Gender Moderation in Gamification: Does One Size Fit All?

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Abstract

Organizations actively seek methods for increasing employee engagement by incorporating game elements in core systems and processes, in an effort to increase their perceived playfulness. However, little is known about the actual impact of these elements on perceived playfulness. This study includes results from three repeated experiments performed during a gamified academic course. The relationships between enjoyment of specific game elements, the way they increase perceived playfulness, and gender moderations of these relations were examined. All three experiments show that badges had a positive relation with perceived playfulness and were more enjoyable to women. Surprisingly, the results showed that when men were the majority of subjects in the group, the relations between the game elements and perceived playfulness were different from when men were a minority. These results provide important insight into what possibly influences perceived playfulness in gamified solutions.

Keywords: gamification, gender, games, information systems, game mechanics, demographics

1. Introduction

The inclusion of playful elements in information systems has become commonplace as a means of engaging users and increasing system acceptance [1, 2]. Hedonic and utilitarian systems traditionally have been treated as separate research entities [3], but in the past few years, they have been converging in a field called gamification, which is defined as the use of game design elements in non-gaming contexts, such as, but not limited to, the workplace [1].

Gamification is a rapidly growing field from both business and research perspectives but despite its potential market growth, there is lack of research on the core components on which gamification is built: game elements. While the existing information systems research is focused on the benefits of playfulness and playful systems [4, 5], the questions of which game elements, or combination of them, trigger playfulness, under what conditions, and how demographic characteristics moderate this effect are unanswered [6]. This knowledge is critical for practitioners seeking to successfully include gamification in enterprise processes and systems.

The most common game elements used in gamification implementations are points, badges, and leaderboards [7]. In this research, we examine these elements along with the progress bar and reward game elements, to understand their contribution to the perceived playfulness (PP) of a gamified learning environment. Although playfulness, in and of itself, is a stable personality trait [8], meaning that some people are more playful than others, perceived playfulness, the focus of this research, refers to the situational characteristics of the interaction between an individual and the situation [9], and can thus be controlled.

Existing research consistently shows that gender differences exist in the motivations for playing games and game genre preferences [10, 11]. Research also shows that gender moderates technology acceptance and usage [12, 13]. As gamification combines both domains, this study seeks to understand what, if any, gender moderating effects exist in a gamified learning environment designed for a specific course. The gamified course was delivered for three consecutive semesters. Gender differences and moderating effects within each semester and between semesters were analyzed using a combined data set from all semesters and as three separate data sets for each semester. This analysis allowed us to test the repeatability of the results and provide robust findings.

This paper is structured as follows: First, a literature review of gamification and gender moderation in games and information system acceptance models is presented. Next, a theoretical model that includes different game elements with the role of gender as a moderating factor is presented and justified. The study itself and the data analysis are presented, and finally, a discussion that includes limitations and future directions is presented.

2. Theoretical background

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Games give players pleasure, are playful and fun, spark various types of motivation, and are engaging [14]. In contrast, work is traditionally viewed as a serious task that is the opposite of play [15]. Therefore, it is not surprising that enterprises are investing efforts in transforming work into something more enjoyable [16]. The utilization of games at work has been studied for several years and has been found to improve the overall work experience [17]. Simply referring to a task as a game has been shown to have a positive effect on the performance of the task, compared to performing the same task when it is called work [18]. Playing is a basic need, and even in places where people are not expected to play, such as workplaces, employees have been observed developing unofficial games that are played with or against each other, consciously [17] and unconsciously [19]. Organizations are now realizing the benefits of creating playful work environments [15] as a method for improving the overall work experience, as well as increasing productivity and creativity. In the information systems field, PP or a system has been shown to be a contributing factor in user acceptance [20, 21].

Gamification has several definitions, but the broadest definition is the use of game design elements in non-game contexts [1], which is not limited to a specific usage or scenario. The first and most important distinction in this definition compared to other game categories is that gamification happens in a non-game context. This distinction appears in many different gamification definitions, some explicitly [1, 22] and some implicitly [2]. A non-game context is anything that was not designed as a game and the context can be related to an industry-specific lens, such as service marketing, value creation [2], or user activities and behaviors, such as problem solving [22], and engagement and participation [23]. Gamification happens within a utilitarian environment, and the user may not even be aware of its existence.

Hand-in-hand with the notion of the non-game context, as expected in a business-oriented system, gamification uses the term "user," whereas the definitions for games refer to the term "player." This difference is not simply a matter of semantics; it emphasizes the point that gamification does not see the participant as a player, although game elements are included. A gaming context makes the people playing the game aware that it is just a game, separate from their real lives. However, in gamification, although the user's experience and motivations are enhanced by the game elements, the mindset is that of work.

A key similarity between games and gamification is the voluntary nature of them. Playing a game must be an act of free will [24]; otherwise, the game might not provide the expected benefits of playfulness and enjoyment. These benefits are hard to achieve in a business setting if employees are required to complete a training program or participate in a simulation game. For example, no matter how much sugar coating is applied, students are required to perform homework; therefore, by definition, homework cannot become a fun activity [14]. From the gamification point of view, when gamifying an activity, employee participation must be conceived of as voluntary and users should not be forced to do anything differently if they do not choose to, and if management imposes a gamified solution, the employees must consent to the game [25].

2.1 Gender

Existing research consistently shows that gender differences exist in the motivations for game playing, game genre preferences, play style during the game, and emotions experienced during the game [10, 11]. For instance, female players are been found to be less attracted to competitive online games [10] and to find games less playful than male players [26]. Male players are more likely to enjoy three-dimensional rotation games [27] and are more aggressive players than women [28]. Many of the games designed, either online games or physical games, acknowledge this difference and are designed with a specific gender in mind [29].

Gender differences have been found in technology acceptance models [20, 21, 30] that show male users focus most often on the usefulness of the technology, while female users are more focused on the ease of use and enjoyment of the system and subjective norms. In most cases, gender differences in games and in technology acceptance have been found to show a positive correlation. For instance, women are more attracted to games that involve long term relationship building and ease of use [11, 31] in the same way that women's decisions to use a system are based on social norms and ease of use in systems acceptance research [32]. It is worth noting however, that these findings are not consistent [27]. Despite these differences, gender implications are missing in most information systems research, including gamification, and remain an area that requires further research [12, 13].

There is reason to believe that because gamification includes hedonic and utilitarian motivations, gender differences exist in gamification. However, only a few studies have examined these differences in a gamification context. In two recent review articles on gamification [33, 34], only two out of 47 studies reviewed, investigated gender differences, and those studies showed that women were more attracted by badges [35] and, in general, were less motivated by games [36], a finding that was repeated in [37].

Despite the aforementioned similarities between gamification, and games and utilitarian systems, gamification differs from games and from utilitarian

systems. In games, users are free to express their personalities and emotions while in utilitarian systems, workplace regulations and ethics may apply to certain behaviors such that users do not feel free to express them. Results from the few studies that have been conducted on gender and gamification do not always coincide with results from studies of games and workplaces. An example of this difference is that female users found gamified experiences more playful than male users [38], which contradicts findings that show men are more playful with games [26].

Addressing different user motivations and needs, such as, but not limited to, gender differences, is a challenge that many gamification designers face. In addition to engaging as many people as possible, they also must avoid disengaging those who choose not to play. This is perhaps the biggest pitfall for gamification designers, where, instead of doing good, they can cause overall damage to the key business objectives that gamification is supposed to increase. An example of this importance can be seen in a study conducted with salespeople in which gamification was applied. Employees who did not engage in the gamified activity suffered from lower performance and lower satisfaction, compared to the period before gamification was implemented [39]. For instance, gamification often includes creating direct (e.g., head-to-head with a single winner) or indirect (e.g., simply applying a leaderboard or a points system) competition among users as a means of increasing motivation. Female users are less likely to be motivated by these types of games [10, 27], as women perceive leaderboards and points as a means of competition, which therefore will motivate men more than women. The results of designing gamification in such a way that it motivates a specific gender carries the risk of gender discrimination.

Thus far, we have discussed the importance of PP in the success of system acceptance and gamification and showed that gender may moderate PP in a gamified environment. In the remainder of this paper, we discuss the proposed model to investigate this moderation and show the results of three empirical studies we performed based on this model.

3. Model development

In gamification, designers include various game elements with the goal of creating playfulness. Since different users are motivated differently by different game elements, it is crucial for designers to understand the relationships between game elements and their influence on users. Previous research had studied the relationships between game elements and PP [40] and have shown that personality moderates these relationships [41]. In this study, we seek to further expand these findings and understand what, if any, gender differences and moderating effects exist within these relations.

Thus far, the term game element has been used in a broad manner; however, there is no agreement on what constitutes a game element. Different classifications exist, each highlighting ways to deconstruct game elements. For the sake of this paper, and because discussing the differences between definitions and classifications is beyond the scope of the paper, we have chosen to use the Mechanics, Dynamics, and Aesthetics (MDA) definitions and framework [42] that provides a simple and easy-to-use classification and is commonly used. The MDA framework deconstructs elements into mechanics, dynamics, and aesthetics. Game mechanics are particular elements of the game at the level of data representation and algorithms, such as points, rewards, status, bonuses, and leaderboards. Game dynamics are a fuzzier concept than game mechanics, and even those who have defined game mechanics do not always define dynamics, although they often use the term. The MDA framework defines game dynamics as the run-time behavior of the mechanics acting on player inputs and each other's outputs over time [42]. A similar definition is given by Brathwaite and Schreiber [43], who view game mechanics as the pattern of play generated by the application of specific mechanics in response to other players or expected interactions. Aesthetics are the graphical elements of the game. Following the MDA framework, leaderboards and points are classified as mechanics, and their use in an application may increase the likelihood of a competitive dynamic between the players, whereas the use of chat box and user profile mechanics may increase the likelihood of a cooperative dynamic.

The list of mechanics and dynamics is not circumscribed, due to the generality of the definitions and the lack of a conceptual definition. It would be pretentious to try to address all game elements in a single study; therefore, the focus from this point on is a small subset of commonly used feedback-related game mechanics. Feedback is a key ingredient of games, providing players with required data about their progress and ways to improve [7]. These mechanics include the use of points as a means of quantifying achievements, rewards as a form of acknowledgement of an achievement, badges as a means of demonstrating achievements, leaderboards as a way of positioning achievements against others, and a progress bar as a means of positioning accomplishments against personal or system expectations. A summary of the definitions for each mechanic can be found in Table 1.

Game mechanics are referred to as design elements used by designers to achieve playfulness; however, how this is done, why certain mechanics are used, and the

exact level of use have no prescription [44]. To the best of our knowledge, no empirical study has shown which combination of game mechanics create playfulness in a game or system context and how they do it. To date, the approach taken by gamification researchers has been deductive. Looking at games that attract players, and breaking them down into their specific game elements, can identify repeating elements and show they are important [45]. Although this approach is useful, it does not explain the impact of each game element.

Table 1 - Legend of game mechanics terminology adapted from [34]

Term	Definition	Alternatives
Points	Numerical units indicating progress.	Experience points; score.
Badges	Visual icons signifying achievements	Trophies
Rewards	Tangible, desirable items	Incentives, prizes, gifts
Leaderboards	Display of ranking for comparison	Rankings, scoreboard
Progression	Milestones indicating progress	Leveling, level up

3.1 Perceived Playfulness of Systems

Existing information systems research treats playfulness with two approaches. The first is that playfulness is a personal trait that is more salient in some individuals. This approach to playfulness, in a system usage context, is defined as the degree of cognitive spontaneity in microcomputer interactions [46]. Playfulness has been shown to influence perceived ease of use, perceived usefulness, and behavioral intentions [47].

The second approach treats playfulness as a situational characteristic of the interaction between an individual and a situation [9], and is measured through perceived playfulness. PP is a controllable system characteristic that has been shown to positively influence the intention to use [48] and the intention to continue using, demonstrated with expectation confirmation theory [9]. Moon and Kim [48] conceptualize PP as 1) a focus on the interaction, 2) curiosity during the interaction, and 3) finding the interaction intrinsically enjoyable or interesting.

PP is achieved by curiosity and an enjoyable interaction [48] that, in a gamification context, are achieved through the game mechanics. Based on the literature on gender, games, and system acceptance, we hypothesize that in a gamified environment, gender would moderate the PP derived from different game mechanics and combinations of them.

Figure 1 summarizes the research model, including game mechanics that provide feedback (points, rewards, badges), and the mechanics used to present the feedback (progress bars and leaderboards). Points are a more immediate form of feedback that is given out in either real time or upon the completion of a short-term task. Badges are a form of virtual or visual feedback and are typically given out as medium-term feedback or in recognition of the completion of specific tasks. Rewards can be physical or virtual and are typically given out as long-term feedback, such as upon the completion of several tasks or the winning of a competition.

Leaderboards and progress bars are standalone feedback presentation game mechanics used to present the information generated by other game mechanics. Progress bars typically show an individuals' progress, while leaderboards compare the results of one user against others. Presentation mechanics have no meaning without the data they need to present which comes from the feedback mechanics, and thus the relation direction is between feedback mechanics to presentation mechanics. It is logical to assume that those who enjoy the feedback mechanics, will enjoy viewing their feedback on a leaderboard and/or a progress bar, therefore these relationships are assumed to be positive. While presentation mechanics are typically used to present information, they can also influence the PP and thus the relations between presentation mechanics and PP are hypothesized.

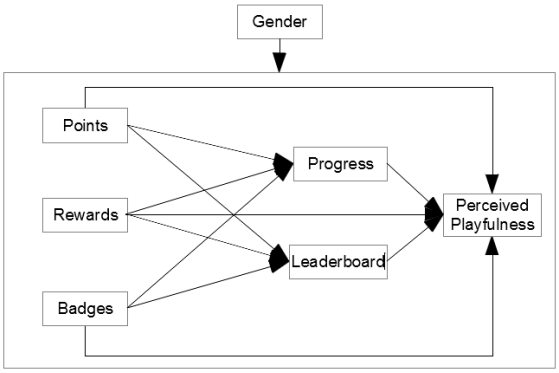

Figure 1 - Theoretical model

PP is the level of playfulness that the entire gamified solution is perceived to have. The model hypothesizes that there is a relationship between the feedback delivery mechanics, the presentation layer, and the PP of the gamified solution and that these connections are moderated by gender.

4. Methodology

4.1 Study Context

This study was performed using university undergraduates participating in the software analysis and design course delivered to students in their third year (out of four). The vast majority of students taking this course were studying industrial engineering and management. The Learning Management System (LMS) platform used was Moodle, the standard LMS at the university where this study took place, meaning students were familiar with the LMS before gamification was included. LMSs carry a big promise for adaptive learning and enriched learning experiences [49]; however, in many cases, student interactions with LMSs are centered on downloading class material, handing in assignments, and reading announcements [49].

The main objective of the gamified course was to increase student engagement with course materials by encouraging more frequent and meaningful interactions. The main functionalities of the standard LMS were kept, and game mechanics were added. First, a discussion board was added where students and staff could discuss items relevant to the course material. Discussion boards include many good design principles for incorporating games in education [50]. They provide student-to-student and student-to-staff interaction opportunities and allow students to create content, build online identities, explore ideas, and take risks. For each contribution to the discussion board, students received a default value of 10 credit points, and for more meaningful contributions, participants received up to 50 points. Meaningless contributions, such as "I agree with the comment above," did not earn students any points. Each post was graded automatically and in real-time using software developed for this purpose. The number of points each participant had was visible to all students on a leaderboard. Contribution to the discussion board was partially mandatory, as students were required to reach 600 points during the semester. However, other mechanisms for earning points were available to those who did not feel comfortable posting their thoughts online. At the end of the course, the average number of points was 902, with a standard deviation of 458, indicating that some participants were extremely engaged while others were not (points ranged from 240–3,140). Many of the students continued discussions long after reaching the mandatory 600 points.

Additional game mechanics aimed to increase engagement were used. Non-mandatory weekly quizzes about the course material were available, and student scores were summed and presented on a dedicated leaderboard ranking students against each other. Badges were awarded for completing certain activities on the discussion boards, such as contributing posts (1, 5, 10, 20, 50, or 100 posts), responding to questions, and participating in various activities online. Logic riddles or small game-theory experiments in which students could voluntarily participate were made available at certain points throughout the course.

The use of points, badges, and leaderboard game mechanics is often criticized by gamification scholars, who claim that using these mechanics are trivial implementations that harm long-term intrinsic motivation [51]. Although this criticism may be true in some cases, for students whose intrinsic motivation is weak to begin with, these mechanics have been found to be successful for short-term tasks [52] and thus were used in this study.

Enjoyment of game mechanics and PP questionnaires were administered during the first and second weeks of the semester. PP was measured again during weeks 6 and 7 of the semester to test how PP changed over time. This study includes data collected across three semesters as shown in Table 2, and the description of gamification was identical in all three. Combining student data across semesters provides higher statistical validity for the findings by using a higher number of subjects. Comparing semesters provides an opportunity to test the repeatability of the findings with completely different subjects. The semesters will be referred to from this point on as semester A, B, and C.

Table 2 - Sample sizes for each semester

Code	Semester	Female	Male	Female/male ratio
A	2015 Spring	60	39	1.54
B	2016 Fall	40	27	1.48
C	2016 Spring	26	43	0.6

4.2 Instrument Validation

Enjoyment from game mechanics was measured using the enjoyment of game mechanics questionnaire validated in [40, 41]. This questionnaire includes 26 items using a Likert scale of 1 (complete disagreement) to 5 (full agreement) testing whether a person has a preference for games that include specific game mechanics. Items included sentences such as "Knowing my position compared to other students in class, encourages me to invest more" (leaderboard), "I find it enjoyable to receive a special badge" (badges), "I am aware of the exact amount of points I receive in a game" (points), "I enjoy games that have real prizes" (rewards), "I find progress bars helpful in understanding where I am vs. what is expected from me in class" (progress bars).

A correlation matrix of the different constructs is presented in Table 3 showing no significant cross loading. The correlation between leaderboard and points is slightly below the maximum level of 0.7 and makes sense as these two mechanics are closely related.

Internal consistency was tested using the Cronbach alpha reported in Table 4, which showed acceptable internal validity values. A confirmatory factor analysis performed on the questionnaire items showed clear constructs as expected.

Table 3 – Correlation matrix for different constructs

	Badges	Leaderboard	Points	Progress
Leaderboard	0.54			
Points	0.48	0.68		
Progress	0.37	0.55	0.43	
Rewards	0.31	0.4	0.51	0.23

The dependent variable in the proposed model is PP, which was measured using a nine-item scale adapted from Moon and Kim [48] and includes items such as "When interacting with course web site, I do not realize the time elapsed" and "Working with the course web site stimulates my curiosity". The original items focused on PP in an Internet usage context, but for the context of this research, these questions were modified to state PP in terms of working on the course's project. The Cronbach's alpha coefficient for this scale is found in Table 4.

To allow the use of data from different semesters, student scores on enjoyment from mechanics and PP from different semesters were compared using analysis of variance (ANOVA). No statistically significant differences were found for these parameters; thus, data from different semesters could be combined.

Table 4 - Validity indices

Construct	AVE	Cronbach's alpha
Badges	0.72	0.87
Leaderboard	0.70	0.79
Points	0.61	0.87
Progress	0.50	0.69
Rewards	0.69	0.78
Perceived Playfulness	0.64	0.92

5. Results

Two main statistical procedures were applied to the data. First, t-tests were performed to examine whether gender differences existed in enjoyment of mechanics and PP. A separate set of t-tests for each semester and for the entire population were performed. A summary of the results is presented in Table 5. Each column represents a semester and the cells include the gender which showed a higher enjoyment level accompanied with the significance indicator of the difference.

The key results from the t-tests are that women enjoyed the badges more than men. This is evident in the first two semesters and in the combined data. Women's PP was higher than that of men at the beginning and during weeks 6 and 7 of the semesters; however, this is true for the total population and was less statistically significant in each semester.

Next, partial least squares (PLS) structural equation modeling was performed. PLS was selected due to the exploratory nature of the research and the small sample sizes [53]. The software used was SmartPLS Version 2.0M3 [54]. PLS analyzes the entire relations between mechanics and PP, and therefore, the PLS results may vary from those seen in simple t-tests. Similar to our approach with the t-tests, we executed a PLS model for each semester and for the combined data. We analyzed gender differences by performing a multi-group analysis t-test [55] on the different paths in order to test whether gender differences moderated the paths. The PP data for weeks 6 and 7 of the semester were used in the current analysis as they provide a more accurate representation of PP throughout the semester.

Table 5 - t-test of gender by semester

Semester	A	B	C	Combined
Points	F*		M*	
Badges	F***	F*		F****
Leaderboard	F***		M*	
Rewards				
Progress	F****			F*
PP Weeks 1-2 of course		F**		F**
PP weeks 6-7 of couse	F**	F*		F**

* p < .1. ** p < .05. *** p < .01. **** p < 0.001

Note: empty cells represent non-significant differences

All PLS runs showed the desired internal validity indices with Cronbach's alpha over 0.7, with the exception of the progress bar construct slightly lower than 0.7. Convergent and discriminant validities were observed by examining the cross loadings of the items and latent variables, and all average variance extracted (AVE) values were above the desired 0.5. The collinearity of the constructs was tested for each model, and the variance inflation factor (VIF) values were below 1.5 in all cases, indicating that there is no issue of collinearity.

Figure 2 shows the path model results for the combined data. The rewards showed no statistically significant impact on any other construct and therefore is not presented in the model. We do not show other relations, such as between badges and progress, that did not show any statistical significance. The combined model shows statistically significant relations between enjoyment of badges and the PP of the solution. It also shows that PP is positively related to enjoyment of badges, and for men, PP is negatively associated with enjoyment of progress bars. A positive relation was demonstrated between points and feedback presentation mechanics and between badges and leaderboards for both genders. A multi-group analysis that compared genders showed no statistically

significant difference in any relation between men and women.

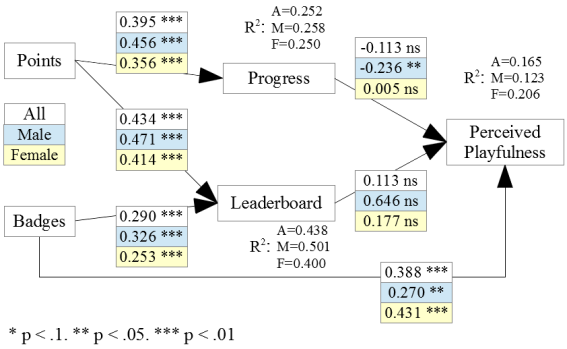

Figure 2 - Path modeling for combined semesters by gender.

To test the repeatability of these results, the model was executed using data from the three semesters. This approach has a key limitation of smaller sample sizes, but the appearance of similar effects even with this limitation would help confirm the results. As shown in Table 6, the results were consistent across all three semesters with similar coefficients.

Next, we wanted to test whether there were gender differences in the relations in the different semesters, a difference that was not visible when using the combined data from all semesters. Results of the path models for each semester by gender can be found in (Table 7). The relation between badges and PP was similar for men and woman in semesters A and B but in semester C there was a significant difference between male and female enjoyment levels. The relation between points and PP was significantly lower for male students in semester A but this finding was not repeated in semesters B and C.

Table 6 - Path model results by semesters

Relation	A	B	C
Badges – Leaderboard	0.30****	0.29***	0.27***
Badges – PP	0.50****	0.45****	0.31***
Badges – Progress	0.08	0.12	0.18*
Leaderboard – PP	0.10	0.13	0.18
Points – Leaderboard	0.47****	0.44****	0.52****
Points – PP	–0.09	-0.04	0.10
Points – Progress	0.40****	0.40***	0.35**
Progress – PP	–0.06	–0.10	–0.24*
Rewards – Leaderboard	0.05	0.06	0.07
Rewards – PP	–0.04	–0.10	–0.16
Rewards – Progress	0.02	0.08	0.02

* p < .1. ** p < .05. *** p < .01. **** p < .001

Last, a similar analysis was performed comparing gender across semesters to test whether each gender showed similar relations. Results for this analysis can be seen in Table 8. With one exception, the relations for women showed no statistically significant difference between semesters. However, the relations for men, especially when compared to semester C, were statistically significantly different in nearly all aspects. Table 7 provides the actual path coefficients that can be used with Table 8 to find the direction of the difference.

6. Discussion and Conclusion

Existing literature shows that PP has a positive effect on ease of use [4, 13, 47], intention for using [56], satisfaction [9], learning [46], and attitude toward using information systems [48]. Based on these findings, designers seek ways to increase system playfulness, in hopes of gaining wider system acceptance. In this study, we took a quantitative approach to measuring the impact of implementing common game mechanics and analyzed the relations between mechanics and how they increase the sense of PP. Although playfulness in and of itself is not gender dependent , gender has been shown to moderate the relationships between playfulness and intention to use [57] and between ease of use and usefulness and intention to use [12, 32].

In this paper, we used a gamified learning environment to examine the relation between game mechanics and PP. We performed this analysis for three semesters, each including different students. In addition to looking at the relations between game mechanics and PP, we also looked at the possibility that gender moderated these relations in the same way that gender is known to moderate games and information systems use. Examining three semesters provides a unique and important contribution because the repeatability of the results can be tested.

When combining the data from the three semesters and analyzing them, it was hard to find gender differences, but when analyzing each semester separately, such differences existed, indicating that not all semesters showed similar results. When comparing data from different semesters, it is evident that semester C showed different results from semesters A and B. Semester C also had a statistically significant different ratio of women to men compared to semesters A and B (Table 2). Semester C had a ratio of 0.6, whereas in semesters A and B, the ratio was approximately 1.5. This means that the female students in semester C were a minority in the class in contrast to semesters A and B.

Both genders reported a decline in the level of PP when comparing the beginning of the semester to weeks 6 and 7 of the semester; however, men reported a stronger decline than women. PP for women was consistently higher in semesters A and B. Gender differences were also found in the reported enjoyment of game mechanics. Women reported higher enjoyment of badges in semesters A and B that is supported by

[35]. Enjoyment of points and leaderboards was statistically significantly higher for women in semester A but higher for men in semester C.

Table 7 – Path model by gender and semester showing only statistically significant relations

Semester	A		B		C	
Gender	F	M	F	M	F	M
Badges -PP	0.49	0.48	0.59	0.60	0.56**	0.18
Leaderboard -PP	0.27***	–0.27	0.12	0.44*	0.46*	0.14
Points -PP	0.00**	–0.42	–0.07	–0.28	–0.06	0.23
Points -Progress	0.34	0.60	0.46	0.65*	0.37	0.20
Progress -PP	–0.02	0.01	0.20	0.04	0.10*	–0.36
Rewards -PP	–0.17	0.29***	–0.11	–0.05	–0.07	–0.25

* p < .1. ** p < .05. *** p < .01. **** p < .001

Note: significance indicator means there is a significant difference between genders for the given semester and the direction of the difference

Table 8 - Multi group analysis for semesters for each gender showing only significant differences

Compared Semesters	A-B		B-C		A-C	
	F	M	F	M	F	M
Badges - PP				***		*
Leaderboard - PP		***	**	*		*
Points -PP				***		****
Points -Progress				**		*
Rewards - PP		**				***

* p < .1. ** p < .05. *** p < .01. **** p < .001

Note: Significance in a cell means there is difference between semesters for the given gender

The path model provides a good method for understanding what game mechanics contribute to PP. The combined data set and the data for each semester showed similar results demonstrating perfect repeatability (Table 6). Not surprisingly, enjoyment of points contributed to the enjoyment of leaderboard and of progress bars. However, the direct relation between points and PP was not statistically significant. The only game mechanic that had a positive relation with PP was enjoyment of badges. Enjoyment of progress had a negative effect on PP for male subjects.

No gender moderation was found when using the combined data set; however, this is not the case when comparing gender moderation within (Table 7) and between (Table 8) semesters. Looking at gender moderation during each semester, sporadic differences appear. The relation between leaderboard and PP was statistically significantly higher for women in semesters A and C but had the opposite direction in semester B. Female subjects found badges more playful than men only in semester C and found points and rewards more playful than men only in semester A.

When examining the differences between semesters, the results are more conclusive. In semester C, the relations between the mechanics and PP were mostly the same as in other semesters for women, with the exception of leaderboard PP being higher. For male subjects in semester C, however, the relationships were all different than those in semesters A and B. For male subjects in semester C, the relation of badges, progress, and rewards with PP was lower, and the relation between points and PP was higher.

A possible explanation for this phenomenon could be the higher ratio of male subjects in semester C compared to semesters A and B. Research on group dynamics and behavior in groups that have a minority of men or women provides different and contradictory explanations [58] and acknowledges that "the psychological impact of being a member of a gender minority may differ for men and women" [59]. It is beyond the scope of this paper to provide such an explanation, but it is possible that the male subjects found the gamified learning experience less playful than the women. As a result, when there is a minority of men, they align with the rest of the group, but when they are the majority, their PP level is lower. However, this does not explain why female PP remains high when women are a minority.

The study contributes to the literature of gamification by examining a model of interaction between game mechanics and PP and by demonstrating that gender moderation exists, meaning that men and women may find different mechanics playful or not. A unique contribution is the comparison of three separate experiments and contrasting their results demonstrating the repeatability of some of the results. A unique finding was revealed showing different relationships for male subjects in the semester in which they were the majority of subjects.

6.1 Limitations and Future Research

The present study has several limitations and possible future directions. Gender studies sometime refer to the gender schema theory [60] that posits male subjects might have feminine behaviors and vice versa. We performed subsequent tests using the Bem Sex Role Inventory (BSRI), but they did not produce any statistically significant findings. However, this might be because the BSRI is based on stereotypes from the mid-1970s that are not necessarily accurate today. Further research should be performed in this area, using a more up-to-date version of the BSRI items.

It is important to note that while the findings here suggest that gender minority of males or females may be the cause of the result, this is an assumption that requires further exploration and alternative explanations to the findings may exist. Future studies should be performed using skewed groups to understand whether the effects we found are due to the skewed groups or some other reason.

External validity of the results may be hard to reproduce as all three semesters used subjects with similar characteristics. Further research is required to execute similar gamification for courses for non-engineering students and in different countries to gain better confidence in the repeatability of the results. The sample sizes for each semester were small. Although PLS is capable of dealing with small sample sizes, ideally, larger sample sizes should be used. Our approach of comparing different semesters is one way we tried to overcome this limitation.

Finally, self-reported items are always problematic for analysis, as there are many biases in such responses. Furthermore, when dealing with gamification, people are not always aware of how they will behave when faced with a competitive or a collaborative environment. People who prefer not to compete and, thus, report leaderboards as non-motivating, might find themselves attracted to leaderboards once they are in place. The present study evaluated self-reported and not actual behavior. Future research should be conducted using actual behavior based on system logs.

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