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Recommended Citation

Butler, B. L., & Bodnar, C. A. (2017). Establishing the Impact that Gamified Homework Portals Can Have on Students' Academic Motivation. Paper presented at 2017 ASEE Annual Conference & Exposition, Columbus, Ohio.

Establishing the Impact that Gamified Homework Portals Can Have on Students' Academic Motivation

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Establishing the Impact Gamified Homework Portals Can Have on Students' Academic Motivation

This research paper describes the investigation of the impact a gamified learning environment has on students' motivation to complete course homework within a second semester freshman year design course. There are many benefits to including a gamified learning environment within a classroom including that it allows for students to learn through failure, and provides many different paths for student success.[1] Previous studies on gamified learning environments have shown improvement in student's engagement in classrooms, as well as learning gains[2,3] although there has been little work done on the effect gamified learning environments can have on student motivation.

In this study, two classes of freshman engineering students completed their homework through the use of a gamified homework platform. The gamified homework portal was designed around quests (or individual activities) allowing for students to select the quests that interested them the most in the pursuit of achieving a final point score. Quests were scaffolded to ensure that students were meeting the minimum learning objectives for the course and progressively being exposed to content of higher difficulty. Students were also not penalized for failure and given unlimited opportunities to resubmit quests to achieve the benchmarks set for the course. As additional incentive, students could earn badges, awards and achievements based off of the quality of their work, and the quests they selected to complete.

To determine the impact that the gamified homework platform had on students' motivation, students were asked to complete the Jones MUSIC Inventory[4,5] and participate in an end of semester focus group. The Jones MUSIC Inventory measures academic motivation and provides a perspective on students' motivation towards completing course objectives. [4,5] Focus group results were analyzed using a grounded emergent qualitative analysis approach by two analysts. The categories were then cross-referenced with the Jones MUSIC model[4,5] to determine alignment of the categories observed with students' academic motivation. Overall, the results have shown that the gamified learning environment had relatively neutral impact on students' academic motivation towards homework.

Introduction and Background

Students' motivation in a class can lead to better learning gains and understanding of class material, thus it is important to keep student's motivated inside the classroom, as well as outside.[1,6,7] However, students can struggle with motivation particularly towards the completion of homework.[6,7] A method that has shown to improve students' engagement is gamification.[1]

Gamification is defined by Karl Kapp as using "game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems".[8] Games can be seen as intrinsically motivating because people who play games are voluntarily investing their time into problem-solving even though they receive nothing in return.[9] Games allow players the "freedom to fail,"[2] which can encourage players to explore, take risks, and try different solutions. Games also require players to recall prior information in order to solve the problems at hand.[10] Lee and Hammer related classroom learning back to games as points received in the classroom

can translate to grades which may also be seen as badges. They also discuss how you can earn rewards or punishments depending on your behavior in the classroom. When students move onto the next class, or semester, it can be seen as "leveling up."[9]

Gamification has already been implemented in engineering classrooms and shown to achieve increases in learning gains, involvement and student engagement. For instance, Juarez *et. al.* found a 59.31% learning gain in his gamified class compared to a 55.81% learning gain in his control class when he implemented badges and points into an Engineering in Computational Technologies class.[1] Akpolat *et. al.* found engagement and "willingness to use the learned practices" increased when they implemented gamification into a software engineering class.[11] Whereas, Barata *et. al.* saw increases in class participation, attendance and interest when he implemented gamification elements within his class through an online platform "Moodle." In his class, students could earn points and level up by correctly answering questions about the online lectures available on Moodle, and through lab challenges.[12] When Bellotti *et. al.* implemented serious games into an entrepreneurship course, they found an increase in the level of interaction between the students, teachers and entrepreneurs as well as an improvement of students' competence and skills on entrepreneurship.[13] Other studies have shown similar increases of students' engagement, learning gains and interest in class material as a result of gamification.[14,15] However, there has been few studies that examine students' academic motivation when gamification is used in a classroom.

Previous studies have shown gamification can result in improvements in motivation.[1,3,16] For instance, Mekler *et. al.* investigated the effect of various game elements (points, leaderboards and levels) on motivation and found that implementing these elements significantly improved the subjects' performance in the gamification platform, and the quality of the work. However, they found that these game elements did not significantly increase competence, need satisfaction or intrinsic motivation which was assessed using the Intrinsic Motivation Inventory.[3,16] Whereas Juarez *et. al.* implemented a different type of gamification element, badges, in his undergraduate classroom and found an increase in students' intrinsic motivation, and a decrease in their extrinsic motivation which was assessed by using the VARK survey. Juarez also stated that "gamification implementation supports better motivation on students when they want to discover new things, but it supports less while motivating students to continue learning about things that they have known before."[1] In this class, students could earn badges for helping other students finish a task, finding a mistake in the professor's material, arriving to class on time five sessions in a row, and so on. Students from this class agreed that they participated in the activities because they found satisfaction in learning new things.[1] One method that can be used to assess students' motivation within a classroom context is the Brett Jones MUSIC Model of Academic Motivation.[4,5]

Brett Jones MUSIC Model was developed to create a better understanding of academic motivation through five areas of impact: empowerment, usefulness, success, interest, and caring. Empowerment relates to the amount of choice a student feels they have in the classroom.[4,5] This particular motivational model was selected as it aligns well with several of the key properties associated with gamification. In a gamified learning environment, students can create their own

path to success by choosing which activities they would like to complete, and which they would like to avoid. Usefulness relates to students believing that the coursework is personally important or beneficial to them.[4,5] Gamified learning environments can include many different activities, ones that deal specifically with the subject area, and others that can involve report writing, or creating a resume. The area of success has to do with students believing they can succeed in the classroom if they put forth the necessary effort.[4,5] As previously mentioned, students are allowed the "freedom to fail"[2] in gamification. Students are able to re-attempt the activities until they succeed. They are also able to avoid activities they feel they might not be able to succeed in. This property of a gamified learning environment helps provide students with the scaffold necessary so that they are always working to the best of their capabilities without being pushed too far, an inherent property of games.[17,18] Interest can be broken down into two categories; situational and individual interest. Situational interest deals with "context-specific environments," where students are only interested in a topic for a short amount of time.[4,5] Situational interest can relate back to activities in gamification that are class specific. Individual interest has to do with students being interested in a topic for a long period of time.[4,5] This could relate back to activities that can teach students basic engineering principles that they can use throughout college and in their careers. The final component, caring, can also be broken down into two components: academic caring and personal caring. Academic caring deals with students believing that their instructor cares about their academic success.[4,5] The benefit of a gamified learning environment is that feedback is given to students throughout their participation to let them know if they are doing well, or what areas should be improved upon. Personal caring deals with students believing that their instructor cares about their well-being.[4,5] Instructors can explain to students within the classroom why the activities integrated into the gamification platform are important to their personal and professional growth.

Our study investigated whether student academic motivation towards homework in a freshman engineering design course was influenced by the integration of a gamification platform. In this course, engineering students of all disciplines learn about fundamentals of engineering such as statistics, economics, ethics, etc. It is important for students to master these basic engineering principles early in their curriculum in order to succeed in future classes within their degree programs. The gamification platform 3D GameLab was implemented in a semester long study in the Spring semester of 2016.

This study addressed the following research question:

How did the implementation of a gamification platform impact students' academic motivation towards homework within a freshman design course?

Methods

Gamification Platform Design
The 3D Game Lab platform was originally designed in the fall of 2015, and was created with nine different levels that students could move through by acquiring experience points (XP). Each quest provides students with a number of experience points (XP) that combine together to achieve students overall XP within the 3D Game Lab platform. This platform builds off an

existing beta software platform that has been developed by GoGo Laboratories.[19] 3D Game Lab consists of a software platform that allows individual instructors to build in quests (or activities) for students to complete that can be categorized back to course content areas. Figure 1 shows an example of the platform from a student view with the students' progress bars at the top of the figure alongside their name and avatar (frogger 101 in this case). The middle portion of the screen includes a listing of the quests available to the students at this time within the course including pertinent information that might help students in their selection of quests such as the title, XP associated with the quest, the average time it has taken other students to complete the quest, the average student rating for the quest, the category of the quest and if there is any due date associated with the specific quest.
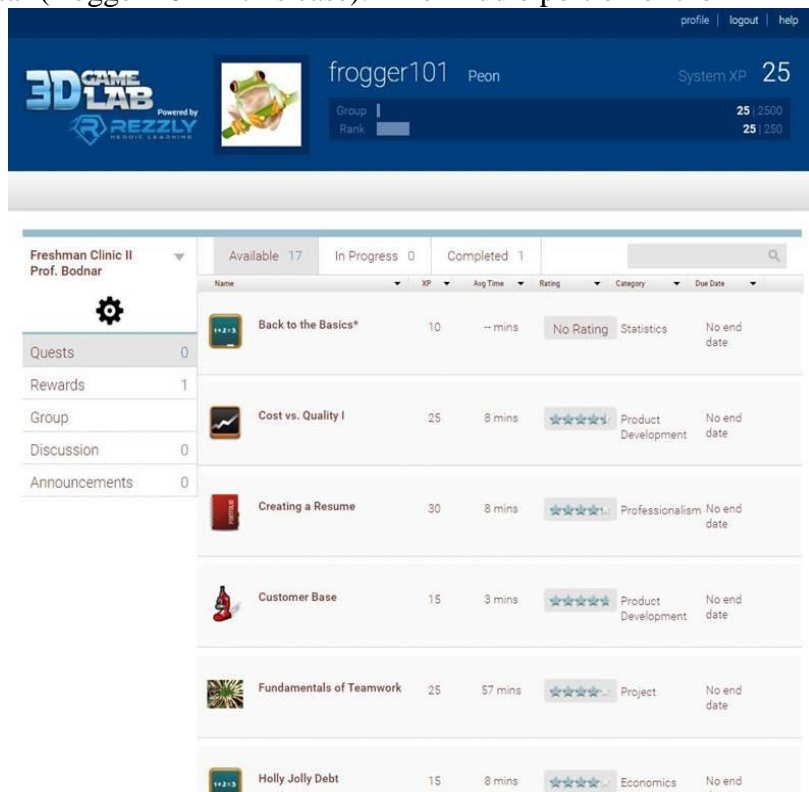
Individual quests are similar to questions or activities that might be provided to students on a weekly homework assignment. The quests provide a variety of different types of activities for students to undertake allowing them to have choice in selecting

Figure 1. Student view of 3D Game Lab Platform.

activities that appeal to them individually. Examples of quests include Back to the Basics (worth 10 XP) where students are provided with a data set and asked to calculate the mean, median and mode of the data set or Fundamentals of Teamwork (worth 25 XP) where students are provided with a web link to a team building site and instructed to work with their lab groups to submit pictures or videos of their lab group completing six of the twenty one activities listed on the website. Another example is MATLAB Graphing (worth 25 XP) where students are guided step by step in how to generate a graph in MATLAB and then asked to submit a copy of their graph along with an explanation of what the graph is demonstrating. Screenshots of the Fundamentals of Teamwork and MATLAB Graphing quests are shown in Figure 2.

Quests within 3D Game Lab are scaffolded for students to allow them to complete more basic activities at the onset of the course and then increasingly more difficult assignments as they build upon their knowledge within a content area. For instance, MATLAB Graphing was a quest that was available to students at the start of their interaction with the 3D Game Lab platform as it guided them step by step on how to set up basic functions within the MATLAB software. Later on, upon completion of several MATLAB related quests, students would be presented with the
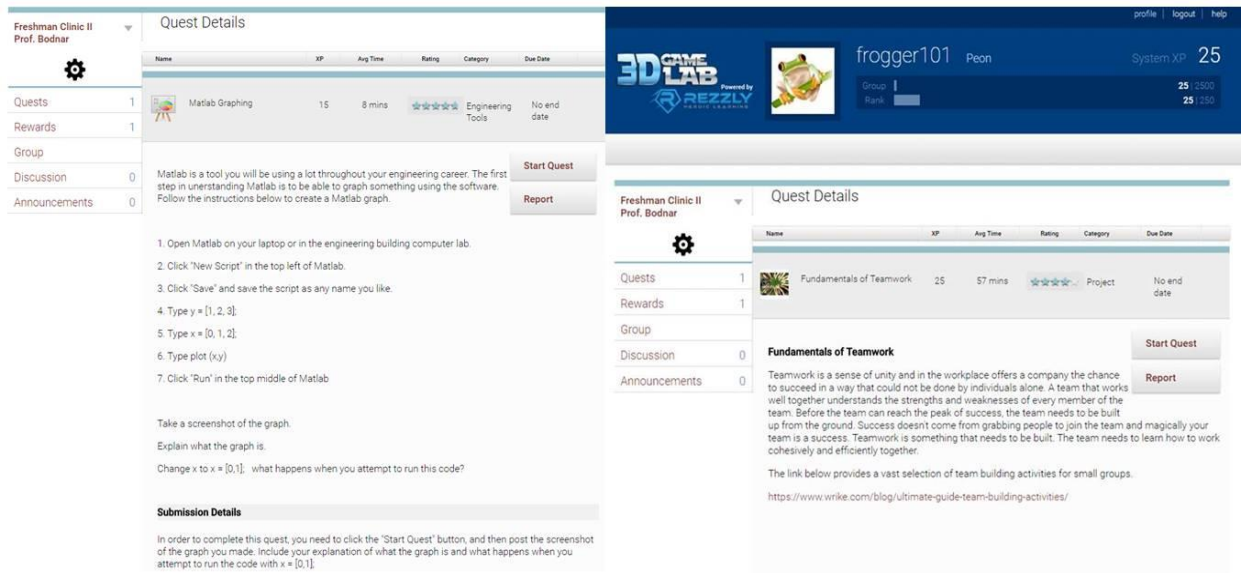
Figure 2. Screenshot of example quests within 3D Game Lab.

opportunity to select a quest called "Code a Board Game". This quest uses their prior knowledge with MATLAB to design the first move of a board game by simulating a dice roll. To get approved for this quest, students must upload their code and a copy of the output that shows their code is functioning.

Instructors may also design badges, achievements and awards that students may earn for completion of different homework goals through the platform. Students can see all the rewards that are available to them on their rewards page (Figure 3) and then click on the link below the reward to see what quests they need to complete or what requirement they need to fulfill in order to be given a reward. For example, students earn the "Welcome to the Big Leagues" achievement by completing their first quest within 3D Game Lab. More details on the design of the gamification platform including its various components, badges, achievements and awards was discussed in an ASEE freshman engineering division conference paper.[20]
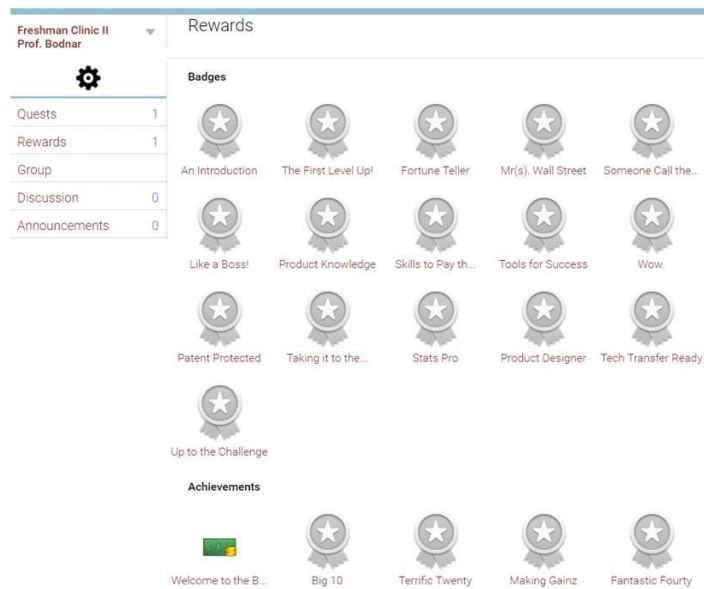

Figure 3. Screenshot of student reward page within 3D Game Lab.

In order to help students move

along and reach the 1250 XP requirement, needed for an "A" in their homework, specific benchmarks were set throughout the semester. A benchmark of 350 XP was required by the end of the first month of the semester, a second benchmark of 700 XP was required to be obtained prior to the start of spring break and finally a third benchmark of 1,050 XP was required by the end of the 3rd month of the semester. These benchmarks were put in place as historically it was found that students would wait until the end of the semester to work on the gamification platform when not provided with these guidelines.[21]

Study Design
The 3D gaming platform was implemented in two Freshman Engineering courses in the spring 2016 semester. The Freshman Engineering course is a required course for all freshmen within the College of Engineering. The course content continues from the introduction to engineering that was started in the fall semester but focuses primarily upon product design, engineering ethics, statistics, engineering economics and computational tools such as MATLAB. Other topics that are touched on over the course of the semester include intellectual property, data acquisition and engineering graphics. The course itself consists of two class meetings per week with one class meeting focused upon content reinforcement through active learning strategies such as think-pair-share, group discussions and case studies. The second class meeting is primarily focused upon the design project and includes lab based experiments, data analysis and group discussions.

Course grades for the Freshman Engineering course include a variety of lab based assignments in conjunction with the semester long design project (literature review, lab reports, final design report and presentation), online homework exercises administered through a content management system, quests on the gamification platform, a midterm and final exam along with professionalism and participation. The completion of quests within the gamification platform accounted for 15% of the final students' grade in the course.

In an effort to assess the impact that the gamification platform which was being applied as a component of student homework in the course had on students' academic motivation, students were asked to complete the MUSIC Model Academic Motivation survey,[4,5] and participate in a focus group. Both the survey and focus groups were voluntary, and took place at the end of the semester. Proper human subjects' approval was obtained prior to conducting the study.

MUSIC Model of Academic Motivation Survey
The first assessment conducted involved having students complete the Jones' Music Model of Academic Motivation Inventory shortly before the completion of the semester.[4,5] This model allows for an instructor to determine the strengths and weaknesses of a given instructional strategy while examining five key principles that are associated with academic motivation as outlined in the Introduction. The MUSIC model survey consists of 26 questions where students rate statements on a scale of 1 (strongly disagree) to 6 (strongly agree). These responses can be coded using a scheme developed by the MUSIC Model authors in order to determine the students overall impression of these components.[22]

Focus Group and Framework Development
We evaluated student perspectives on the platform through conducting a voluntary focus group with students near the end of the freshman design course. Focus groups have been shown to be effective tools in attaining feedback on products or programs.[23,24] Six students out of twenty three students in the first course participated in the focus group while eleven students out of eighteen students in the second class participated in the focus group. The focus groups were not part of the course and hence no extra credit was provided to any of the students who selected to participate. The focus groups lasted for an hour in duration and were semi-structured starting with a pre-defined set of questions that could then be probed further based upon responses that were received from the focus group participants. Table 1 shows the focus group questions that were asked of participating students.

Table 1. Focus Group Questions

1. Were these quests beneficial to you?
2. How do you think you performed on these homework assignments? Were they too challenging? Too simple?
3. Could these assignments be changed to make them more enjoyable, interesting or useful? How?
4. Did you choose quests based off of rewards or personal interest? Or another reason?
5. Which quests did you find most enjoyable? Least enjoyable?
6. When did you find time to accomplish these quests? Before class? After class? Or another time during the week?
7. Was it complicated or easy to remember to accomplish the quests? How often did your instructor remind you to do them?
8. Did you feel as if you class time had an impact on your motivation to accomplish these quests?
9. How much control did you feel you had over the quests?
10. Do you feel as if the comments provided on quests have a positive, negative or neutral connotation on your work? Why?
11. Additional Feedback

After having collected all of the focus group responses we analyzed the data by using a coding framework. The coding framework was developed using a grounded emergent qualitative analysis whereby the framework was derived from the data itself and then supported by literature on the MUSIC Model of Academic Motivation.[4,5] The final framework that was applied in coding the focus group data is shown in Table 2.

Table 2. Framework Developed from Student Focus Group Responses

Category	Sub-category	Description
Empowerment	Choice	Students level of choice over the quests
	Incentive/Rewards	Effect of badges and rewards on students' activity
	Strategies	Different ways students completed the quests
	Competition	Opinions of competition within the gamification platform
Useful	Relevance	How quests related back to students' personal use

	Course Alignment	How quests related back to other course objectives
Success	Low Difficulty	Aspects of the platform that students found simple
	High Difficulty	Aspects of the platform that students found hard
	Confidence	How confident a student was about completing quests on the platform
Interest	High Enjoyment	Aspects of the platform the students' enjoyed
	Low Enjoyment	Aspects of the platform that students' didn't enjoy
	Quest Design	Students opinions about quest design
Caring	Positive Feedback	Students thoughts on receiving positive feedback through the platform
	Negative Feedback	Students thoughts on receiving negative feedback through the platform
	Insufficient Feedback	Areas where students felt they were getting insufficient feedback
	Expectations	Students' perceptions of what was expected of them through the platform

After coding was completed, the most prominent themes that were found through the analysis were documented and are presented in the results.

Reliability Analysis
The field notes obtained from the focus groups was analyzed by two coders. One coder was a faculty member and the instructor for the course. The second coder was an undergraduate student that was trained on how to perform qualitative analysis of field notes. The two coders trained on five student entries before separately coding the remaining 94 entries using a grounded emergent qualitative analysis approach with the framework outlined in Table 2. Inter-rater reliability between coders was assessed using Cohen's Kappa. An inter-rater reliability of 0.68 was obtained indicating a fair level of agreement.[25]

Results and Discussion
The following section summarizes the results that were obtained through the assessment performed with the MUSIC model survey of academic motivation and the focus group analysis. We also include a section that discusses how the results from this work can be used to help guide other faculty members that might be considering the use of gamification platforms in their courses to ensure the best possible motivational outcomes.

MUSIC Model Survey
Results from the MUSIC model survey showed high scores in the "empowerment" and "caring" categories in both classes, being rated between a 4 (somewhat agree) to a 5 (agree). The remaining categories, "usefulness," "success," and "interest" had more moderate results in class 1, being rated between a 3 (somewhat disagree) to a 4 (somewhat agree) whereas they were rated higher in class 2 with a score between 4 (somewhat agree) to a 6 (strongly agree). A summary table of these results can be seen below in Table 3.

Table 3. Student Ratings of Academic Motivation in Response to Gamification Implementation

Motivational Model Element	Class 1 (23 students; 21 survey responses)		Class 2 (18 students; 6 survey responses)	
	Average	Std. Dev.	Average	Std. Dev.
Empowerment	4.30	1.01	4.90	0.10
Useful	3.80	1.35	5.07	0.25
Success	3.99	1.27	5.21	0.22
Interest	3.75	1.27	4.92	0.33
Caring	4.73	1.20	5.64	0.40

There are many possible reasons for the differences in the scores that were obtained between the two classes. For instance, in class one almost all of the students that were in the class participated in the survey (91%) which would have provided a more representative sample of student opinion of the gamification platform. Whereas in class 2, only six of the eighteen students in the class (33%) participated in the survey which means the results could be representative of those students that were particularly interested in the gamification platform or enjoyed its implementation in the classroom environment. As discussed in the limitations section that is at the end of the results and discussion it is important to note that due to the small sample size of this population and that this was only a single implementation within two course sections, these results are not generalizable to a broader student population at this time.

Overall however, it is possible to make note of some interesting trends. For instance, both classes found that the gamification platform provided them with an empowering experience within the classroom. In the introduction, we discussed how empowerment is related back to the students' ability to make choices and feel that they have some control over their educational experience. This is a definite benefit of a gamification platform such as 3D GameLab. When students first start the gamification platform they are provided with a single quest in each of the topic areas that the course covers. When students complete a quest within one content area, it then opens up additional quests on that topic area allowing for students to go deep and explore more in depth topics that are of particular interest to them. The quest design is also scaffolded in a manner that ensures that students will still meet the minimum learning objectives of the course in all topic areas and for this reason, they are limited in how far they can explore any one topic area until they have completed at least a minimum component of quests in the other topic areas. The other additional factor that would relate back to students' empowerment is choice over the types of quests that they complete. Quests that were included in the platform consisted of different types of experiences for the students. As an example, some quests involved students taking the time to work with other students in their class on team exercises (Fundamentals of Teamwork discussed in Methods) whereas other quests involved students reviewing videos of content and then completing a short online game to test their knowledge of the subject area. The goal behind this design approach was to ensure that students were not limited by the type or content of activities that were available to them.

Another interesting result was that the area of caring was also rated highly between both classes. Caring as described by the MUSIC model publications relates back to both academic and

personal caring.[4,5] In this application of the gamification platform; students would complete the quests within the system and then would submit them to the instructor for approval. This approach allowed for the students to continue to obtain timely feedback on their performance on the quest, whether it met the instructor's expectations and if not what was necessary to be changed in order to gain approval. The quest feedback screen also has ample room for instructor comments that allow for the instructor to provide constructive feedback on the students' responses even when they did meet the requirements for approval. In this manner, students were continually receiving feedback demonstrating that the instructor was invested in their success within the course and seeking to assist them in reaching their goals. The gamification platform was also an ideal conduit for allowing the instructor to connect the students with how the skillsets being worked upon would benefit them in their future engineering studies or careers. Each quest includes a description where it was possible to make these linkages for students and then provide them with additional resources where they could obtain further information if they were interested. In this manner, what was introduced as part of class content was being reinforced within the gamification platform providing a continuum of learning for the students.

Table 3 does indicate that there was a discrepancy in the results obtained on the other MUSIC model dimensions (useful, success and interest). We believe that the results from class 1 are likely more representative of both classes overall based on the feedback obtained from the focus groups that will be discussed below. The reasons we believe that these particular dimensions were lower than was anticipated when initiating the study was due to a disconnect between the gamification platform and the other online homework system which was administered through the course management system. Although the overarching topics were similar, the two platforms were mainly independent from one another which would have appeared to the students as not being as useful to their course performance and success. It is also important to note that the online homework system is used across all sections of the freshman design course (17 in total) whereas the gamification platform was only being applied in two sections further reinforcing the concept that the gamification platform may be the aspect that didn't align well with course content. Another observation is that as this implementation was being done during the first semester that the instructor who was advising the students on the gamification platform development was teaching the course, it is possible that the lack of familiarity with course content could have contributed to less alignment between quest based activities and the content being covered within the class itself. Finally, although undergraduate students played a significant role in the quest design to ensure that quests would be of interest to the students taking the course, it is possible that the students building the quests may not have had as strong an understanding of their audience as is necessary to create quests that were appealing to this student population.

Focus Group Results
The top three themes from the grounded emergent qualitative analysis performed were strategies (24 student responses), quest design (21 student responses) and expectations (17 student responses). When discussing strategies, students were providing feedback on their approach to selecting quests within the gamification platform. Students were sharing that they would specifically select the quests based on the points that they could obtain but when quests were of similar points they would then prioritize it based on which quests interested them the most. Students additionally used other student ratings when selecting which quests to complete. It is of

interest that strategies for approaching this platform are linked back to student empowerment which was one of the more highly rated aspects from the academic motivation survey.

Relevant to the theme of quest design, students provided both positive and negative feedback on the types of quests that were available to them. A common suggestion was to improve the linkage between the amount of XP the quest was worth and the difficulty of the assignment as most students found that it wasn't worth their time to attempt more difficult assignments when easier ones could provide them the same potential for points. Another suggestion was the type of material provided within the quest design document. Students didn't really enjoy the quests that provided them with additional reading material and then questions to reflect upon. Rather they preferred quests that provided them with information and asked them to complete a task based upon this new material.

The results from quest design also aligned with some comments from students' expectations. For instance, the correlation between point value and difficulty of assignment was a concern as students didn't expect to have to do more work for a difficult task. Another concern raised related to expectations was the name of the platform. It can be a bit of a misnomer that the gamification platform is called 3D GameLab which implies for students that the activities they will be doing are all game-based. Although the platform does employ best gamification practices including points, leaderboards and badges, most of the quest based activities are not games in and of themselves which can be confusing to students.

Implications for Research to Practice
The implementation of the 3D GameLab gamification platform within the Freshman Design course provided a lot of valuable information on students' perception of the platform and how it was able to impact their academic motivation towards completion of homework. One of the key outcomes from this study was how important it is to be clear with the students about what the gamification platform is being used for in the classroom and the types of activities that will be available to them once they login. In doing so, it would be possible to avoid some of the confusion these students experienced when they felt that they were going to get to play some version of a digital game and were disappointed that the platform was more similar to online activities with game-based elements.

It is also important that gamification platforms be designed so they align closely with course content materials and make a clear connection for students between the activities they are doing, their performance in this course and future success. In the subsequent iteration of this platform, the quests have been re-designed to link back directly to course content that is introduced within the other online homework system. The topics areas of the quests have also been modified to focus specifically on the core content areas that are covered in class meetings. Additionally, the quest design descriptions have been enhanced to make better connections for students between the assignments they are being given and their future success within the course.

Another key piece of advice is that although gamification can lead to enhanced student empowerment through choice of activities and more control over their learning, it is the overall environment that will ultimately impact students' academic motivation. For this reason, it isn't

enough to just rely on a platform to encourage better student engagement but all pieces of the course should emphasize how students can use the homework content to their ultimate success within their engineering careers.

Limitations

One of the major limitations of this study was the sample size of the population under investigation. This particular study was only conducted on two sections of a freshman engineering design course with a total of forty-one participants. As the two sections of the course were also taught by different course instructors it is not possible to combine the results from the MUSIC model survey as the instructor would be a particular influencer on students' academic motivation towards homework. Due to the small sample size and that this implementation was only conducted one time during a single course implementation it is not possible at this time to generalize these results beyond the students that were under investigation.

The results from the focus group are also not transferable as they relate directly to gamification platform elements that were applied within this particular course and may not be included in every gamification study. Additionally, students self-selected to participate in the focus group which may have influenced the results and the type of feedback that we were able to obtain on the gamification platform.

We do feel that the results indicate some potential trends that are noteworthy of further investigation but emphasize the need for this study to be conducted with a larger sample size, in more types of engineering classes and at other types of institutions before they will be generalizable and transferable.

Conclusions

Gamification is the use of game-based mechanics to engage people, enhance learning, and promote motivation.[8] In literature, gamification has shown positive results in student engagement and learning gains in engineering classrooms.[1,12,14,15] Gamification has also shown an increase in student motivation outside of engineering.[3,16] However, there is limited research done on the impact of gamification on students in engineering education. Using the Brett Jones MUSIC Model of Academic Motivation,[4,5] this study aimed to find the effects of gamification on students' motivation.

The gamification platform 3D Game Lab was implemented in two Freshman Engineering courses during the spring 2016 semester. Completion of the quests within the platform accounted for 15% of the students' final grade. In order to study the effects the platform had on students' motivation, students were asked to complete the MUSIC Model Academic Motivation survey,[4,5] and participate in a voluntary focus group. The framework used to assess responses from the focus groups was developed using a grounded emergent qualitative analysis based off of the MUSIC Model of Academic Motivation.[4,5]

Results from the MUSIC Model survey[4,5] showed high scores in the "empowerment" and "caring" categories in both classes. Empowerment relates back to student choice and ability to feel in control of their education while caring could indicate students appreciated the constant feedback they were receiving on their work. There were differences however in scores between

the classes on the other three measures of academic motivation, with one class rating every category higher than the other class. These results could be due to the amount of students in each class that took the survey, with the higher scores coming from the class in which only 33% of the students participated. We believe that the results from class one (91% student completion of survey) better represent both classes due to the feedback that was received during the focus groups. Students expressed their dislike that the gamification platform did not intertwine well with their other online homework system and the class, which could be the reason for the lower rating in these categories.

Results from the focus group showed the top three themes being strategies, quest design, and expectations. When students spoke of strategies, they mentioned how they would choose quests mainly based off of the XP points. When quests had a similar amount of XP points (which a majority did), students would next choose based off of which quest interested them most. Following this, students would choose based off of time, or quest ratings. Both positive and negative feedback was received on the topic of quest design, with the most common comment being the linkage between quest XP, and the amount of work or time necessary to complete that quest. This also pertained to the theme of expectations as well. Students preferred quests that would allow them to use new information to complete a task rather than complete a reading assignment and reflect on what they had read.

Overall, the implementation of the gamification platform had relatively neutral impact on student's academic motivation towards homework. The areas where the gamification platform had the most impact on student motivation were relative to empowerment and caring. Students enjoyed that they were able to choose their own quests and have control over their homework. This approach to homework shows potential as a first step towards providing students with the tools necessary to personalize their learning experience.

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