Decision processes through Dungeons and Dragons: Meaningful gamification using a tabletop roleplaying game

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Abstract

Incorporating gamelike elements into courses can increase student engagement and motivation, especially when the game involves freedom, choice, and storytelling. In this paper, I describe the "meaningful gamification" of an upper-level decision science course using the tabletop roleplaying game *Dungeons and Dragons*. The course was organized into a seminar and a game component such that students spent the first class of each week in a traditional lecture and the second class of each week applying evidence-based solutions to problems within their Dungeons and Dragons games. Reception of the class was universally positive, and students reported high levels of engagement. Importantly, students reported that the opportunity to practice course concepts in-game made it more likely that they would be able to apply them in real life. In this paper, I share the structure, goals, and logistics of the course so that other instructors can use the framework to adapt their own courses.

Keywords: decision processes, judgment and decision making, gamification, dungeons and dragons, tabletop roleplaying game, TTRPG

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Applying game design elements to classroom settings has been shown to have an overall positive impact on student involvement and achievement (Deterding et al., 2011; Rahman et al., 2018; Squire, 2007; Stansbury & Earnest, 2017). However, "gamified" classrooms may have varying success depending on the method of gamification.

A simple, widespread way to gamify a classroom is to introduce external rewards such as points for completing relevant tasks. However, because external rewards can decrease extrinsic motivation (Deci et al., 1999), reward-based gamification might not be as helpful as educators would like, and might even have a detrimental effect on student motivation when rewards are no longer available. This is not a reason to dismiss gamification, but rather to question whether external reward systems, including those as ubiquitous as grades themselves, replace intrinsic motivation for mastery with extrinsic motivation to earn points, rewards, or grades (Nicholson, 2015). If so, the key to effective gamification is not overlaying additional rewards onto a traditional grade-based structure, but creating an immersive learning environment that reduces focus on grades altogether. In such an environment, the game and learning should be one and the same (Isaacs, 2015; Nicholson, 2015).

Immersive games are less common in educational settings than achievement-oriented ones (Majuri et al., 2018). However, examples of immersive classroom environments include Sheldon and Seelow (2017)'s "multiplayer classroom", quest-based learning (Haskell, 2012), and Nicholson (2015)'s "meaningful gamification". In the multiplayer classroom, the class and the game are one and the same, the primary mode of learning is through making mistakes, and the game is highly flexible (Sheldon, 2020). In this and other types of "quest-based learning", mastery goals are broken down into smaller "quests". Students have some choice over which quests to complete and can retry the quests multiple times so that students can learn by making mistakes without long-term consequences. Points may be incorporated, but the primary focus is on the game itself, rather than rewards.

Drawing on the multiplayer classroom and research on self-determination theory (Deci & Ryan, 2004), Nicholson (2015) coined the term "meaningful gamification" to describe gamification that increases intrinsic motivation by emphasizing mastery of skills, choice, and relatedness to the actions of others. Past courses incorporating elements of meaningful gamification have been effective compared to traditional modes of teaching. For example, Stansbury and Earnest (2017) meaningfully gamified an industrial/organizational psychology course by having students roleplay as a consulting team. Compared to a concurrent traditional-style course, students in the gamified version performed equally well and reported higher perceived learning and a more positive experience. In a research methods course, students in gamified and traditional sections also performed equally well on a test of factual knowledge, but those in the gamified sections chose more challenging activities and produced more and better questionnaires and discussion board comments (Tan & Hew, 2016). Meaningful gamification has also received positive evaluations from students in courses on reading comprehension (Ling, 2018) and teaching (Kingsley & Grabner-Hagen, 2021). In this paper, I describe a meaningfully gamified Decision Science course in which students learned by playing the tabletop fantasy roleplaying game Dungeons and Dragons.

Dungeons and Dragons and Meaningful Gamification

In Dungeons and Dragons, players create characters with different skills and work together to solve puzzles and battle fictitious monsters (Crawford et al., 2014). The "game master" – in this case the instructor – acts as the narrator of a story in which the players are the main characters. Thus, each challenge in the game is embedded in a meaningful ongoing narrative, and players have the capacity to directly influence the trajectory of their game. The challenges themselves involve strategic problem-solving, chance (via dice rolls), and social interactions with other players and with non-playable characters (NPCs) played by the game master. The game's framework is highly compatible with meaningful gamification and provides ample opportunities to introduce statistical, logical, and social psychological concepts.

The course "Decision Processes through Dungeons and Dragons was set up so that students spent half of the contact hours each week in a traditional lecture and the other half playing an

ongoing Dungeons and Dragons campaign. Each week, at least one problem faced within the game could be solved only by correctly identifying which course concept(s) were relevant and applying an empirically-supported solution.

In his "recipe for meaningful gamification", Nicholson (2015) describes six principles of meaningful gamification, which I incorporated as described below.

Play

A gamified course should be "played". Play is optional; players must be able to choose their activities, explore, fail, and modify the boundaries of the game. Dungeons and Dragons is an open-world game. The "game master" describes the world and the circumstances the characters are in, and players then have almost infinite freedom to explore and exert influence upon the imagined world. Success and failure within the game are determined by dice rolls as well as solving puzzles with specific answers as determined by the game master. Rolling a low number on a die or failing to solve a puzzle does not end a game, but produces in-game repercussions which players must address. Thus, students had freedom to fail and could learn from their mistakes (or contend with their bad luck).

When failure resulted from a lack of understanding of course material, the instructor or players' teammates could correct the misunderstanding in real time. Sometimes, students reasoned correctly but failed anyway due to bad luck. Because probability and luck are major concepts in Decision Science, in-game good and bad luck were used as an opportunity to discuss probability and cognitive biases that make random chance seem non-random. Examples include the outcome bias, where decisions are judged based on their outcomes rather than the quality of the decision-making process (Baron & Hershey, 1988), and the hot-hand fallacy, where randomly-occurring clusters of successes and failures are attributed to non-random factors (Gilovich et al., 1985).

Exposition and Choice

Exposition, as an element of meaningful gamification, refers to creating stories for and with players. As mentioned above, this is an important element in Dungeons and Dragons as the players

and game master are active participants in storytelling. In the class, the backstories that students wrote for their characters and the in-game choices they made were incorporated into the game such that, although they all started at the same starting point, by the end of the class, each section's story was unique. Students reported being invested in what happened to their characters and considered the game setting to be an arena to practice the course concepts.

Engagement

In the context of meaningful gamification, engagement refers to interactions with other people. In this course, each Dungeons and Dragons session was played in a group of six. In each group, students' characters had different skills, which encouraged groups to work together and encouraged timid students to participate more when their character was the most suited to a particular task. As mentioned above, students worked together to correct each other's mistakes and use the course concepts to solve problems. In out-of-character discussions, students reasoned about which approach they should use to solve a problem and what roles each person should take. They then roleplayed implementing their solution. Thus, the game involved a high degree of in-game participation as well as social engagement.

Reflection

After each session and in the final paper, students discussed what went wrong and what went well during the game. In addition, the consequences of their actions in one session carried over into the next session, so students had the opportunity to reflect on what they learned in this way as well. This allowed students to reflect on their learning in a way that traditional courses sometimes lack when information is more sequestered into topic-based sections.

Method

Participants

Participants were 18 students (10 women, seven men, one non-binary) enrolled in a 400-level Psychology course called "Decision Processes through Dungeons and Dragons" at a large public university in the Midwest in 2021. One student was a sophomore and 17 were seniors.

Seventeen out of 18 students had Biopsychology, Cognition, and Neuroscience; Cognitive Science; or Psychology as one of their majors.

Class Structure

The course was organized as half seminar and half game such that for the first class of each week, all students met together for a traditional lecture and discussion of assigned readings. Readings were a mix of primary literature articles and book chapters on judgment and decision making. For the second class of each week, students played Dungeons and Dragons in three separate sections with six students each. Due to COVID-19, students had the option to attend both the lecture and game sessions remotely, and we used the online gaming platform Roll20.net to allow students to play remotely as needed.

At the beginning of the semester, each student created a character using the Player's Handbook (Crawford et al., 2014) for the 5th Edition of Dungeons and Dragons. Students could choose the type of character they wanted to play (e.g. a magic user such as a wizard, a tough character such as a fighter, or a healer such as a cleric) and write a backstory for their character. They could also choose their characters' strengths and weaknesses by assigning different point values to their six skill statistics: Strength, Dexterity, Consititution, Wisdom, Intelligence, and Charisma. A character's score on each of these statistics determines a "modifier" that is added or subtracted from the player's dice rolls during the game. In this way, these statistics determine a character's likelihood of success when attempting certain actions in the game.

Throughout the semester, each time students attended their gaming session, they roleplayed as their characters and used course concepts to solve puzzles, reason with non-playable-characters (NPCs), and fight monsters. The assigned readings for the course were referred to in class as the "sacred texts" that the characters received from a helpful wizard character. Each game was customized to decisions that students made in the game, such that succeeding or failing at tasks or choosing to go to different destinations could influence what happened to the characters.

Consent in Gaming and Diversity, Equity, and Inclusion

Before gameplay began, students completed a "Consent in Gaming" form that allowed them to indicate to the instructor if there were topics that they would find upsetting if they appeared in the game (Reynolds & Germain, 2019). Topics of racism, sexism, homophobia and other forms of discrimination were be handled in two ways: in the classroom, we discussed discrimination in the context of real-world examples and empirical research. Within the game, societal conflict could occur in the context of the fantasy setting (e.g., conflict between fictional countries). At the beginning of the class, I explained that I would do my best to portray in-game characters, races, and cultures without racial, cultural, or gender stereotypes. I asked students to use an anonymous feedback form, available throughout the semester, to notify me if they experienced any issues that they wished to bring to my attention anonymously. I also invited them to provide feedback through email or in office hours.

Example Lessons

Bayes' Theorem and the Representativeness Heuristic

During the week covering Bayesian inference, base rate neglect, and the representativeness heuristic, students needed to apply all three concepts appropriately in their game to best prepare to fight an unknown species of monster. During the game, they learned that some nearby farmers were having trouble with monsters attacking their cows. One of the farmers had seen a monster through a window, but had only been able to determine that it was red and had wings. Because of this description, rumors had surfaced that a red dragon had been attacking the cows. However, players recognized that the rumors were likely due to the representativeness heuristic: because dragons are a highly salient red, winged creature, their prevalence is likely to be overestimated (Kahneman & Tversky, 1973).

As they tried to gather more information about the cow attacks, the players met a naturalist who possessed data on sightings of 10,000 individual creatures, sorted by species. The players learned that the naturalist had seen 627 creatures that might be red and have wings, and only three had been dragons. Players needed to understand that the base rate of dragons within the population

of creatures was .3%, and that knowing the creature was red and had wings increased the likelihood of it being a dragon only slightly. They applied Bayes' Theorem: $P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$ to update their priors (.3% chance of a dragon) in light of new information (red with wings) and to calculate the likelihood of encountering each type of red, winged creature.

The characters then had the opportunity to purchase supplies such as potions and weapons. Since they learned that a dragon was unlikely to be the culprit and that they would be wiser to prepare to encounter a more common creature, they were able to make their purchases based on the creatures they were most likely to encounter. The actual encounter they faced was based on a dice roll by the game master and the probabilities associated with each creature matched the probabilities the students had calculated. This lesson was one of a few lessons where students applied statistical concepts to improve their predictions of the roll of the dice.

Regression to the Mean

Another type of lesson that students encountered involved non-playable characters exhibiting cognitive biases which the characters needed to correct (or exploit) to achieve better outcomes for their group. For example, in one session, the characters encountered a series of pest incidents in the city where they were traveling. They learned that the city's mayor intended to shut down the border to prevent travelers from entering the city because he suspected that pests could be introduced unintentionally by travelers carrying food. The mayor argued that every time pest incidents increased, the border was shut down, and when the border was shut down, pest incidents decreased.

Students needed to recognize that this pattern was likely due to regression to the mean (Galton, 1886). That is, because the mayor closed the border when incidents were at their peak, a decline after closing was statistically likely due to natural fluctuations in pest incidents. Students needed to explain the phenomenon to the mayor (played by the instructor) well enough to persuade him not to close the border (thus limiting their characters' mobility). With the data available, students could not demonstrate that pest incidents merely reflected regression to the mean but could only make the argument that this was one explanation that could account for the pattern the mayor

described. Sometimes, students also suggested experimental methods which would help determine if there was a causal relationship between the border closings and the pest incidents. Thus, students had the opportunity to explain course concepts to others, which enhances learning (Duran, 2017).

Feedback, Grading, and Evaluation

Students received feedback on their performance and understanding throughout the game by experiencing the consequences of their in-game actions in real time. Feedback came from both the instructor and from peers. For example, during the lesson on Bayes' theorem, when one student tried to use base rates alone to solve the problem, another reminded them that it was possible to make a more accurate prediction using the description they received. In the lesson on regression to the mean, if a player left out key details in their explanation, the "mayor" would not be convinced and the students would have the opportunity to try again. Thus, students had the freedom to fail and learn from mistakes, and they received feedback in a variety of forms that might be impactful for their characters but were relatively low-stakes for students themselves.

Students' final grades were based on participation (20%) and a final paper (80%), an 8-10 page "chapter" of the study of their group's adventure and could be written in a creative writing style provided that students referenced academic sources and provided APA-style citations to back up their claims. The final paper was scaffolded such that students completed four mini-assignments (topic selection, an outline, a first draft, and a peer review) worth five percent of their final grade before turning in their final draft, which was worth 60%. Grades on the mini assignments thus provided a low-stakes way to alert students to potential issues before they turned in their final drafts.

I did not teach this course concurrently with a similar non-gamified course and cannot meaningfully compare students' performance in a gamified and non-gamified context. However, grades in the course were high, with 15 students receiving an A, one student receiving a B, and two students receiving a C+. Anecdotally, I found the final papers to be as good or better than those in decision science courses I graded in previous semesters.

Student Reception and Reviews

Eight out of 18 students completed the course evaluation for the course. Students' median ratings of the course, (answered on a Likert-type scale ranging from 1 = strongly disagree to 5 = strongly agree) along with university-wide medians, where available, are included in Table 1.

Open-ended comments on the course evaluations indicated a positive reception as well. Students found practicing course concepts in class to be particularly helpful:

"■This is the best psych class I have taken at this university, and there is a very specific reason why. In every other class I've taken, I have never been really able to apply the material that I learned in lecture and discussion to the outside world. You learn concepts and terms in class, then you take tests and write papers in class, and you never have to apply anything you learn to help solve an actual applicable problem. This class is the opposite. Yes DnD is fantasy, but it forces you to think outside of the box and use what you learn in class and in the reading to solve problems in a semi–real life game instead of answering a multiple choice test question. This was the first time in my life where I've been outside of class and I'm able to make decisions not based on the classroom terms, but on thinking back and saying "hey that's funny, I'm having a problem, and my DnD group used this psych term in this way, how can I modify it to solve this problem I'm having now." It feels like it prepares you for the world by introducing a topic in class, then in a semi–real way in game, so then you can use it in a REAL life way, almost like stepping stones where you slowly transition from book material to the real world. I understand that playing DnD for college credit isn't the most traditional of learning methods, but I commend you for taking that step and making a class that was fun, interesting, and helpful in the real world for a long time to come."

"This is one of the best courses I have ever taken, and I believe that I will retain more material from this course than I ever have from any other course! We got to learn things in a very fun and engaging way, and also got to apply them, which is something most classes lack."

"[...] I was able to use this course to help learn or supplement information I needed for

other courses in ways that I hadn't been able to do previously."

   Other students commented on the social aspect of the class or the classroom environment:

"I absolutely loved this class. As someone who came in with no experience with playing DND and had no idea what to expect, I was looking forward to our gaming sessions each week and it was a highlight of my week. I loved the community we built in our rooms and I felt comfortable with the people around me and with [the instructor]. As for the theoretical section of class, those were always super fun and engaging."

   Another student appreciated the control students had over the story, and described a flow-like state where learning seemed incidental:

". . . We all started in the same place, but by the end of is the three sections had their own endings. You did a great job of letting the game flow organically while also making sure that each group talked about the "sacred texts." It never felt forced because every time we used the sacred texts to solve a problem it seemed to be the logical solution, and not that we had to bend an ill fitting problem into a solution that felt forced."

General Discussion

   Using Dungeons and Dragons along with meaningful gamification principles is a way to present material in a fun, engaging way. This method allows students to practice, make mistakes, and learn in a realistic but low-stakes environment. In Decision Science courses, students often apply evidence-based solutions to real-world problems in course assignments. These assignments help students better understand *which* concepts to apply to a given problem, but they leave out an equally important skill: identifying *when* a Decision Science concept might be helpful. While we were playing the game, students never knew which concepts would be relevant and which problems would require them to use the "sacred texts". This allowed them to practice identifying opportunities to use their learning.

Another benefit to a meaningfully gamified course like this one is that feedback provided in the game was instant. Instantaneous feedback has been show to help students improve over iterations of the same assignment (Nutbrown et al., 2016). Not only did the students receive instructor feedback right away within the game, the instructor was also able to assess student learning in real-time. When students' behavior in-game revealed common misunderstandings, fellow students could correct them or their characters could experience a suboptimal outcome in the game. In the latter case, the outcome itself acted as feedback. When in-game events did not provide enough context for students to understand a concept, I was able to identify and correct misunderstandings on the spot or in a post-game debrief. This allowed me to address misconceptions while the relevant concepts were still being discussed (rather than, say, after an exam when students are less motivated to focus on the concepts they initially misunderstood; Motani and Garg, 2002).

The field of Decision Science is full of concepts that can be useful to students in their everyday lives. Students in "Decision Processes through Dungeons and Dragons" reported in their course evaluations that, compared to their other courses, they felt better equipped to use the course concepts outside of the classroom because they had practiced identifying opportunities to use the concepts, as well as their actual implementation, in the context of their games. Of course, more research is needed to measure whether students actually do apply course concepts outside of class more when learning through a gamified course compared to a traditional one. Future research should also compare other learning outcomes, such as factual knowledge, between traditional courses and courses gamified using D&D.

Nevertheless, students who took a Decision Processes course where they practiced course concepts in their Dungeons and Dragons game had high levels of engagement, rated the course highly, and felt that they learned skills that they could apply to their other courses and to their daily lives. Because the game incorporates statistics, puzzle solving, and social interactions, it is an excellent fit for gamifying courses on Decision Processes and should be considered as an option for gamifying courses in related fields.

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Table 1

Students' Quantitative Evaluations of the Course

Item	Decision Processes through D&D	University-Wide
This course advanced my understanding of the subject matter	4.8	4.5
My interest in the subject has increased because of this course	4.9	4.2
I knew what was expected of me in this course	4.8	4.5
I had a strong desire to take this course	4.8	4
As compared with other courses of equal credit, the workload for this course was (5 = much lighter, 1 = much heavier)	3.5	3
[The instructor] seemed well prepared for class meetings	5	4.8
[The instructor] explained material clearly	5	4.7
[The instructor] treated students with respect	5	4.9
The grading system was clearly explained	4.8	
I attended this class more than 80% of the time	4.9	
My expected grade in this course is (5 = A, 1 = F)	4.9	
[The instructor] was sensitive to multicultural issues in the classroom	4.9	
[The instructor] was willing to meet and help students outside the class	5	
[The instructor] encouraged student participation in an equitable way	4.8	
[The instructor] appeared open to viewpoints besides their own	5	
I had fun in this class	4.9	
I made new friends in this class	4.7	
I learned something in this class that I can use in my day-to-day life	4.9	