Gamification for Change: A New Approach to Investigate Students' Attitudes Toward Educational Gamification in Online Learning Environments

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Introduction

Gamification is "the use of game design elements in non-game contexts" (Deterding, Dixon, Khaled, & Nacke, 2011, p. 10). Gamification in education differs from creating a full-fledged game as it focuses on extracting the factors that make video games fun and pleasurable and adapts those factors into course design (Deterding et al., 2011; Measles & Abu-Dawood, 2015). The purpose of educational gamification is to motivate students by creating an engaging learning experience that can keep students focused on the learning task (Abudawood, Measles, Madrigal, & Kaplan, 2015). Instructional designers may insert one or more game design elements like: (a) badges, (b) leaderboards, (c) points, (d) levels, (e) storylines, or (f) avatars to promote students' interactions with each other and their interactions with the course content.

In education, most empirical gamification studies focus on the effectiveness of using game design elements in specific learning contexts (Dicheva, Dichev, Agre, & Angelova, 2015). Unfortunately, researching students' attitudes towards gamification in online learning environments is limited. In addition, there is a lack of "validated psychometric measurements" created according to rigorous research methodologies (Ortiz, Chiluiza, & Valcke, 2016). Most of the gamification research in higher education that sought students' perspectives was conducted after students' involvement in a gamified learning experience (Chou & He, 2017; Denny, 2013; Domínguez et al., 2013; Fotaris, Mastoras, Leinfellner, & Rosunally, 2016; Kumar & Khurana, 2012; O'Donovan, Gain, & Marais, 2013; Pettit, McCoy, Kinney, & Schwartz, 2015). Because developing gamified online courses are costly endeavors (Bernik, Bubas, & Radosevic, 2015), using validated instruments to investigate students' attitudes toward gamification in online learning environment before implementation is needed.

To overcome the lack of rigorous methodologies that investigated students' attitudes before the implementation of educational gamification, this paper reports a research methodology to investigate graduate and undergraduate students' attitudes toward gamification in online learning environments. This explanatory mixed-method approach employs both quantitative and qualitative methods to explore students' perspectives toward the pleasurability of different learning experiences. These learning experiences could be gamified and implemented in online courses using various game elements: (a) feedback, (b) points, (c) progress bar, (d) storytelling, (e) badges, and (f) levels. The current approach is based on: (a) the concept of pleasurability, (b) the self-determination theory of motivation (SDT), and (c) situated learning. This approach applies two methods for investigation: (1) Pleasurable Learning Experiences Scale (PLLEXs) (A, 2016) to assess students' attitudes toward video games and gamification quantitatively and (2) semistructured interviews to assess students' attitudes toward gamification qualitatively.

This new approach proposes to identify the main key features of educational gamification from students' perspectives with the objective of changing the way of identifying students' needs before the implementation of educational gamification in online learning environments. This change in approach will inform our practices as instructors and instructional designers in the field of learning technologies to enhance students' learning and performance in higher educational institutions.

Theoretical Background of Educational Gamification

The Concept of Pleasurability

The concept of pleasurability could be considered from two perspectives: (a) Human-computer Interaction (HCI) design and (b) video game design. From an HCI design perspective, the effective product design should meet three consumer needs proposed by Jordan (2003) as a three-level hierarchy: (1) functionality: refers to the product containing the necessary functions to perform the intended tasks, (2) usability: refers to the product being easy to use, (3) pleasurability: refers to the product being a living interactive object that brings emotional joy when used.

The pleasurability of the product can be further classified into four types: (a) *physio* pleasure, (b) *socio* pleasure, (c) *psycho* pleasure, and (d) *ideo* pleasure (A, 2016; Jordan, 2003). These types of pleasure are defined as

physio pleasure—the pleasure derived from our senses such as touch and feel,
socio pleasure—the pleasure derived from having social relationship with others,
psycho pleasure—the satisfaction derived from the feeling of competence when having the required skills and resources to accomplish a certain task, and
ideo pleasure—the emotional pleasure derived from people's values of a specific theoretical entity, like the emotional value of using environmental friendly products that goes beyond the functionality and usability of the product (A, 2016; Jordan, 2003).

These four types of pleasure can be theorized from video game design perspectives to inform the design of educational gamification by utilizing various game elements that can evoke different pleasurable aspects of learning (A, 2016). Table 1 illustrates the four pleasurability aspects in video games using game elements.

Table 1. Four Pleasurable Aspects of Video Game Elements

Physio Pleasure	Socio Pleasure	Psycho Pleasure	Ideo Pleasure
Points Progress Tracking	Collaboration Feedback	Challenges Levels	Badges Leaderboards Storytelling

Note. A (2016)

Educational gamification aims to motivate and engage students in their learning. Designing gamified courses should make learning more pleasurable and fun (A, 2016). The Playful Experiences (PLEX) framework is a game design framework that classifies the fun and playful factors that one would experience while interacting with video games into 22 categories (Arrasvuori, Boberg, Holopainen, Korhonen, Lucero, & Montola, 2011). A (2016) found that only seven categories from the 22 PLEX categories were appropriate for use in learning contexts with two additional categories added (interaction and visualization). These nine categories formed the Pleasurable Learning Experiences Scale (PLLEXs), as illustrated in Figure 1.
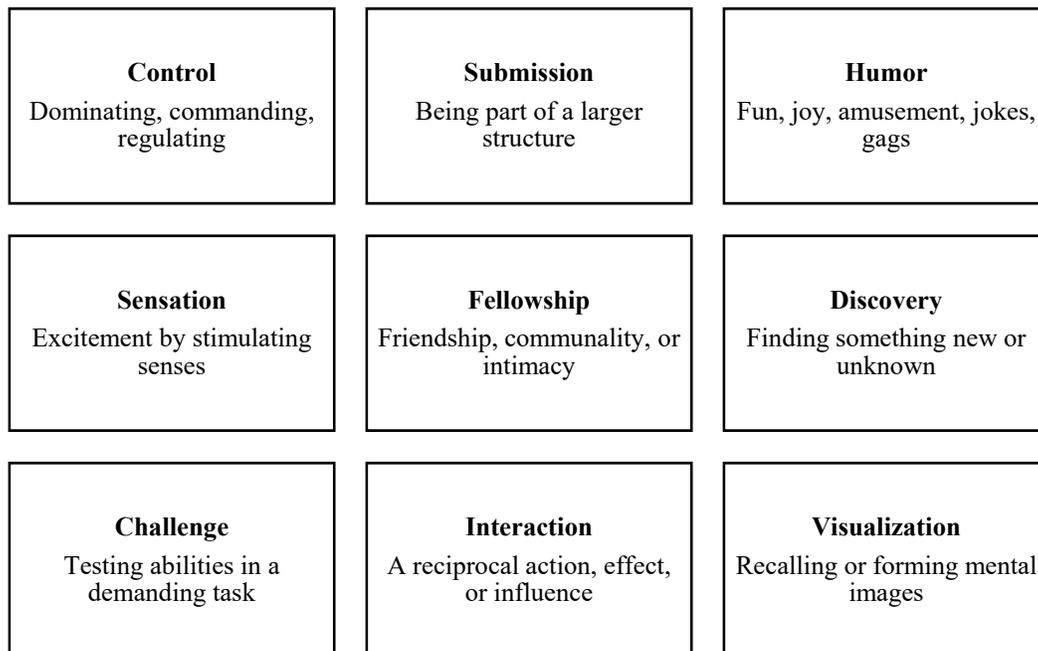
Control
Dominating, commanding, regulating

Submission
Being part of a larger structure

Humor
Fun, joy, amusement, jokes, gags

Sensation
Excitement by stimulating senses

Fellowship
Friendship, communality, or intimacy

Discovery
Finding something new or unknown

Challenge
Testing abilities in a demanding task

Interaction
A reciprocal action, effect, or influence

Visualization
Recalling or forming mental images

Figure 1. The Nine Categories of the Pleasurable Learning Experiences Scale (PLLEXs)

Self-Determination Theory of Motivation

Human motivation is vital to understanding why people are moved to do a certain task. There are two sources of human motivation that can drive someone to do a specific task: (a) the task itself being interesting and enjoyable, which refers to the task features, and (b) the satisfaction that individuals gain from performing a task, which refers to the satisfaction of innate psychological needs (Ryan & Deci, 2000). The *self-determination theory* (SDT) is a macro theory that focuses on understanding the innate psychological needs that spur a student's motivation (Ryan & Deci, 2000). In this theory, Ryan and Deci distinguished between two kinds of motivation: intrinsic motivation and extrinsic motivation (2000). When the task is intrinsically motivating, the person continues their involvement due to the feeling of enjoyment, rather than from attaining external rewards. According to SDT, a task becomes intrinsically motivating when three basic psychological needs are satisfied (Ryan, Rigby, & Przybylski, 2006):

the need for autonomy, which means the task is done because of its personal value;
the need for competence, which means the task is difficult but doable and doing it can enhance the feeling of self-efficacy; and
the need for relatedness, which means the task can afford social connection (Ryan et al., 2006).

While intrinsic motivation is an independent construct from extrinsic motivation, they do not oppose each other because human motivation can also be theorized as a continuum from fully internal to fully external motivation (Ryan & Deci, 2000). Therefore, the balance between intrinsic and extrinsic motivators in designing gamified online learning environments is essential to sustaining student engagement.

Engagement focuses on sustaining student attention by creating an immersive learning environment that can motivate students to continue working on the learning task. SDT has been utilized in various contexts, including video game play, to understand how games work to satisfy players' psychological needs (Przybylski, Rigby, & Ryan, 2010). Playing video games can be an intrinsically motivating activity because players may feel competent, autonomous, and related as a result of their video game play (Ryan et al., 2006). These three needs have been found to be strong predictors of game enjoyment and of future game play (Ryan et al., 2006). In light of SDT, gamification in online learning environments should address these three innate psychological needs in order to maintain students' intrinsic motivation by providing (a) freedom of choice to allow for autonomy, (b) challenging but doable tasks to promote competence, and (c) communication and collaboration opportunities for social connection (Aparicio, Vela, Sánchez, & Montes, 2012).

While PLLEXs is based on the PLEX framework, considering the underlying psychological needs that can stimulate students' intrinsic motivation is important. Based on these three innate psychological needs—autonomy, competence, and relatedness—the proposed approach connects the PLLEXs subscales and categories to the associated psychological needs that should be satisfied to motivate students in gamified online learning environments, as illustrated in Table 2.

Table 2. PLLEXs Subscales and Categories with Associated Psychological Needs According to SDT

PLLEXs Subscales	PLLEXs Categories	Associated SDT Psychological Needs
Preferences for Instructions	Control	Autonomy: The gamified course provides freedom of choice to promote the feeling of the learner being in control of his/her learning path.
	Submission	Relatedness: The gamified course provides opportunities for learners to feel that their work is one part of a larger structure.
Preferences for Teaching Styles	Humor	Relatedness: The gamified course is designed in a way that reflects a sense of humor to promote the feeling of fun.
	Sensation	Competence: The gamified course promotes the feeling of competence by stimulating students' senses through the use of multimedia (video) to illustrate skills.

PLLEXs Subscales	PLLEXs Categories	Associated SDT Psychological Needs
	Visualization	Competence: The gamified course promotes the feeling of competence by using multimedia (video) to help students recall information or form a mental image of a concept or a skill.
Preference for Activities	Challenge	Competence: The gamified course promotes the feeling of competence by providing learning tasks that are challenging but doable.
	Discovery	Autonomy: The gamified course provides various opportunities for students to try new things.
	Fellowship	Relatedness: The gamified course provides opportunities for interaction and communication to promote the feeling of fellowship.
	Interaction	Relatedness: The gamified course provides opportunities for reciprocal action to promote interaction.
Preferences for Learning Effectiveness	Fellowship	Relatedness: The gamified course provides opportunities to build rapport.
	Control	Autonomy: The gamified course provides opportunities to control the flow of learning content.

Note: PLLEXs = Pleasurable Learning Experiences Scale (A, 2016); SDT = self-determination theory (Ryan & Deci, 2000)

Situated Learning

Situated learning considers learning that occurs "in the same context in which it is applied, constructed socially by participants through their interactions and collaborations" (Abu-Dawood, 2016, p. 374). As a term, situated learning was invented by Lave and Wenger in 1991, when they described learning as "a process that takes place in a participation framework, not in an individual mind" (p. 15). According to this theory, learning is situated in an authentic context that encompasses knowledge and skills to be acquired. Through participation in such authentic contexts, learners become involved in a community of practice; this community embodies unique identities and behaviors and when learners acquire those behaviors, novice learners become experts as they move from the periphery of that community to its center (Lave & Wenger, 1991).

In video games, players learn how to play the game itself through rapid *cycles of expertise*, which means that players are involved in repeated cycles of practicing skills until these skills become nearly automated, then having these skills challenged in a new situation, which necessitates acquiring a new set of skills and continued practicing until reaching a higher level of mastery (Gee, 2004). This continuous involvement in the rapid cycles of expertise enables players to try different identities and transfer their gained experiences into new situations. Essentially, games are socially and culturally situated systems, which means that games are one component in complex social systems that include players as actors and social norms as resources that can enable or disable the course of play (Ramirez & Squire, 2014). This notion has implications for designing gamified online learning environments.

Educational gamification can provide opportunities for learners to take new roles and try new identities, such as doctors, lawyers, writers, or instructional designers. Because learning is situated in an authentic context, gamified online courses should provide opportunities for students to be involved in rapid cycles of expertise that shape failure as a necessary step to succeed until reaching level of mastery. The use of storyline can create learning situations where students can construct their experience through cognitive course content interactions and social interactions with others (Abu-Dawood, 2016). Gee (2008) discussed the projective identity in games using a situated learning matrix, in which "learning moves from identity to goals and norms, to tools and technologies, and only then

to content" (p. 37). This matrix signifies the necessary conditions to be met in order to construct these experiences; these conditions are not limited to individuals' cognition but also consider the active participation in a social system as part of meaning making (Gee, 2008). The design of educational gamification should consider rethinking the roles of students and the assessment mechanism used to promote students' competence and encourage them to try new identities and to have a wide range of experiences to create shared knowledge.

In this proposed approach, the use of storytelling as a game element is proposed and supported by situating learning theory. Students' perspectives toward the pleasurability of different learning experiences can be investigated where storytelling as a game element is mapped to more than one learning experience in PLLEXs. The use of storytelling in PLLEXs serves three goals: (a) as rules given to the learners, (b) as narratives used to present the learning content, and (c) as a scaffolding mechanism to provide supportive information as needed.

A New Approach for Investigating Students' Attitudes Toward Educational Gamification

The proposed new approach to investigate students' attitudes toward the pleasurability of educational gamification in online learning environments is based on *explanatory sequential design,* discussed by Creswell and Plano Clark (2011). This two-phase approach supports the use of both qualitative and quantitative methods for investigation. The first phase focuses on collecting quantitative data using PLLEXs to explore the pleasurability of 22 learning experiences from students' perspectives. The second phase focuses on collecting qualitative data by conducting semistructured interviews with selected students to get their insights regarding their rationales of considering certain learning experiences as pleasurable or unpleasurable ones. According to this approach, the collected data is integrated during the interpretation stage, as illustrated in Figure 2. The analysis for each method should be carried out independently; then, the quantitative results would be further explained by the qualitative findings. In this way, the statistical quantitative results are compared with the qualitative thematic findings to search for possible additional themes that might emerge. The quantitative phase informs the plan and the implementation of the qualitative phase. The results should be reported giving detailed description of participants' experiences and the researchers' interpretations to provide rich contextualized information to the reader. Both quantitative and qualitative methods will be discussed in detail.
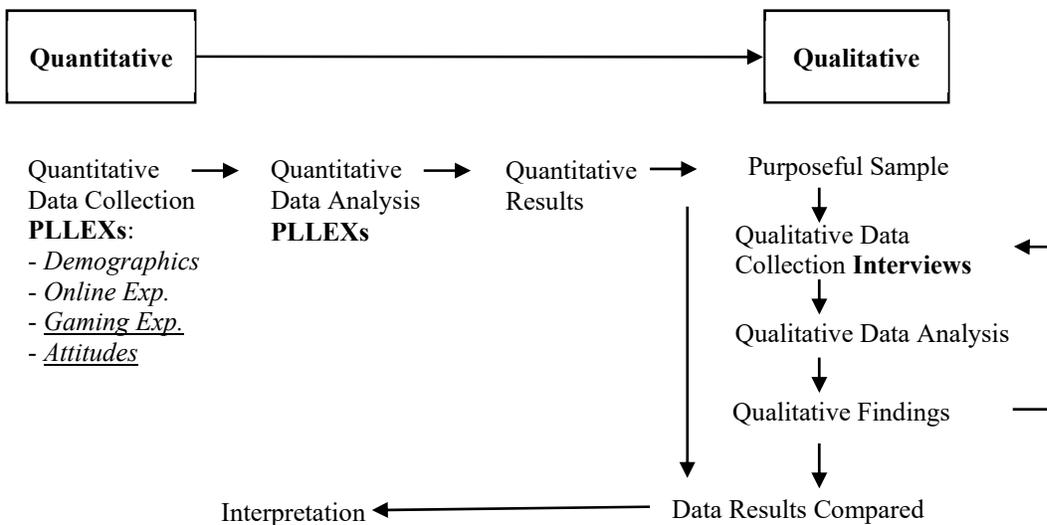

Figure 2: The Approach Design for Investigating Students' Attitudes Toward Educational Gamification

Pleasurable Learning Experiences Scale (PLLEXs)

As this approach encompasses both quantitative and qualitative phases, the quantitative phase employs a nonexperimental one-time attitudinal survey (PLLEXs). The PLLEXs is a 4-point Likert scale created by A (2016) to fulfill the need for having a quantifiable measure to assess students' attitudes toward the pleasurability of different learning experiences. These learning experiences can be gamified using specific game elements, thus creating educational gamification. The PLLEXs is based on the Playful Experiences (PLEX) framework (Arrasvuori et al.,

2011). The PLEX framework encompasses 22 categories that describe the playfulness aspects that a user can experience while interacting with video games (Arrasvuori et al., 2011). However, PLLEXs consists of seven categories out of the 22, with two additional categories that emerged during the application of the scale in learning contexts (A, 2016), for a total of nine categories. According to A (2016), these nine categories demonstrate the pleasurable feelings that college students may experience in their learning environments. These categories were illustrated in Figure 1.

Due to the nonexperimental nature of this approach, the use of PLLEXs is not intended to test hypotheses but to gain useful insights regarding students' perspectives toward gamification and establish priorities as the research proceeds. PLLEXs includes two types of variables: (a) independent variables and (b) dependent variables. The independent variables occupy the first three parts of the survey: (a) demographics, (b) online learning experience, and (c) gaming experience. The questions in these three parts are designed to serve two goals: (a) describing the participants and (b) looking for possible correlations between participants' attributes and their attitudes. Because gamification is stemmed from video games, understanding students' gaming habits is essential to explore any possible correlation between video games experience and students' attitudes toward educational gamification. The descriptions of all independent variables that are related to students experience with video games are illustrated in Table 3.

Table 3. Description of Gaming Experience Independent Variables

Independent Variables	Description
Previous Gaming Experience	Students self-report whether they have played video games before.
Current Gaming Experience	Students self-report the number of video games they are currently playing: 0, 1-2, 3-4, 5-7, more than 7 games.
Gaming Frequency	Students self-report how frequently they play video games: daily, weekly, monthly, rarely, or never.
Numbers of Gaming Hours	Students self-report the number of hours they spend every week playing video games: 0, 1-3, 4-6, or more than 6 hours.
Gaming Motivation	Students self-report their reason for playing video games: to play with friends, to make new friends, as a mental challenge, as a physical challenge, to relieve stress, to get rid of boredom, none, or other (specify).
Level of Gaming Experience	Students self-report their level of experience in playing video games: no experience, novice, intermediate, or expert.
Game Genre	Students self-report their favorite types of video games: puzzle, casual, strategy, action, adventure, fighting, shooter, racing, sports, role-playing, MMOVGs, or none.
Player Type	Students self-report their type as players: explorer, achiever, winner, socializer, or none.
Gaming Likeness	Students self-report how much they like playing video games by dragging an indicator on a scale (0-10).

Note. MMOVGs = Massively Multiplayer Online Video Games.

The fourth part of the survey is a 4-point Likert scale that encompasses 22 items. These items are organized into four subscales, which constitute the four dependent variables:

Preferences for Instructions (8 items),
Preferences for Instructors (3 items),
Attitudes towards Activities (6 items), and
Preferences for Learning Effectiveness (5 items).

Each item represents a specific learning experience. Students can indicate their agreement/disagreement with the pleasurability of each learning experience by choosing one answer from the four possible choices: (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. The more agreement the student shows on any item, the more weight will be assigned to that item. For example, if a student responds to the item "I like instructors

to provide clear rubrics." by selecting "strongly agree," the weight that will be given to that item is 4 and it could be inferred that the student perceived this experience as a fun and playful learning experience.

Semistructured Interviews

Semistructured interviews are the second phase of this approach and will be conducted to provide rich details on students' perspectives towards gamification in online learning environments. This qualitative phase of the current approach will help to further explain the correlations that might exist between dependent and independent variables and the reasons behind any such correlations. In this case, the interviewer is the instrument for qualitative data collection. The criteria for selecting individuals to interview necessitates that they must have had an experience with online learning environments. This information could be obtained from students' responses on the survey question where they report the number of online courses they have had. Because this approach is based on SDT of motivation and situated learning, selecting individuals who have diverse gaming experience should be considered to provide differing points of view. Graduate and undergraduate students who are at different levels of video game experience could hold different perspectives toward the pleasurability of gamification in online learning environments. To get a balanced view, the researcher can select some students whose answers on the attitudinal questions would represent more positive attitudes toward gamification and others who would be identified as exhibiting more negative attitudes toward gamification. This purposeful sampling of selecting outliers' cases allows the researcher to target individuals who might be likely to provide in-depth information to further explain the quantitative research findings.

The semistructured interview protocol works best for this approach because it can be seen as more of a conversation that draws out rich, in-depth data (Qu & Dumay, 2011). The data gathered through interviews must be understood within its social context, rather than considering the interview itself as a tool for collecting data (Qu & Dumay, 2011). This comprehensive understanding of the social context will help instructional designers and instructors to include applications of educational gamification in online courses. In this regard, the design of online courses can tackle various motivational issues of teaching and learning in online environments. Since interviews are best done when the interviewer approaches the interviewee with "a respect for and curiosity about what people say, a willingness to acknowledge what is not understood, and the ability to ask about what is not yet known" (Rubin & Rubin, 2005, p. 13), a semistructured approach will allow the interviewer to follow the course of conversation as it emerges through the dyadic exchange.

A semistructured interview could start by asking some questions of the interviewee to initiate the discourse, such as: (a) "Tell me about your personal experience with video games." (b) "Why did you perceive (item X) as the most pleasurable learning experience regarding instructions?" or (c) "Why did you perceive (item Y) as the least pleasurable learning experience regarding instructions?" However, the interviewer should let the participants lead the way with their own unique insight as well. For this reason, the interviewer must listen for cues from the interviewee to find areas where he/she can expand on the findings.

The interviewer could use both scheduled and unscheduled probe techniques during the semistructured interviews to elicit as much information from the participant as possible (Qu & Dumay, 2011). Scheduled probes can help to elaborate on interesting or unusual comments made by the interviewee by asking follow-up questions like: "Can you tell me more about that?" and "Can you give an example?" A semistructured interview is not a neutral process, but "a situated event in which the interviewer creates the reality of the interview situation" (Qu & Dumay, 2011, p. 247). Due to the subjectivity that might be imposed by the interviewer, the interviewer should report the interview process and findings with thick descriptions. This part of the process must include in-depth details of the interview setting, context, participants, and the interviewer's actions to facilitate the transferability of the findings into other contexts (Yilmaz, 2013).

Conclusion

Educational gamification is intended to design engaging learning experiences that can spur students' motivation to learn. This type of persuasive design adapts the strategies that make video games pleasurable and fun into the learning task so students feel fully immersed in their learning. To accomplish this goal, educators and instructional designers in higher education institutions should explore what would make learning pleasurable and fun from students' perspectives as a first step to designing effective educational gamification. Unfortunately, there is limited research that investigates students' attitudes toward educational gamification before its implementation in online learning environments. Moreover, most of the studies that intended to analyze students' needs lacked the use of validated tools that are based on theoretical foundation. This proposed approach is a research methodology to

investigate graduate and undergraduate students' attitudes toward gamification in online learning environments. This explanatory mixed-method approach employs both quantitative and qualitative methods to explore students' perspectives toward the pleasurability of different learning experiences.

The current approach is based on: (a) the concept of pleasurability, (b) the self-determination theory of motivation (SDT), and (c) situated learning. The concept of pleasurability refers to joy that students would experience while engaging in gamified online courses. This experience can be classified into nine categories: (a) control, (b) submission, (c) humor, (d) sensation, (e) visualization, (f) challenge, (g) discovery, (h) fellowship, (i) interaction. These nine categories are associated with three psychological needs that should be satisfied to make learning internally motivating activity to the students. According to SDT, these needs are autonomy, competence, and relatedness. Because learning is situated in an authentic context that encompasses knowledge and skills to be acquired, gamified online courses should provide opportunities for students to try multiple identities and be involved in rapid cycles of until reaching level of mastery. In this approach, the use of storytelling as a game element can support situating learning by giving students clear rules, presenting the course content as a story that engages and empowers students, and providing scaffolding to students as needed.

This proposed approach employs two methods for investigation: (1) the Pleasurable Learning Experiences Scale (PLLEXs) (A, 2016), and (2) semistructured interviews. The PLLEXs is a survey that consists of four major parts: demographics, online learning experience, gaming experience, and attitudes toward gamification. The attitudinal questions are targeting students' preferences for: (a) Instructions, (b) Instructors, (c) Activities, and (d) Learning Effectiveness. These four constructs constitute the overall students' attitudes toward the pleasurability of educational gamification. According to this proposed approach, data collection and analysis are done in two phases sequentially. The first phase focuses on collecting quantitative data using PLLEXs to explore students' attitudes toward video games and gamification quantitatively. The second phase focuses on collecting qualitative data by conducting semistructured interviews with selected students to examine their attitudes toward gamification qualitatively. The analysis of each phase would be carried out independently and the quantitative phase should inform the plan and the implementation of the qualitative phase. The collected data is integrated during the interpretation stage to provide in-depth information to the researcher. In this way, the approach could help to identify the key features of educational gamification from students' perspectives, which would change the way students' needs in online gamified education are identified and also change the way educational gamification could be implemented in online learning environments.

References

A, G. (2016). *Selecting appropriate game factors in educational gamification: An instrument for investigating undergraduate students' pleasurability in learning* (Doctoral dissertation, University of Kansas). Retrieved from https://kuscholarworks.ku.edu/bitstream/handle/ 1808/22018/A_ku_0099D_14858_DATA_1.pdf?sequence=1&isAllowed=y

Abu-Dawood, S. (2016). The cognitive and social motivational affordances of gamification in e-learning environment. In J. M. Spector, C.-C. Tsai, D. G. Sampson, Kinshuk, R. Huang, N.-S. Chen, P. Resta (Eds.), *Proceedings of the 16th IEEE International Conference on Advanced Learning Technologies (ICALT 2016)* (pp. 373-375). Los Alamitos, CA: Conference Publishing Services, Institute of Electrical and Electronics Engineers Computer Society.

Abudawood, S., Measles, S., Madrigal, I., & Kaplan, M. (2015). A demonstration of gamification: A gamified course catalog to increase engagement and motivation within an eLearning environment. In C. Ho & G. Lin (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2015* (pp. 528-533). Chesapeake, VA: Association for the Advancement of Computing in Education.

Aparicio, A. F., Vela, F. L. G., Sánchez, J. L. G., & Montes, J. L. I. (2012, October). Analysis and application of gamification. In F. Botella, M. Lozano, J. A. Gallud, F. Botella, A. Peñalver, & A. Mashat (Eds.), *INTERACCIÓN '12: Proceedings of the 13th International Conference on Interacción Persona-Ordenador* (Article Number 17). New York, NY: Association for Computing Machinery. doi:10.1145/2379636.2379653

Arrasvuori, J., Boberg, M., Holopainen, J., Korhonen, H., Lucero, A., & Montola, M. (2011). Applying the PLEX framework in designing for playfulness. In F. Zurlo, A. Deserti, & G. Simonelli (Eds.), *Proceedings of the Conference on Designing Pleasurable Products and Interfaces, DPPI 2011* (pp. 1-8). New York, NY: Association for Computing Machinery.

Bernik, A., Bubas, G., & Radosevic, D. (2015). A pilot study of the influence of gamification on the effectiveness of an e-Learning course. In T. Hunjak, V. Kirinić, & M. Konecki (Eds.), *Proceedings of the Central European Conference on Information and Intelligent Systems* (pp. 73-79). Varaždin, Croatia: University of Zagreb, Faculty of Organization and Informatics.

Chou, C. C., & He, S.-J. (2017). The effectiveness of digital badges on student online contributions. *Journal of Educational Computing Research*, *54*(8), 1092-1116. http://dx.doi.org/10.1177/0735633116649374

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.

Denny, P. (2013). The effect of virtual achievements on student engagement. In *CHI '13, Changing perspectives: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 763-772). New York, NY: Association for Computing Machinery. doi:10.1145/2470654.2470763

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. In *MindTrek '11, Proceedings of the 15th International Academic MindTrek Conference: Envisioning future media environments* (pp. 9-15). New York, NY: Association for Computing Machinery. doi:10.1145/2181037.2181040

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Educational Technology & Society, 18*(3), 75-88.

Fotaris, P., Mastoras, T., Leinfellner, R., & Rosunally, Y. (2016). Climbing up the leaderboard: An empirical study of applying gamification techniques to a computer programming class. *The Electronic Journal of e-Learning*, *14*(2), 94-110.

Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling*. New York, NY: Routledge.

Gee, J. P. (2008). Learning and games. In K. Salen (Ed.), *The ecology of games: Connecting youth, games, and learning* (pp. 21-40). Cambridge, MA: Massachusetts Institute of Technology Press. doi:10.1162/dmal.9780262693646.021

Jordan, P. W. (2003). *Designing pleasurable products: An introduction to the new human factors*. London, United Kingdom: Taylor & Francis e-Library.

Kumar, B., & Khurana, P. (2012). Gamification in education—Learn computer programming with fun. *International Journal of Computers and Distributed Systems*, *2*(1), 46-53.

Lave J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York, NY: Cambridge University Press.

Measles, S., & Abu-Dawood, S. (2015). Gamification: Game-based methods and strategies to increase engagement and motivation within an eLearning environment. In D. Rutledge & D. Slykhuis (Eds.), *Proceedings of the Society for Information Technology & Teacher Education International Conference 2015* (pp. 809-814). Chesapeake, VA: Association for the Advancement of Computing in Education.

O'Donovan, S., Gain, J., & Marais, P. (2013). A case study in the gamification of a university-level games development course. In P. Machanick & M. Tsietsi (Eds.), *SAICSIT '13: Proceedings of the South African Institute for Computer Scientists and Information Technologists* (pp. 242-251). New York, NY: Association for Computing Machinery. doi:10.1145/2513456.2513469

Ortiz, M., Chiluiza, K., & Valcke, M. (2016). Gamification in higher education and STEM: A systematic review of literature. In L. G. Chova, A. L. Martínez, & I. C. Torres (Eds.), *Proceedings of the 8th Annual International Conference on Education and New Learning Technologies, Edulearn 16* (pp. 6548-6558). Valencia, Spain: International Academy of Technology, Education and Development. doi:10.21125/edulearn.2016.0422

Pettit, R. K., McCoy, L., Kinney, M., & Schwartz, F. N. (2015). Student perceptions of gamified audience response system interactions in large group lectures and via lecture capture technology. *BMC Medical Education*, *15*, 92. https://doi.org/10.1186/s12909-015-0373-7

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, *14*(2), 154.

Qu, S., & Dumay, J. (2011). The qualitative research interview. *Qualitative Research in Accounting & Management*, *8*(3), 238-264.

Ramirez, D., & Squire, K. (2014). Gamification and learning. In S. P. Walz & S. Deterding (Eds.), *The gameful world: Approaches, issues, applications* (pp. 629-652). Cambridge, MA: MIT Press. Retrieved from http://www.jstor.org/stable/j.ctt1287hcd.46

Rubin, H. J., & Rubin, I. S. (2005). Listening, hearing, and sharing social experiences. In *Qualitative interviewing: The art of hearing data* (2nd ed.). Thousand Oaks, CA: Sage.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54-67.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*(4), 344-360. doi:10.1007/s11031-006-9051-8

Yilmaz, K. (2013). Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education* [Special issue: Adult learning systems in a comparative perspective], *48*(2), 311-325. doi:10.1111/ejed.12014