Contextualizing Gamification Design: Using Extended Achievement Goal Theory to Understand College Learner Differences

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Abstract

Gamification is considered a promising approach to motivating learners. Yet, existing research found an inconsistent motivating impact of gamification designs. This paper explores individual differences in gamification design in the college learning context. Drawing upon the extended achievement goal theory, we posit that individuals' academic and social achievement goal orientations can portray user types for gamification designs in a learning environment. Using data collected from college students, we validate an instrument to measure college learners' achievement goal orientations. We subsequently identify three clusters of learners: the Self-image Worriers, the Minimizers, and the Eager Learners. We name this learner taxonomy ASGOL (Academic and Social Goal Orientation Learners). We speculate about gamification design implications for supporting all ASGOL types.

Keywords: gamification, achievement goals, goal orientations, ASGOL types.

1. Introduction

Using gamification in learning is a promising approach to motivating, engaging, and sustaining learners (Legaki et al., 2020; Sailer & Homner, 2020). Gamification has been integrated into various class designs, ranging from primary school students to college students. Existing empirical evidence showed varied effects of gamification designs (Koivisto & Hamari, 2019). The expected positive impact is not always identified in influencing non-game task performance. The inconsistency may be due to two factors: the lack of attention to the context (Khan et al., 2020; Te'eni, 2016) and the lack of awareness of context-specific user differences (Koivisto & Hamari, 2019).

Contextualization is "considering and examining the context when planning and doing research to arrive at a better understanding of the phenomena under question" (Te'eni, 2015, p. 362). Because of the diverse application contexts of gamification designs, understanding contextual factors becomes a critical prerequisite to providing a nuanced insight into gamification research. Khan et al. (2020) argued that the lack of consideration for contextual factors is the cause of inconclusive or mixed findings of gamification designs. In addition, Landers et al. (2019) proposed that individual characteristics, such as users' knowledge, ability, and personal interest, may alter the effectiveness of gameful systems in creating gameful experiences. Klock et al. (2020) reviewed the association between users' characteristics and suitable game elements. They found a list of individual factors that should be considered when tailoring gamification design, such as player typology, gender, personality traits, and others.

Few theories have addressed these two factors effectively, even though different theories have been used to understand the role of gamification in user-system interaction (Liu et al., 2017). For example, self-determination theory can explain how gamification satisfies innate psychological needs and result in positive outcomes, such as better performance and enhanced well-being (Xi & Hamari, 2019). Goal-setting theory can explain how gamification should be designed to carry specific goal attributes to improve task performance (Landers et al., 2017). Motivational affordance theory helps explain the possibility of using game elements to afford gameful experiences (Morschheuser et al., 2017; Zhang, 2008).

In this paper, we investigate user types in the context of college education by applying achievement goal theory from the learning literature. We differentiate learners by their dispositional academic and social achievement goal orientations, synthesize and validate an instrument for measuring such differences, and construct specific personas to illustrate possible gamification designs.

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2. Related work

2.1. Contextualization in gamification research

Realizing the importance of context in gamification studies is not new. Contextualization means introducing contextual factors into a general research model to fit the specific characteristics of a particular research problem (Te'eni, 2015). Te'eni (2016) commented that gamification is an excellent example for IS scholars to examine the role of contextualization. Seaborn and Fels (2015) claimed that gamification outcomes are context-specific; therefore, similar gamified IS do not necessarily produce the same results in different contexts. Koivisto and Hamari (2019) suggested that researchers may risk delivering results only applicable in a specific problem setting without careful consideration of context. Thus, they proposed that future research should emphasize the role of context to reach a precise and comprehensive understanding of the phenomenon.

Despite the claim of the importance of context in gamification designs, few identified and covered specific contextual factors. Among them, Khan et al. (2020) adopted the context definition from Johns (2006, p. 386): "situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables." Context may be task or social. Task contexts relate to task characteristics, and social contexts include physical conditions of the workplace, national culture, and macroeconomic conditions. Liu et al. (2017) focused on creating meaningful gamification designs congruent with the tasks in the context.

One noticeable gap in the literature is the lack of attention to the roles of context-specific theories. For example, Silic and Lowry (2020) stated that few studies have attempted to use context-relevant theories to illustrate how gamification takes effect. In this paper, we intend to investigate gamification designs with the guidance of a context-specific theory.

2.2. User types in gamification research

Understanding users is a long-lasting consideration in human-computer interaction studies (Dillon & Watson, 1996; Norman, 2005). In game literature, some research found that user differences in demographics, motivations, preferences, and neurobiological traits, may affect players' responses to games. For example, in commercial games, companies often categorize players by age, gender, or income, to achieve an efficient marketing strategy. One famous taxonomy is the Bartle's player types for video games (Bartle, 1996, 2004), which denotes four player types: achievers, explorers, socializers, and killers, based on players' desire to interact or act in a particular genre of game. According to neurobiological findings of users' personality traits, Nacke et al. (2011, 2014) developed the BrainHex archetypes of player styles, including seeker, survivor, daredevil, mastermind, conqueror, socializer, and achiever.

The significant role of user types is also acknowledged in the gamification literature. Liu et al. (2017) proposed a gamification principle that "gamification elements must match users' characteristics." (p. 1020). Landers et al. (2019) stated that individual characteristics, such as ability, knowledge, and skills, would change the impact of a gameful system on creating gameful experiences. Marczewski et al. (2015) developed the Hexad framework for gamification user types. This framework categorized six player types based on players' various motivations for playing: philanthropists, socializers, free spirits, achievers, players, and disruptors. Using the Hexad framework, gamification scholars discussed why users have preferences over game elements (Santos & Oliveira, 2021). Hallifax et al. (2019) compared the impact of game elements across three user typologies (i.e., BrainHex, Hexad, and the Big Five personality trait model) in a contextless setting; they recommended that the choice of user typology and the implementation of gamification designs should be considered to achieve tailored gamification.

Koivisto and Hamari (2019) suggested considering the roles of the users, users' goals, and their individual characteristics to ensure the adoption and effectiveness of gamification. Specifically, they posited that users' goals within the context, their orientations toward the goals, and users' different tasks are factors that make a single design solution impossible to fit every situation. Klock et al. (2020) reaffirmed the importance of understanding user characteristics in gamification processes.

In the education literature, it is well established that individuals learn and process information differently. For example, Endorf and McNeff (1991) identified five distinct types of college learners: (1) confident, pragmatic, and goal-oriented; (2) affective; (3) learners-in-transition; (4) integrated; and (5) risk takers. Individuals differ in their ways of transforming experience into knowledge and preferred methods of processing information (Hawk & Shah, 2007). Thus, teachers are advised to design different instructional strategies for individuals with varying learning styles (Prithishkumar & Michael, 2014).

Education is one of the most applied domains of gamification designs (Klock et al., 2020; Zhang et al., 2021), yet only a few studies identified or focused on the role of learner types in gamified learning systems.

For example, Barata et al. (2017) empirically examined how different students adapted to a gamified course and identified six student clusters with observational data of students' performance matrices, including achievers, underachievers, disheartened students, late awakeners, regular students, and halfhearted students. The six student clusters showed varying responses to the same gamification environment, and students from the underachiever cluster even ignored the gaming aspect of the course. Using the Index of Learning Styles (Felder & Spurlin, 2005), Hassan et al. (2021) identified four student learning styles: information processing style, information input style, information understanding style, and information perception method; they suggested providing an adaptive gamification experience to students according to their learning dimensions. Reyssier et al. (2022) noticed that randomly assigned game elements generally demotivated learners, so they used the Hexad framework to differentiate player types. They found that players' initial motivation and user types significantly influenced their motivation to learn.

Investigations of user types in the game, gamification, and education literature pave the way for understanding user characteristics and preferences from different aspects, such as action tendencies (e.g., Bartle), motivations (e.g., Hexad), individual traits (e.g., Big Five personality), and behavioral matrices (e.g., Barata et al.). These studies inspired the theoretical advancement and empirical validation of user characteristics research in gamification designs. Some of the existing user typologies are context-independent (e.g., Bartle, BrainHex, and Hexad), which means these taxonomies address user profiles with a generic and high-level characterization that may have some limitations in uncovering the fine-grained user differences in a particular domain. Some user taxonomies were developed based on observational behavior data without theoretical support (e.g., Barata et al.). To our knowledge, none of the studies on learner type in gamification research is derived from domain-specific theories in education. Therefore, this paper explores context-specific user differences with a context-specific theory to provide more nuanced guidelines for gamification designs in learning.

3. Extended achievement goal theory

According to Fishbach and Ferguson (2007), a goal is "a cognitive representation of a desired endpoint that impacts evaluations, emotions, and behaviors" (p. 491). Achievement goals have been considered to be cognitive representations that concentrate on competence (Elliot & Harackiewicz, 1996).

Achievement goal theory (AGT), emphasizing the conceptualization and impact of achievement goals, has blossomed into one of the most popular frameworks in motivation research since its introduction in the late 1970s and early 1980s (Urdan & Kaplan, 2020). Originated from educational psychology (Dweck, 1986), AGT has been applied in many other domains, contexts, and disciplines, such as organization science (Welsh et al., 2019), human resource management (Hirst et al., 2009), gamification design (Tang et al., 2020), and others.

Individuals may have different goals when participating in an achievement activity (Ames, 1992). Their achievement goals may originate from their personal traits (thus dispositional) or cues purposely built into environmental conditions (thus situational), such as classrooms or work settings (DeShon & Gillespie, 2005; Jagacinski et al., 2001; Pintrich, 2000). Goal orientations refer to the personal aspect of achievement goals, indicating one's dispositional propensities (Dweck, 1986; Dweck & Leggett, 1988; VandeWalle et al., 1999). Goal structure refers to environmental conditions imposed by instructional practice and policies within a classroom (Meece et al., 2006). Goal structure has been explored to guide gamification designs to facilitate students' adoption of learning goals in a gamified environment (e.g., Zhang et al., 2022). This present study considers dispositional goal orientations of an individual to examine learner types.

Early work on AGT focused on academic achievement goals in educational settings, which predominantly emphasized cognitive competence. Academic achievement goals are bifurcated into mastery goals and performance goals (Dweck, 1986). Mastery goals, sometimes referred to as task goals (Urdan & Maehr, 1995) or learning goals (Welsh et al., 2019), focus on individuals' competence in doing things, leveraging the goal for self-improvement and self-growth. Performance goals, referred to as ability goals (Urdan & Maehr, 1995) or outcome goals (Welsh et al., 2019), emphasize goal achievement for the sake of accomplishing an externally-reference standard. The mastery-performance dichotomous achievement goal model was then developed into a trichotomous model, in which performance goals were divided into approach and avoidance aspects (Dowson & McInerney, 2004; Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Approach refers to a promotion focus that seeks gains, whereas avoidance is a prevention focus that averts loss (Elliot & Harackiewicz, 1996).

Achievement goal theory was extended beyond cognitive (or academic) competence to include social competence. Social achievement goals are significant and relevant in a learning environment (King & McInerney, 2020; King & Watkins, 2012; Ryan & Shim, 2006). They highlight the significance of social

competence development and demonstration. Social competence refers to social skillfulness and social abilities people would like to master and demonstrate in order to achieve peer acceptance and become socially desirable (Ryan & Shim, 2006). Mirroring academic achievement goals, Ryan and Shim (2006, 2008) developed three social achievement goals: a social development goal, a social demonstration-approach goal, and a social demonstration-avoid goal. A social development goal relates to developing social competence, such as learning new social skills, deepening the quality of social relationships, or improving one's 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.

In this paper, we follow the trichotomous achievement goal framework for academic and social achievement goals in the college education context. Table 1 summarizes the definitions of these six achievement goals.

Table 1. Academic and social achievement goals

Goal type	Definition
A1. Mastery goal	"achieve to demonstrate understanding, academic competence, or improving performance relative to self-established standards" (Dowson & McInerney, 2004, p. 295).
A2. Performance-approach goal	"achieve to outperform other students, attain certain grades/marks, or obtain tangible rewards associated with academic performance" (Dowson & McInerney, 2004, p. 295).
A3. Performance-avoid goal	"avoid the demonstration of incompetence" (Midgley et al., 2000, p. 9).
B1. Social development goal	"concerns a focus on developing social competence…on learning new things, growth, and improvement." (Ryan & Shim, 2006, p. 1247).
B2. Social demonstration-approach goal	"concerns a focus on demonstrating social competence and gaining from others positive judgments that one is socially desirable" (Ryan & Shim, 2006, p. 1247).
B3. Social demonstration-avoid goal	"concerns a focus on demonstrating that one does not lack social competence…avoiding something that would incur negative judgments from others and indicate social undesirability" (Ryan & Shim, 2006, p. 1247).

Note. A means academic achievement goals; B means social achievement goals.

4. Methodology

A mixed-method approach is utilized to identify learner types and the corresponding gamification design implications. First, we collect empirical data from American college students and use confirmatory factor analysis to validate an instrument for dispositional achievement goal orientations. Then, we use cluster analysis to identify patterns of students' dispositional achievement goal orientations. Finally, we present three personas and discuss gamification design implications for these learner types.

In the Fall 2021 and Spring 2022 semesters, students in five undergraduate classes on Information Systems and Analysis at a major university in North America participated in the study. Students needed to complete individual assignments and a semester-long team project for the course. Both academic and social competences were emphasized as learning objectives in the syllabus.

A total of 83 students participated in the surveys on six dispositional achievement goal orientations at the beginning of their semesters. Five responses were dropped due to incomplete data, resulting in a sample of 78 students. Table 2 shows the demographic data.

Table 2. Demographic information

Variable	Value	Frequency
Gender	Female	30
	Male	48
Age	18-22 years old	75
	23-30 years old	2
	31+ years old	1
Ethnicity	African-American	7
	Asian	20
	Hispanic	6
	Multiracial	2
	White	42
	Choose not to report	1

5. Data analysis and findings

5.1. Reliability and validity of the instrument

We adopted a total of 26 items measuring six goal orientation (GO) constructs (five for A1, five for A2, four for A3, four for B1, four for B2, and four for B3) from the established instruments. Items of A1 and A2 are from GOALS-S (Dowson & McInerney, 2004), and items of A3 are from Midgley (2000). Items of B1, B2, and B3 are from Ryan and Shim (2006). After the instrument validation process, two items for A1, one for A2, one for A3, and one for B1 are eliminated from further analyses because of their low factor-loadings.

Table 3 presents the reliability of the six GO constructs. Cronbach's α values of A1, A2, A3, B1, and B2 are higher than the threshold of 0.70, and B3 is slightly below. The average variance explained (AVE) for each construct is higher than the threshold of 0.50

(Hair et al., 2021). The composite reliability values of all constructs are higher than the threshold of 0.70. The results suggest good reliability and convergent validity. The correlation between latent factors depicts that the square root of the AVE of each construct is higher than its correlation coefficients with other constructs. Table 4 shows the final factor loading and cross-loadings of the measurement model, indicating that all items have much higher loadings on their related constructs than all their cross-loadings on the other constructs. All evidence supports the discriminant validity of the instrument, presented in Table 5.

Table 3. Reliability and convergent validity

	Cronbach's α	CR	AVE	GOA1	GOA2	GOA3	GOB1	GOB2	GOB3
GOA1	0.718	0.830	0.622	**0.788**					
GOA2	0.759	0.846	0.580	0.397	**0.761**				
GOA3	0.803	0.879	0.709	0.155	0.299	**0.842**			
GOB1	0.730	0.841	0.641	0.412	0.152	−0.032	**0.80**		
GOB2	0.847	0.897	0.686	0.156	0.449	0.278	−0.02	**0.828**	
GOB3	0.684	0.806	0.510	0.077	0.339	0.439	−0.18	0.602	**0.714**

Note. GO means goal orientation; CR means composite reliability; AVE means average variance explained.

Table 4. Factor loading and cross-loadings

	GOA1	GOA2	GOA3	GOB1	GOB2	GOB3
GO-A11	**0.893**	0.515	0.169	0.326	0.239	0.147
GO-A13	**0.736**	0.093	0.124	0.436	−0.086	−0.040
GO-A14	**0.725**	0.168	0.036	0.237	0.127	−0.005
GO-A21	0.370	**0.820**	0.197	0.115	0.414	0.140
GO-A22	0.258	**0.768**	0.264	0.142	0.462	0.351
GO-A23	0.417	**0.761**	0.215	0.194	0.151	0.212
GO-A25	0.164	**0.691**	0.231	−0.005	0.291	0.324
GO-A36	0.169	0.135	**0.822**	0.001	0.250	0.410
GO-A37	0.130	0.367	**0.899**	−0.043	0.296	0.430
GO-A39	0.076	0.217	**0.802**	−0.040	0.086	0.192
GO-B11	0.388	0.153	−0.082	**0.878**	0.011	−0.138
GO-B13	0.372	0.136	0.069	**0.843**	−0.058	−0.182
GO-B14	0.167	0.042	−0.104	**0.665**	−0.001	−0.112
GO-B21	0.033	0.370	0.267	−0.027	**0.818**	0.587
GO-B22	0.057	0.314	0.226	0.002	**0.787**	0.454
GO-B23	0.186	0.401	0.248	−0.099	**0.868**	0.481
GO-B24	0.241	0.397	0.173	0.056	**0.839**	0.462
GO-B31	0.115	0.225	0.532	−0.113	0.276	**0.686**
GO-B32	−0.057	0.141	0.229	−0.229	0.612	**0.733**
GO-B33	0.128	0.376	0.245	−0.123	0.504	**0.771**
GO-B34	0.027	0.219	0.256	-0.019	0.263	**0.661**

5.2 Identification of learner types

Classifications of learner types can help gamification designers understand user characteristics. Cluster analysis can generate a set of clustered objects that exhibit high internal (within-cluster) homogeneity and high external (between-cluster) heterogeneity (Balijepally et al., 2011). Gamification studies have found this approach appropriate for identifying patterns of user preferences or behaviors (e.g., Barata et al., 2017; Schmidt-Kraepelin et al., 2020). In this study, we apply this method to reveal learner types based on participants' responses to six GO constructs.

Table 6 shows the descriptive statistics of six GOs by the 78 students. Using R 4.1.0, we explore the patterns of participants' achievement goal orientations with a two-step clustering analysis approach proposed by Punj and Stewart (1983). In the first step, we use the agglomerative hierarchical partition procedure with Ward's method to determine a preliminary solution. The dendrogram suggests a three-cluster solution. Then, we use the k-means method, which is a non-hierarchical algorithm, to arrange the participants into their final cluster solution. According to the elbow rule, the cluster solutions of sizes three and four have the most explanatory power. After inspecting these two solutions, we find that a three-cluster solution is the best outcome

to ensure homogeneity within and heterogeneity between clusters.

Table 5. Final Instrument for six achievement goal orientations

GO	Measurement	
GOA1	GO-A11	I want to do well at school to show that I can learn new things.
	GO-A13	I work hard to understand new things at school.
	GO-A14	I work hard at school because I am interested in what I am learning.
GOA2	GO-A21	I want to do well in school because being better than others is important to me.
	GO-A22	I try to do well at school because I am only happy when I am one of the best in the class.
	GO-A23	I want to learn things so that I can come near the top of the class
	GO-A25	When I do good schoolwork, it's because I am trying to be better than others.
GOA3	GO-A36	It is important to me that I don't look stupid in class.
	GO-A37	One of the goals is to keep others from thinking I'm not smart in class.
	GO-A39	One of my goals in class is to avoid looking like I have trouble doing the work.
GOB1	GO-B11	In general, I strive to develop my interpersonal skills.
	GO-B13	I feel successful when I learn something new about how I relate to other people.
	GO-B14	It is important to me to work on improving the quality of my relationships with my friends.
GOB2	GO-B21	It is important to me to have "cool" friends.
	GO-B22	I want to be friends with "popular" people.
	GO-B23	It is important to me that others think of me as popular.
	GO-B24	It is important to me to be seen as having a lot of friends.
GOB3	GO-B31	My goal is to avoid doing things that would cause others to make fun of me.
	GO-B32	I would be successful if I could avoid being socially awkward.
	GO-B33	In social situations, I feel successful if I manage to avoid having others think I am a geek.
	GO-B34	I try not to goof up when I am out with people.

Note. GO means goal orientation; A means academic achievement goals; B means social achievement goals.

Table 7 shows the clusters' size and the center scores of six goal orientations in each cluster. Because the means of measurement items are standardized in cluster analysis, the center scores range from −1 (meaning one standard deviation below the sample mean) to +1 (one standard deviation above the sample mean). Figure 1 is the cluster plot; it shows no overlapping participants. To better illustrate the three clusters concerning the six GOs, we draw a radar chart (Figure 2) based on the results reported in Table 7.

Table 6. Descriptive information of GOs

Sample	GOA1	GOA2	GOA3	GOB1	GOB2	GOB3
Min	2.33	1.00	1.00	2.00	1.00	1.00
Max	5.00	5.00	5.00	5.00	4.25	4.75
Mean	4.26	2.60	2.89	4.31	2.15	2.61
SD	0.68	0.94	0.96	0.64	0.88	0.90

Table 7. Standard scores of GOs by cluster

Cluster	*N*	GOA1	GOA2	GOA3	GOB1	GOB2	GOB3
1	28	0.10	0.51	0.62	−0.37	0.95	0.84
2	21	−1.00	−0.92	−0.55	−0.53	−0.72	−0.56
3	29	0.62	0.17	−0.20	0.74	−0.40	−0.41

As indicated in Figure 2, among all three clusters, Cluster 1 has the highest scores on A2, A3, B2, and B3, and the medium scores for A1 and B1. They care about what others think of their competence and thus focus more on demonstrating performance and avoiding showing incompetence. They tend to worry about their images more than learning. We name these learners *Self-Image Worriers*.

Cluster 2 has the lowest scores among the three clusters on all six goal orientations. These learners have the lowest goal orientations on both mastering and demonstration. They are least eager to learn new things and least concerned about what others think of their competence. They aim for minimum efforts. We name them *Minimizers*.

Cluster 3 scores the highest on A1 and B1, and medium values for A2, A3, B2, and B3. These learners have a more dominant orientation toward academic and social competence development. They are eager to learn and master and care less about their images. We name them *Eager Learners*.

We name our taxonomy ASGOL, which stands for Academic and Social Goal Orientation Learners.

Figure 1. Cluster plot of participants by goal orientations

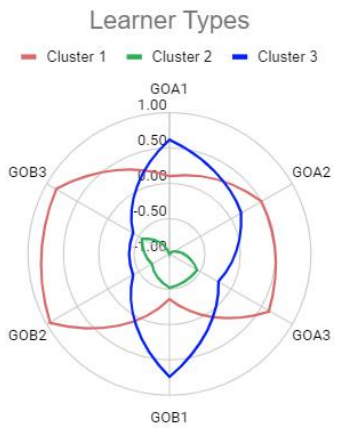

Figure 2. Learner types concerning six goal orientations

5.3 Learner personas and gamification design implications

Considering the usefulness and popularity of personas in HCI and other social science disciplines and applications (Nielsen, 2019; Salminen et al., 2021), we develop three personas, one for each cluster. As a design tool, a persona is a lens to highlight relevant issues and the specific context associated (Nielsen, 2019). In a two-step procedure, we first identify three students from the study pool since all participants submitted their consent for the study. We locate the cluster number they belong to according to their responses to the survey, then review their comments for the open-ended questions and their behaviors in the class. Secondly, we fictionize the personas by providing more details, which also helps diminish the identity of the three students the personas are based on.

In this section, we speculate on design considerations for the three personas. The purpose is to create scenarios and solutions based on the needs of the users (Nielsen, 2019).

1) Self-Image Worrier: Vicky

Vicky is soft-spoken and has a warm personality. She always has a smile on her face and wants everyone to like her. Her primary goal is to get an A. Learning more about the subject matter and working well with her group are also important, although they mainly help her do well in job interviews. In general, she wants to avoid losing face when showing her work, avoid showing her socially awkwardness, and demonstrate that she can complete her part of the group work.

Vicky is a bit intimidated to speak up in class at the beginning. After receiving confirmation and appraises on several occasions during the first few weeks, her confidence grows, and she starts to speak up more, even volunteering to share her in-class exercise solutions with the class several times. She gradually plays more of a leader's role in her group project. She also develops friendships with her team members and decides to take courses with some of them in future semesters. She finishes the class ranked number two in overall scores that reflect performances in both academic and social tasks.

To support Vicky, a gamified learning system could provide cognitive, affective, and social feedback to ensure that she has a positive image in front of her peers and the professor. For example, leaderboards show only a few highest achievers in the class. If Vicky is on the leaderboards, she is happy that her competences are demonstrated to the class. If Vicky is not on the leaderboards, it does not mean Vicky's competence is at the bottom of the class. Therefore, Vicky wouldn't be worried about losing face.

In general, points, leaderboards, and medals for academic and social task performances can show that Vicky is doing well academically and socially. Appraises from the professor and cheers from their peers can provide the affective feedback that is important to her. In a gamified environment like this, Vicky can stay motivated and engaged in her study and thrive in her learning.

2) Minimizer: Leah

Leah is content and wants to be in control of her life. Her plate is full of classes, social responsibilities, and personal interests. She belongs to several student organizations and has two conferences to attend during the semester. She wants to stay afloat in the class, not fall behind and not put too much effort. An A grade would be excellent, but a B is not too bad, either. She is shy, but that does not bother her too much. During the semester, she misses several classes and group meetings and earns an average grade of B on her individual assignments. She is not eager to share her questions or comments in class unless the professor calls upon her. She does not feel embarrassed when her answers are off because the professor states clearly in class that mistakes are a part of learning.

To support Leah, a gamified learning environment could use points and class averages for both academic and social performance assessments to remind Leah of where she is in comparison to others and where her current standing is for her grade. Such feedback cues provide cognitive and social feedback that can prompt her to put more effort or remind her that she is doing fine the way she is. In addition, by only showing high achieving students on the leaderboards and only a few medal receivers, Leah would not feel uncomfortable even if she is in the lower half of the class in case she slips. The affective feedback can make her relieved and content with her performances.

3) Eager Learner: Michael

Michael is an ambitious student who wants to be a well-rounded high achiever. Besides required assignments, he works on extra credit tasks and often shares insights and comments regarding others' work. He considers social competence extremely important to influence others in a positive way. Michael has two buddies who are also on the university's sports teams. The three of them often take the same classes together, with Michael sitting in the middle. This way, the other two could see his notebook and ask him questions whenever necessary. Michael wants his buddies to stay engaged in learning and doing well so that their grades are not a concern for them being on the sports teams. This pushes Michael to go the extra mile in learning the subject matter so that he can answer any questions his buddies may have.

To support Michael, a gamified learning environment could provide additional challenges for him to enhance his academic knowledge and social skills. For example, academic challenges and level-up assignments would allow him to pursue additional course materials and fulfill the need for mastery. Besides, a gamified learning environment could use social challenges, such as role-playing, to provide opportunities for students like Michael to act as a discussant, moderator, or judge of team exercises, a coordinator or leader for class sessions, and/or a mentor for other students.

6. Discussion and conclusion

Following the theoretical agenda for gamification research to consider contexts and individual differences (Klock et al., 2020; Koivisto & Hamari, 2019; Te'eni, 2016), in this paper, we use achievement goal theory as a context-specific theory to investigate learner differences in college settings. By studying learners' six achievement goal orientations, we develop the ASGOL taxonomy with three learner types: *Self-Image Worriers*, *Minimizers*, and *Eager Learners*.

We suggest that commonly used gamification design elements such as points, medals, or leaderboards can effectively motivate all three learner types, yet in different ways. For *Self-Image Worriers*, points, medals, and leaderboards may function as a referent for them to compare their performance with others to ensure that they are not in danger of losing face even if they are not at the top of the class. For *Minimizers*, these elements are feedback cues to inform them where they are in their performance so that they can regulate their behaviors without falling too much behind. For *Eager Learners*, these elements can be a referent for self-evaluation of task mastery. Additional challenging activities such as level-up assignments and role-playing can inspire *Eager Learners* to thrive.

Our work provides additional support to the notion from the literature that the same gamification design elements can offer the users different motivational affordances (Koivisto & Hamari, 2019). Therefore, instructors and designers should be mindful of the same gamification design generating differential impacts for different types of users.

Compared with other user types in the game and gamification literature developed with different context considerations or theoretical support, our learner types may appear to share some similarities. Nonetheless, in essence, they are very different. For example, *Self-Image Worriers* are similar to *Socializers* in BrainHex, Hexad, and Bartle typologies in that they all care about others. However, *Self-Image Worriers* care about others' assessments or opinions of themselves, while *Socializers* care about interacting and enjoying the connection with others. *Minimizers*, *Disruptors* (from Hexed), and *Underachievers* (from Barata et al.) may share similar low efforts and behaviors but have different motivations. *Disruptors* intend to cause changes to the system or social norms; *Underachievers* emphasize the lowest acceptable performance to pass a course; while *Minimizers* want to put minimum effort to achieve desirable performance. *Eager Learners* are similar to all *Achievers* in various user typologies. Yet, not all of them are the same. *Eager Learners* and *Achievers* in Hexad and Bartle emphasize self-development as a process; *Achievers* in Barata et al. and BrainHex focus on completing all collections, acquiring all possible points, and excelling in every aspect of the course, and these are closer to performance demonstration instead of mastery goal orientations. In summary, our taxonomy of learner types is domain-specific theory-driven and thus contributes to the gamification literature in a unique way.

We collected dispositional goal orientation data from undergraduates in five classes at a major North American University. Larger and more diverse samples may help confirm our findings of learner types. Future research may demonstrate the linkages among learner types, gamification designs, and learning outcomes with this context-specific ASGOL taxonomy.

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