, and Achievement.," *Journal of Educational Psychology*, vol. 96, no. 2, pp. 236–250, 2004.

[54] C. Ames and J. Archer, "Achievement goals in the classroom: Students' learning strategies and motivation processes.," *Journal of educational psychology*, vol. 80, no. 3, pp. 260–267, 1988.

[55] S. S. Shim, Y. Cho, and C. Wang, "Classroom goal structures, social achievement goals, and adjustment in middle school," *Learning and Instruction*, vol. 23, pp. 69–77, Feb. 2013.

[56] T. Urdan and E. Schoenfelder, "Classroom effects on student motivation: Goal structures, social relationships, and competence beliefs," *Journal of School Psychology*, vol. 44, no. 5, pp. 331–349, Oct. 2006.

[57] J.-H. Wang, S. Y. Chen, and T.-W. Chan, "An Investigation of a Joyful Peer Response System: High Ability vs. Low Ability," *International Journal of Human-Computer Interaction*, vol. 32, no. 6, pp. 431–444, Jun. 2016.

[58] L. Ding, C. Kim, and M. Orey, "Studies of student engagement in gamified online discussions," *Computers & Education*, vol. 115, pp. 126–142, Dec. 2017.

[59] E. P. P. Pe-Than, D. H.-L. Goh, and C. S. Lee, "Making work fun: Investigating antecedents of perceived enjoyment in human computation games for information sharing," *Computers in Human Behavior*, vol. 39, pp. 88–99, Oct. 2014.

[60] J. Hamari and J. Koivisto, "Why do people use gamification services?," *International Journal of Information Management*, vol. 35, no. 4, pp. 419–431, Aug. 2015.

[61] D. Song, P. Ju, and H. Xu, "Engaged Cohorts: Can Gamification Engage All College Students in Class?," *EURASIA Journal of Mathematics, Science and Technology Education*, vol. 13, no. 7, pp. 3723-3734, Jul. 2017.

[62] J. Koivisto and J. Hamari, "Demographic differences in perceived benefits from gamification," *Computers in Human Behavior*, vol. 35, pp. 179–188, 2014.

[63] G. Aydin, "Adoption of Gamified Systems: A Study on a Social Media Gamification Website," *International Journal of Online Marketing*, vol. 5, no. 3, pp. 18–37, Jul. 2015.

[64] W. L. Bedwell, D. Pavlas, K. Heyne, E. H. Lazzara, and E. Salas, "Toward a Taxonomy Linking Game Attributes to Learning: An Empirical Study," *Simulation & Gaming*, vol. 43, no. 6, pp. 729–760, 2012.

[65] R. Hunicke, M. LeBlanc, and R. Zubek, "MDA: A formal approach to game design and game research," in *Proceedings of the AAAI Workshop on Challenges in Game AI*, 2004, vol. 4, p. 1722.