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Gaming the System: Helping Students Level Up Their Learning

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The use of gamified learning has increased within the educational community over the last decade in an attempt to enhance student learning in multiple ways. In particular, researchers have started to examine gamified learning and its impact on student motivation and engagement within educational settings. However, few have examined the relationship between specific tools embedded within a learning management system (LMS) and student outcomes at the postsecondary level. The purpose of this study was to examine the impact of a grade predictor tool embedded within a gaming inspired learning management system on 75 college students' ability to accurately predict their final grades. Results indicated that all students reported using the tool on at least a monthly basis and that the majority of students were able to correctly predict their final grades.

Gamified learning, or the gamification of learning, has been defined as the use of game design elements in non-game settings in order to increase motivation and attention on a task (Deterding, Dixon, Khaled, & Nacke, 2011; Simões, Redondo, & Vilas, 2013). It is important to note the distinction between teaching through a gamified pedagogical approach and teaching through the use of actual games, which has been found to be an effective way to teach things such as grammar (Tuan & Doan, 2010; Yolageldili & Arikan, 2011), computer programming (Doherty & Kumar, 2009), digital citizenship, and problem solving (Gros, 2007). Unlike teaching with games, gamified instruction is the integration of gaming principles, and this approach to teaching and training is gaining popularity in the field of education (Caponeto, Earp & Ott, 2014; Domíngues, et al., 2013) as well as private and public corporations (Dale, 2014). Evidence suggests that gamified learning, or the creation of gameful experiences, can impact engagement, motivate target behaviors, and drive innovation (Kapp, 2012).

This research draws on social constructivism and self-determinism as a theoretical framework. The social constructivist theory of learning states that learners construct new knowledge based upon prior knowledge and experiences (Vygotsky, 1978). According to this theory, teachers and students both generate knowledge as they reflect and work together towards conceptual understanding of the content (Vygotsky, 1978). Constructivist theory contends that knowledge is created through this collaborative work between teachers, content experts, and students (Brown et al., 1993; Lave, 1988). The notion that knowledge is constructed indicates that students must take an active role in their learning as opposed to being passive vessels into which teachers pour information (Au, 1998). This also implies that knowledge is not a static entity but instead an evolving process that differs from learner to learner (Gredler, 1997). Additionally, meaningful learning occurs when learners have the opportunity to construct meaning from multiple representations of the same material (Mayer, Moreno, Boire, & Vagge, 1999) rather than relying on a single viewpoint or perspective. This theory of learning aligns closely with a gamified approach to teaching where students are provided multiple opportunities to interact with their teachers, the content, and their classmates in an attempt to construct new meaning.

In addition to social constructivism, the theoretical framework of this research draws on self-determination theory. A primary tenet of self-determination theory is that when individuals are given the autonomy to make their own decisions about the tasks they complete, they are more likely to be engaged in their work (Gagne & Deci, 2005). Choice is an integral component in self-determination theory, which posits that having the autonomy to make decisions can also lead to greater motivation in task completion (Ryan & Deci, 2000). When students are allowed to choose which learning activities they engage with, they are more likely to make selections that align with their own learning style, which can make the learning more relevant and meaningful to them (Biggs, 1999). In addition, when students are provided with a learning environment where they are encouraged to take risks and delve into challenging problem solving, they are more likely to develop effective learning dispositions (Claxton, 2007). The challenge comes in aligning course goals and assignments with the interests of individual students so that as students choose to complete various assignments, they are also meeting the objectives of the course (Barata, Gama, Jorge, & Goncalves, 2013). Providing students with choice in assignment selection is at the foundation of the gamified instructional approach (Dickey, 2005), which is why self-determination theory, combined with social constructivism, provides a logical framework for research in this area.

In his book, *What Video Games Have to Teach Us About Learning and Literacy* (2014), James Gee describes thirty-six learning principles that are present in good games. These learning principles provide the

catalyst for good game design and, in turn, can be used as guiding principles when designing a gamified learning environment. For instance, good games provide players with information when they need it and within the context in which the information will be used (Gee, 2003). This allows players to put that information to use immediately in order to complete a task, solve a problem, or otherwise progress through the game. Quality games also challenge players so that they are routinely working at the peak of their abilities and knowledge (Gee, 2003). Vygotsky (1978) referred to this as the zone of proximal development, which is the area where a learner is constantly being tested and challenged. Having students, or players, operate within this optimal learning zone helps keep them engaged and encourages them to learn more in order to meet the demands of the next challenge.

Games, particularly multi-player games, require players to collaborate and work in teams where they have to share knowledge and skills (Gee, 2003). Being engaged in a community of practice (Lave & Wenger, 1991) focused on solving a common problem or completing a joint task can promote social learning opportunities. Games that specifically promote and reward cooperation and teamwork have a positive impact on the development of prosocial skills (Granic, Lobel & Engels, 2014). Creating gamified learning environments that likewise promote cooperative learning could have a similar impact on social skills.

Gee (2003) also contends that well designed games are motivational, primarily because of the different learning principles outlined previously. Working at the limits of their abilities keeps players engaged as they continue to take on new challenges (Ott & Tavella, 2009). Gee (2003) refers to this process as a cycle of expertise, which requires players to constantly learn, act, revise, and learn again in order to demonstrate mastery and be successful in a game. Allowing students to engage in this iterative process of learning, testing, and revising can be an effective way to keep them engaged in authentic tasks (Barata et al., 2013). In addition to the motivational aspect of the cognitive element of games, Lee and Hammer (2011) suggest that the social and emotional aspects of gaming environments can contribute to student engagement as well.

Most games have reward systems that allow students to earn things such as points, badges, and trophies, which unlock new features or levels based on the completion of various tasks. Conversely, there are usually consequences when tasks aren't completed correctly. The key is finding a balance between rewards and consequences such that players remain motivated to proceed but do not become overwhelmed or discouraged by the complexity of the task (Domínguez et al., 2013). A well-designed game can also motivate players to stay engaged by enhancing the value of the task or tasks being completed (Yang, 2012). This is particularly beneficial with educational games focused on academic content like civics, geometry, or science. In most traditional classrooms, the primary way students are rewarded is through grades, which are given *after* the completion of an assignment, paper, quiz, or test. In a gamified classroom, students are rewarded *throughout* the learning process as a way to encourage their active engagement in problem solving and critical thinking.

Another key component inherent in most gaming environments is the element of choice, which allows players to decide where to go within the gaming environment and what decisions to make based on the tasks and situations with which they are confronted. Providing authentic opportunities for choice can lead to more engaged learning as players feel they have control over the outcome of the game and the ability to customize their experience (Dickey, 2005). However, providing students with too much choice can result in negative consequences. This has been referred to as the "paradox of choice" (Schwartz, 2005) and suggests that having too many choices can be overwhelming and actually detrimental to the decision-making process. Finding the balance between enough choice and too many options is one of the many challenges game designers face. Incorporating an element of choice is yet another design element to consider when creating a gamified learning environment.

Over the last decade, a variety of gameful learning environments such as ClassCraft (http://www.classcraft.com/), Playlyfe (https://playlyfe.com/), and TalentLMS (http://www.talentlms.com/) have been developed to promote and facilitate gamified learning. Some are better suited for K-12 education, and some are designed for post-secondary environments. That said, research on how these learning environments affect specific student outcomes is limited. The authors of this study chose to use the learning management system (LMS) called GradeCraft (https://www.gradecraft.com), which was developed at a prominent midwest university. GradeCraft incorporates a variety of elements of gamified learning including additive grading, where students start at zero and advance through levels by earning points via the completion of assignments and other graded tasks. Courses can also be structured such that the successful completion of one assignment will unlock, or make available, subsequent assignments. Other gamified elements present in GradeCraft include a leaderboard, badges that can be awarded for exceptional work, focus on mastery learning, the creation of avatars to represent students in the LMS environment, and student choice in assignment selection.

One way to provide students with choice in an educational setting is by allowing them to pick from a range of assignments and assessments to complete rather than telling them specifically what they need to do and when it needs to be completed. In addition to assignment choice, providing students with a tool that helps them predict final grades may bolster learner autonomy within the course. One such tool is the Grade Predictor feature embedded in GradeCraft, which allows students to track their progress and anticipate a final grade in ways that would otherwise not be possible in the absence of this tool.

The Grade Predictor tool is designed to let students explore different pathways through the course assignments in order to see what choices will help them achieve the grade they hope to earn in the class. This research focuses specifically on student use, and perceptions of, the Grade Predictor tool in order to learn how students might make use of this predictive capability. There are several unique features within GradeCraft that make it different from other learning management systems. Likewise, there are many differences in the pedagogical approach between a gamified course and a more traditional course. Investigating all of the different features and making comparisons between the multitude of differences in instructional approaches would be beyond the scope of a single manuscript. Therefore, a deliberate decision was made to focus on the Grade Predictor because of the novelty of this tool and the potential it provided for students to take greater control of their studies.

Grade Predictor

The Grade Predictor tool, as the name implies, makes it possible for students to predict their final grade while selecting the assignments they want to complete. The ability to accurately predict a final grade can help students make determinations about what material they need to master and how they should prepare for upcoming tests and examinations (Burns, 2007; Hacker, Bol, Horgan, & Rakow, 2000). Moreover, when students are accurately able to predict their grade in a course they can make better informed decisions about how to distribute the time and effort they devote to studying (Grimes, 2002).

The Grade Predictor tool allows students to pick all the assignments they intend to complete and see how many points they would earn, as well as the overall grade they would receive, based on the completion of those assignments. They can even select an individual score for each assignment to determine exactly what they would need to earn in each case in order to reach their target grade for the course. This is similar to a progress bar or status indicator in a gaming environment that shows the players where they are in a level and what they have left to complete in order to advance in the game. However, picking a score for an assignment doesn't mean students automatically receive that score. It just allows them to see how many total points they would earn in the course based on the assignments they select and the scores they anticipate receiving.

The Grade Predictor automatically gives students credit for assignments completed so that those points get factored into their final predicted grade. Students can use the Grade Predictor as frequently as they like, making revisions to the assignments they plan to complete based on whatever criteria they choose. This aligns closely with the tenet of choice that is a central part of gameful learning. The Grade Predictor tool is designed to help students make informed decisions about the assignments they choose to complete so that they can plot a productive and efficient pathway through the course. That said, questions remain about the frequency and usefulness of the Grade Predictor tool.

Prior to the start of the winter 2015 semester, Institutional Review Board approval was sought and granted to implement GradeCraft in a series of cross listed (undergraduate/graduate) courses to examine the impact a gaming inspired LMS has on students' ability to accurately predict their final grades. More specifically, to answer the following research question: Does using a Grade Predictor tool embedded within a gaming inspired learning management system enhance students' ability to accurately predict their final grade at the college level?

Method

During the fall of 2014, the authors chose to adopt GradeCraft as the primary LMS for two classes they taught in the fall semester of 2015 and winter semester of 2016. The classes selected for implementation were both education classes serving undergraduate and graduate students, many of whom were pursuing a teaching certification or an additional teaching endorsement. More specifically, one class had a focus on transition services for individuals with disabilities, and the other class on the integration of educational technologies within the K-12 environment.

Participants

All students (n = 76) who were enrolled in the courses during the two semesters listed previously were eligible to participate in the study. The sample for this study included undergraduate (n = 73) and graduate (n = 2) level students who received all instruction on campus within a face-to-face classroom framework. Of the 75 students, 11 were male, and 64 were female. No age or ethnicity information were collected. Participation in the research was completely voluntary,

Table 1
Survey Participation

Participants	Pre-Survey	Midterm Survey	Response Rate
Total	75	68	91%
Undergraduate	73	66	90%
Graduate	2	2	100%

and no incentive was given for participation. Additionally, no penalty was administered for nonparticipation if students opted out.

Measure

Data were collected through surveys distributed electronically to all participating students at the start, middle point, and end of each semester. The three surveys were created collaboratively by both authors and consisted of open ended and multiple-choice questions. Students were asked about their grade status including both current and anticipated grades, use of LMS features such as the Grade Predictor, and assignment preferences. As stated earlier, the Grade Predictor tool is embedded in GradeCraft and assists students in determining which assignments are needed to obtain a specific grade for the course. Students can generate hypothetical "final" grade scenarios based on the selection of assignments they intend to complete. For example, students may use the Grade Predictor to select the minimum number of assignments to complete in order to achieve their desired final grade.

Procedures

Student participation in data collection was limited to answering three online surveys during the course of the semester. Links to the pre-survey, mid-survey, and post-survey were distributed each term to correspond with the first week of class, midway point of the term, and last week of class respectively. Prior to any survey dissemination, a consent form was distributed to all potential participants that included, but was not limited to, the following: the purpose of the study, research procedures, possible risks, and contact information for the university's office of research. Students did not have a choice on whether or not they used GradeCraft, but they did have the option to not participate in the study. On the first day of each semester, students were informed that GradeCraft would be the LMS for the course and were shown a brief video providing an overview of GradeCraft. Next, an orientation exercise was assigned to familiarize the students with the GradeCraft features and help them learn how to navigate the site successfully. More specifically, the Grade Predictor was introduced, and students were shown how to use it. Lastly, the collected data was analyzed at the conclusion of the winter 2016 semester.

Results

The purpose of this study was to explore whether using a Grade Predictor tool embedded within a gaming inspired LMS (i.e. GradeCraft) allowed students to accurately predict their final grade. Three separate surveys were distributed during each semester to 75 students over the span of two academic semesters. Due to a low response rate on the post-survey (n 42), data reported in tables 1 - 3 are exclusive to the Pre and Mid surveys. That said, a fourth table has been included and contains Grade Predictor user opinion data collected from the post survey since the authors believe these data add value to the manuscript. Lastly, data were analyzed to see whether students were able to accurately predict their final grade based on two variables (a) student use of Grade Predictor and (b) final grade.

Participation

Total enrollment for all classes was 76 students. Out of the 76 students, 75 consented to participate in this study, and 100% of those participating completed the pre-survey (see Table 1). Seven of the initial 75 participants failed to complete the midterm survey, resulting in a 91% response rate for students completing both surveys. A possible explanation for why seven students did not complete the midterm survey is that all seven had acquired enough points to offset attendance/participation points awarded for each class session and, therefore, were not in class the day the midterm survey was administered. The sample consisted of 64 females and 11 males.

Grade Predictor

Students were asked on the pre-survey to predict their use of the Grade Predictor tool prior to any

Table 2
Pre-Survey for Grade Predictor (n=75)

Participants	Daily	Once a Week	Every Other Week	Monthly	Did Not Use
Accurately Predicted (n=33)	6	15	8	4	0
Within 1 Grade Value (n=10)	2	5	3	0	0
≤ 2 Grade Values (n=10)	3	5	0	2	0
≥ 3 Grade Values (n=22)	3	7	7	5	0

Table 3
Midterm Survey for Grade Predictor (n=68)

Participants	Daily	Once a Week	Every Other Week	Monthly	Did Not Use
Accurately Predicted (n=29)	1	3	18	7	0
Within 1 Grade Value (n=9)	1	2	4	2	0
≤ 2 Grade Values (n=9)	0	1	6	2	0
≥ 3 Grade Values (n=21)	0	4	9	8	0

assignments being completed. They were presented with five answer choices ranging from daily use of the Grade Predictor to no use of the Grade Predictor. Students were also asked to predict their final grade. Table 2 compares students *anticipated* use (pre-survey) of the Grade Predictor in determining their final grade against their *actual* final grade in the course to represent how accurately each student was able to predict their grade. It should be noted that a student who predicted an A but earned an A- was considered to be within 1 grade value. Likewise, if a student predicted a B but earned a B+, he/she was also considered to be within 1 grade value.

Pre-survey. Of the 75 students, all responded they intended to use the Grade Predictor tool during the semester. Frequency of intended use varied across participants with 61.3% of students anticipating using the Grade Predictor either daily or at least once a week compared to 39% of students intending to use it at least once a month. The most commonly selected option was once a week (43%) while monthly usage was the least selected answer (15%), indicating a possible initial reliance on the tool to predict final grades. There were 33 students (44%) who accurately predicted their final grade on the pre-survey. An additional 10 students were accurate within one grade value.

Midterm survey. After a six-week exposure to course content and assignments, students were prompted to complete the midterm survey. Instead of asking students how they *anticipated* using the Grade Predictor, this survey asked how frequently they had *actually* been using the tool over the first half of the semester. Similar to the pre-survey, students were asked again to predict their final grade in the course. Student self-reported frequency of use was noticeably different compared to the pre-survey results. Table 3 displays the results of the use of the Grade Predictor by students at the midway point of the semester compared with the accuracy with which students predicted their final grade.

Only 18% of the students reported using the tool on at least a weekly basis even though 61% anticipated using it that frequently on the pre-survey. All of the participants indicated using the Grade Predictor at least monthly if not more frequently. Additionally, over half (54.4%) of the students reported using the Grade Predictor every other week and only two students used the tool daily. As shown in the table, 29 (43%) of the students accurately predicted their final grade at the midway point of the semester. This was nearly unchanged, on a percentage basis, from the pre-survey where 44% accurately predicted their final grade.

The majority (57%) of students accurately predicted their final grades within one grade value. However, 29% incorrectly estimated their final grade by 3 or more grade values. A closer analysis of that 29% revealed four students underestimated their final grades (i.e., earned a higher grade than predicted) and the other 24% overestimated. Since all students used the Grade Predictor tool at least monthly, it was difficult to correlate frequency of usage with ability to accurately predict a final grade. For example, of the 43 students who accurately predicted their final grade, 51% of them used the Grade Predictor tool every other week, and only two students used the tool on a daily basis. Additionally, weekly use was also low among the respondents with just five students from each group using the tool on a weekly basis. However, the most commonly reported usage of the tool on a frequency basis was every other week. In addition, of the 29 students who accurately predicted their grade, 18 (62%) reported using the Grade Predictor at least every other week. Conversely, of the 19 students who only used the Grade Predictor on a monthly basis, only 7 (37%) accurately predicted their final grade.

Post Survey. During the final week of the semester, students were instructed to complete a post survey. Similar to the pre- and midterm surveys, questions focused on the frequency of Grade Predictor use and final grade outcomes. Additional queries on the post survey went beyond what was previously asked on the pre and midterm surveys, to include questions focused on users' opinions of the Grade Predictor tool, more specifically, how beneficial the tool was in planning work for the semester, reducing workload anxiety, and instilling confidence in the student's ability to earn his/her desired grade for the course. As stated previously, response to the post survey was 56%, so a decision was made to exclude the data from the reporting of student use of Grade Predictor and final grades alongside the pre and midterm surveys in Tables 1-3. After an analysis of the other post survey data, the authors agreed that the data focusing on user opinions for the Grade Predictor tool added value to the overall manuscript (see Table 4).

Users' opinions regarding the Grade Predictor tool revealed an overall positive view. The majority of respondents (62%) reported using the Grade Predictor tool to plan a course of study throughout the semester. Additionally, more than half (53%) believed the Grade Predictor tool instilled an additional level of confidence when working towards a predicted final grade, and half reported that the tool reduced grade anxiety. It should be noted that a percent of respondents were compelled to select a neutral answer to the three questions. That said, the number of neutral answers did not surpass the positive responses for each question.

Discussion

An increasing number of researchers have conducted studies with a focus on gamified learning and its impact on motivation and engagement within education (Gee, 2003; Yang, 2012). However, few have examined the relationship between specific tools embedded within the LMS and student outcomes at the postsecondary level. The purpose of this study was to examine the impact of using a Grade Predictor tool embedded within a gaming inspired learning management system on 75 college-level students' ability to accurately predict their final grades. Based on the results, the majority of students were able to accurately predict their final grade by using the Grade Predictor tool at least once every two weeks, thus increasing autonomy in the learning process by providing students the ability to design their own learning path and predict their learning outcomes (i.e., grades). Furthermore, the intrinsic results from the post survey, coupled with data representing actual use of Grade Predictor, provide further evidence that the tool was helpful to the majority of students.

Table 4
Grade Predictor Opinions (n 42)

	Very True	Neither True or Untrue	Not True At All
I used the grade predictor tool to plan my work for the semester.	26	10	6
I used the grade predictor to reduce my anxiety over my workload.	21	16	5
The grade predictor tool helped me to be confident of achieving the grade I wanted.	22	12	8

The Grade Predictor tool is designed to provide students with a way to accurately predict their final grades by seeing, not only what assignments they need to complete, but also the specific scores they would need to earn on those assignments. Tools such as the Grade Predictor are only effective if they are used on a consistent basis and are readily available. Equally important is that within a gamified environment, rules are established and remain in effect throughout the duration of the course. This is particularly important when using an additive method of point accumulation within a gamified environment so that students have an advantage in determining which assignments will result in favorable points through the consistent use of the Grade Predictor tool.

Results of this study indicated that students who used the tool every other week had the highest success rate of accurately predicting their final grade. This, in part, could be due to the fact that students who used the Grade Predictor every other week were more aware of their ongoing progress in the course compared with their classmates who were only using the tool on a monthly basis. Using the Grade Predictor every other week likely allowed students to make more timely decisions about what assignments they still needed to complete based on scores they were receiving on submitted work. Students could also recover more easily from a low score on an individual assignment if they were regularly checking the Grade Predictor.

In addition, students who utilized the Grade Predictor every other week would be better able to stay abreast of the staggered deadlines inherent within a gamified course where there are many different assignment options to choose from. An additional benefit of using the tool weekly was a reduction in anxiety, as reported in the post survey results. Those students who were only using the Grade Predictor on a monthly basis would have been at a disadvantage as they would have likely missed several deadlines from month to month and thereby lost the opportunity to earn points for several assignments.

There was a discrepancy between *intended* use (pre-survey) and *actual* use (midterm survey) of the Grade Predictor tool. Students predicted a higher rate of Grade Predictor use on the pre-survey compared to their actual reported use on the midterm survey. This may be due to the fact that students gained a better understanding of the demands of the targeted courses, and associated assignments, and their corresponding ability to meet those intellectual demands as the term progressed, thus reducing the need for the tool. This makes sense because initial predictions about grades are influenced by past performance in similar courses (Burns, 2007) and, not surprisingly, grade predictions made later in a course tend to be more accurate than those made early in the term (Koriat, 1997). This is largely because once students become more familiar with the expectations and rigor of a course, they are better able to predict how well they will perform in the class.

Another explanation is that assignments across courses were designed so that due dates extended over the duration of the semester versus having weekly deadlines, so students might not have felt inclined to use the Grade Predictor every week since they were not receiving graded work that frequently. A final explanation is that some classes only met once a week, whereas others met twice a week. Students in classes that met more frequently may have had regular reminders, and opportunities, to use the Grade Predictor when they logged into the LMS during class. Regardless of the frequency of use, every student reported using the Grade Predictor during the course of the semester. This is encouraging because it's one indication that students perceive this tool as having some measure of value when it comes to self-guided learning.

Limitations

A couple of limitations of the study are worth noting. First, only data from the pre and midterm surveys were used in tables 1-3 because of a low response rate for the post survey. One explanation for the low response rate is that the post survey was administered either during the final week of class or at the final exam class period. Several students who had already earned enough points to get an A in the course did not bother to attend the final class sessions and were not required to complete the final exam. This meant they were not present to receive verbal prompts to complete the post survey nor did they feel obligated to respond to e-mail reminders requesting the completion of the survey. Exploring ways to insure a higher completion rate will be important for future research. The second limitation of note was the focus on data collection from student self-reporting on surveys at different checkpoints each semester. While this approach generated useful information, it will be important to expand data collection efforts to include other methods such as course evaluations, interviews, and observations where appropriate.

Future Research

One suggestion for future research is to examine how students are choosing assignments and what criteria they use when given the opportunity to choose which assignments they will complete. This might include looking at patterns across classes to see whether or not certain assignment types (e.g., quizzes or written papers) are selected more often than other types of assignments.

This line of research would provide practitioners with valuable insight that could improve future course offerings by increasing student engagement and motivation through the creation of assignment types that more closely align with student interests. To conduct this research, it is imperative that more faculty start implementing GradeCraft so data collection can expand across a greater range of courses and disciplines. This would hopefully alleviate smaller sample sizes of participants in future studies and promote the collection of data across a broader array of courses. As the number of courses using GradeCraft increases, naturally future data collection efforts will grow. This will present opportunities to explore the impact of gamified learning in a variety of content areas.

A second suggestion for future research is to reexamine existing survey questions to ensure that future iterations of this line of study will continue to yield worthwhile insights. In addition, a more comprehensive approach to administering the post survey for future courses is necessary to insure responses from students who do not attend class at the end of the term. One solution would be to administer the survey within the last two weeks of the course when more students will likely be in attendance rather than waiting until the final exam period.

Implications for Practice

Based on data collected in this study, all students made use of the Grade Predictor tool available to them in order to stay abreast of their progress within their courses. As reported earlier, 100% of the participants in this research across multiple semesters and classes indicated that they made use of the Grade Predictor tool on at least a monthly basis. A tool such as this seems particularly critical in gamified courses where students are given the autonomy to pick and choose which assignments they will complete. Students took advantage of the opportunity to test out different pathways to get to the course grade they hoped to achieve and the ability to revise those pathways as the semester progressed. Therefore, instructors planning to use gamified pedagogies in their courses should provide students with access to a tool such as the Grade Predictor so they can easily track their progress and predict their grade.

While virtual tools such as Grade Predictor have the potential to be powerful learning mechanisms within a gamified learning environment, simply providing these tools to students without the necessary guidance and instruction on how to effectively use them is counter-intuitive. A comprehensive training for students on how to use these types of tools prior to implementation, and continuous fidelity checks throughout the semester, can help to maximize their use. In turn, this could increase the chances of students reaching their academic goals (i.e., desired final grade) and help them better manage their coursework in a gamified learning environment.

One notable issue encountered during this study was the assumption by several students that full points would be automatically awarded for any assignment that was submitted. This false assumption may have been a result of a miscommunication between students and the instructor on the capabilities of the Grade Predictor or simply a misconception of how the tool worked. More specifically, students equated hypothetical assignment submissions represented in the Grade Predictor with automatic full credit instead of compensating for points not awarded due to mistakes and assignments that did not demonstrate mastery of targeted concepts. This provides further justification for explicit, and ongoing, training throughout the semester. Lastly, it should be noted that the authors of this study have only been using GradeCraft for a year and acknowledge that they are still learning the best ways to effectively implement gamified learning in their respective courses. Having said that, the authors see the potential benefits of using gamified learning at the university level and intend to continue using GradeCraft for future classes as they work collaboratively to refine their competency with the tool.

Conclusions

From a very early age, games are used to teach and enhance human development (Yang, 2012). Incorporating and increasing gamified elements within an academic curriculum seems to be a natural progression as educators continue to compete with personal technology for their students' attention. The extant literature supports the notion that a gamified approach can increase student motivation and engagement, but more work is needed to know how much and in which contexts gamified elements should be used. Additionally, there is still much to learn about the best way to implement principles of gamified learning into a formal class setting and effective ways to prepare students to be successful learners in courses where these pedagogical strategies are used. Universities are in a unique position to help further this exploration through empirical research by expanding the use of gamified learning across disciplines.

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