

Using Game Design Theory as a Framework for Course Design

Andre Malan
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Introduction

This paper looks at the way in which current game design theory and practices can be used to inform course design practices. The intent is not to look at how do develop an educational game, but instead to treat a course as the game and design the course in a way that would make it an engaging game. In order to accomplish this, the study looks at the key aspects of design that game developers use and evaluate how well those could be translated into a course. The key design issues that will be assessed are reward, punishment, challenge, community, freedom and simplicity. Throughout this assessment I have drawn extensively on my own experience of playing a large variety of video games, as well as the experience of having completed close to 40 university level courses. When specific games are used as examples within the text, those examples will draw from the actual experience of playing the games themselves. The study concludes with examples of how these design principles could possibly be applied to two different Computer Science courses at UBC.

Why Game Design?

The question of how do design a course is essential to the topic of education. There are many arguments on how to design effective courses, all drawing from research and experience. A well designed course provides students with the resources needed in order for learning to take place and perhaps more crucially, the motivation for that learning to take place. The question then becomes, how do we motivate students to perform the tasks necessary for learning? Games have been seen as one answer to this question. Games have a unique ability to motivate humans to perform arbitrary actions (Chatfield, 110). Educational games have thus emerged, in order to help create a more engaging environments for students. However, there have been many challenges associates with this approach. As Kurt Squire discovered when he studied an attempt to teach history through the game Civilizations 3, when commercial games are introduced into the classroom, students have often found the games to be too complex and overwhelming (Squire, 2). When games are designed specifically for the classroom, those games are often considered boring and incredibly costly to produce and keep up to date (Peirce).

In order to avoid the problems, an alternative approach could be taken. Instead of creating educational games, it may be possible to design a course as if it were a game. While the definition of the word “game” is contested, there is a general consensus that a game is something where players take part of their own volition and work towards a goal. After a meta-analysis of varying definitions of “game”, Jessie Schell defines a game as “a problem solving activity done in a playful manner” (Schell, 30). A university course very easily fits into that definition. Students are faced with a multitude of problems, the key problem being “how do I

get the grade I want in this course”. Solving this problem requires many other problem solving activities, completing assignments, understanding principles and so on. In fact, any course that uses the technique of learning goals is in essence creating a very explicit problem solving activity. The problem is to accomplish each individual learning goal. Students however, tend to be more motivated by grades than learning goals. In order to discover how educators could best motivate students to complete learning goals, we will turn to the theory of game design, as games designers are really good at motivating players to solve problems. Perhaps, if we can utilize these strategies more effectively within our course design, then we can better motivate students to learn the skills and knowledge that they need to learn from the course.

Why is school not perceived as a game?

If a course can be thought of as a game, why is that not the normative perception? I believe that the key reason is that school is not approached in a “playful manner”. A good game is a fun game. Without fun, a game would not be approached in a “playful manner”, a key part to Schell’s definition of games. For the most part, school is seen as work by students and is not seen as fun. It is thus not unreasonable to turn to video games to figure out how to make school fun. Of course, how we make a game fun is a complex and multifaceted question. Schell describes fun as “pleasure with surprises” (Schell, 26). Fun is incredibly hard to analyse as it is really difficult to predict whether or not an experience will be pleasurable. Experts differ widely on what they believe makes games fun and pleasurable. Theories include whether it is the “escape from reality (Crawford), the unexpected opportunity for growth (Aycocock) and the overcoming of obstacles (Malone). All of these theories can be proved and disproved with plenty of examples and counter-examples. In a less reductionist approach, Tom Chatfield argues that games are fun because they contribute to a whole set of complex human motivators, “achievement, competition, collaboration, learning and improvement, communication and self-expression” (Chatfield, 11). In reality game designers take a similar approach, in order to create a fun experience, game designers do not rely on one aspect, instead they combine a variety of elements trying to hit on as many ways to create fun as possible. No game has all of the design elements that they use, but most games combine as many as possible. In order to create a course that students experience in a “playful manner”, several of the design elements need to be combined. This paper will explore a selection of more important game design elements and provide some examples of how they could possibly be implemented in the classroom.

Key design issues that games use:

Player motivations

One of the first steps of creating an engaging game is to design in a way that appeals to the player's motivation to play. Game designers have realized that not all game players play with the same motivation. Designer and researcher Bartle created a four-part model of game player's motivations (Chatfield, 40):

- Killers: Players who are motivated by competing with others.
- Achievers: Players who are motivated to improve their own character's identity, by gaining as much power as possible.
- Explorers: Players who are motivated by completion and discovery of the entire game world.
- Socializers: Players who are motivated by interaction with other players and social capital.

These motivations are shared in different quotients by all game players. These motivations are important, as satisfying them is experienced by the player as pleasure, a key element of fun (Schell, 112). Well designed games recognize the different motivations and provide gameplay elements that will satisfy all or many motivations. For instance some of the ways that the game Diablo 2, provides for them are as follows:

- Killers: Allows player to fight against each other to prove who is the best.
- Achievers: Allows players to collect rare items that very few other players will have.
- Explorers: Creates a number of side quests, not part of the central storyline that players can engage with.
- Socializers: Provides mechanisms for players to form parties and fight monsters as a team.

The motivations for attending university have also been studied. Based on several studies, Levine and Cote developed the following typography (Cote):

- Careerist-Materialists: those who see university as a means of gaining money or becoming successful.
- Personal-Intellectual Development: Students who are motivated by personal growth, studying, learning and understanding.
- Humanitarian: Helping those less fortunate by discovering new ways to solve world problems.
- Expectation-Driven: Students responding to expectations and pressures from family or friends.
- Default: Students who do not know why they are attending university, it just seems like the best option.

These motivations are not mutually exclusive, but simply the ones that tend to dominate a student's psyche. Although there is not a direct mapping, all of Cote and Levine's motivations can be mapped to game motivations.

- Careerist-Materialists: These can be seen as a mixture of "achievers" and "killers" These students will want to achieve as much as possible and could possibly want to show that they are more successful than others.

- Personal-Intellectual Development: These fit into the “explorers and “achievers” categories.
- Humanitarian: These fit into the explorers and “socializers” categories. They are looking for new ways around existing problems and are prepared to work with and help other students along the way.
- Expectation-Driven: the expectation-driven students can be seen as “achievers” and to a certain extent, . These students will attempt to achieve as much as possible, as the achievements are artifacts that can be shown to family and friends. When the expectations are more competitive in nature e.g. “be in the top 5% of the graduating class” then these type of students become “killers”.
- Default: Default students can be likened to casual gamers, people who do not consider themselves “gamers” but will play games in short bursts, when they are around. Casual gamers still fit into one Bartlett’s 4 categories, but will do so with less intensity. Similarly, although it is not discussed by Cote and Levine, it’s feasible to think that “Default” students do fit into the other categories, but perhaps to a smaller extent.

The fact that student motivations can be mapped to game motivations allows course designers to create motivation based on game design rather than course design principles. For instance, instead of asking “how do I cater to expectation-driven students?” a course designer can ask “how do I provide opportunities for achievements?” Since the game motivations are more concrete, they can be more easily implemented.

Reward

Rewards are a large portion of what game designers use to motivate players to continue playing the games. Good games rely on variation in rewards to keep players motivated. This contrasts most courses that have grades as their single reward system. Grades are used to motivate students to perform many tasks, such as complete assignments, learn the material (through exam and test grades) and participate in class.

A variety of rewards allows games to motivate players to perform actions that are not necessarily part of the central game-play arc. It increases variety, which in turn helps to reduce instances of boredom. In the “Art of Game Design” Jessie Schell lists 9 different types of rewards that game developers use, of which we will discuss the 6 most relevant to a course (Schell, 190):

Completion

Completing things allows players to feel closure. In games completion is used as a very large motivating factor. In the game “Diablo 2” some of the things that players can complete are as follows:

- Player levels (an experience bar counts up until the player has attained a new level).

- A maximum level of 100 can be obtained.
- Quests. Each act has a set number of quests that can be completed
- Areas – An area can be completely cleared of all monsters.
- Armour sets can be completed.
- Acts. Each difficulty level has 4 acts that can be completed.
- Difficulty levels. The game allows players to complete 3 different difficulty levels.
- Skills can be completed (by investing 20 skill points in a skill).

Resources

Games will often provide players with resources in exchange for completing actions. These rewards can be either direct resources used for game-play (e.g. food, hit points, armour) or with a currency that can be exchanged for other rewards in the game. Players can often collect things like coins, gold or gems that are later exchanged for things like extra lives or equipment. It is often not a requirement to collect these resources in order to complete the game, but their presence allows explorers and achievers to satisfy their needs collecting more items and by becoming more powerful.

Power

Power is a strong human motivator and any games include ways for players to become more powerful. Although arguably the act of learning makes students more powerful and is thus an intrinsic motivator, it is possible to think of other power motivators that can be provided. An essential commonality between the different forms of power in games is that they allow players to reach a goal more quickly (Schell, 190). A course could accomplish this by providing a lessened workload as a reward for good performance. For instance, if a student performed exceptionally well on a previous assignment, they may be allowed to not take a quiz on the same material.

A Gateway

Some games reward players by allowing them to access other parts of the game environment. This can be an incredibly motivating reward for players motivated by exploration. This prerequisite structure in many universities provides this kind of reward at a degree level (completing CPSC 344 allows one to take CPSC 444), but not at a course level. One could imagine having certain learning goals unlocked by completing others, or have some assignments contingent on completing others.

Points

Points are often used in games purely to measure a player's success. This system is probably the most analogous to the current grading system. However, points in games are combined with the ability to repeat actions in order to try and get a higher score. Another way that points motivate players is by allowing them to compare themselves to each other, which appeals to killers and achievers. There are multiple ways in which comparison can be achieved in the classroom.

Praise

Games utilize a variety of methods of praising players including audio and video cues as well as the appreciation of in-game characters. Praise is used in a limited amount in some courses. Some markers will write small bits of praise on graded assignments “98% excellent work” or provide praise during in class interaction “great question”. Researchers have however found that this kind of arbitrary praise can not only be ineffective, but detrimental. Instead they suggest praise or encouragement being codified and delivered systematically (Brophy, 24). This is exactly how games tend to deliver their praise .

Game designers will often use operand conditioning tactics as well as random ratio reinforcement in order to increase the effectiveness of their rewards. Early on in games rewards are achieved quickly, with little effort, but as time goes on, rewards are distributed more sparsely and require more skill (Yee, 190). A combination of variable and fixed rate reward schedule has been shown to increase the effectiveness of rewards (Mazur, 305). Modern video games, especially online multi-player games are able to use their massive real-time data-gathering capabilities in order to continually tweak their rewards schedules in order to obtain the optimum result (Chatfield, 31). Although it would be impossible for educators to emulate this data-driven approach, educators can simply rely on fact that game designers have already gathered this data and reuse the schedules of successful games in their classrooms. Including elements of randomness in the way that rewards are assigned could also greatly increase a student’s motivation to work for them.

Punishment

Punishment is used extensively in good games. It is used in order to make success seem valuable, to increase the excitement by providing risks for players to take and increases the challenge of tasks (Schell, 192). One design element that modern game designers use is the idea of providing low consequences of failure for the players (Gee 2008, 1029). Although many older games required players to reach certain points before they were able to save their game and would make them retrace much of their work if they failed, this type of game-play seems to have been replaced by game design where users are able to save at any point in the game and to have the game save for the player at crucial points. The outcome of this is that players are more likely to take risks and feel less frustration. Of course, there has to be some consequence of failure in order to give the player a sense of accomplishment, but modern games are designed to reduce the frustration of this as much as possible and game designers spend a lot of effort on creating this balance (Schell, 192).

This can be contrasted against the current model of punishment for failure within a course.

Typical courses have students complete tasks and then grade them on how well the task was done. If a student “fails at a task” by achieving below optimum results, they will get a bad grade. Low grades on a given task are a very high consequence of failure as there is no way to make up for them. A low grade on a midterm may lead to a low grade on the course, which in turn would lead to the student getting a lower GPA and possibly not being able to enter the graduate or professional school of their choosing, or not getting a job. The constant threat and indeed manifestation of this high consequence failure could be one of the reasons that school is perceived as being so unpleasant.

An obvious way to reduce the consequences of failure is to do away with the current system of percentage grades and replace them with something else. That would require a systemic change of the university however, which would be outside the scope of this investigation. Thus a way to lower the consequences of failure is required, while working within the current framework of providing a percentage grade at the end of the course.

One candidate is the idea of making the percentage score a “percentage complete” score. In modern games like “Assassin’s Creed” and “Grand Theft Auto, Vice City”, players have constant access to a number representing how much of the game they have completed. A large part of this percentage represents the central storyline, which the developers have balanced to allow the average game player to obtain. In order to get scores higher than 90% though players have to work very hard, performing tasks like searching the world for hidden objects or defeating incredibly challenging levels. This grading system seems especially relevant in a course setting as it gives a cumulative measure at the end of the course as opposed to a collection of ability at different points of the course.

Another method used in games such as “Gran Turismo 2” is the practice of assigning a grade at the end of each level completed. This system is very similar to our current system. However, in these games players are given the opportunity of going back to the previous levels and retrying them in order to gain a better grade. Players will often do this once they have completed other levels in the game and have thus obtained greater mastery over the skills needed to get a high grade for those levels. For instance, in “Gran Turismo 2” players will receive grades on skill tests. An example skill test will be the ability to complete an S-turn. Players are asked to negotiate a short course until they complete the turn in an acceptable manner. Players will be allowed to move on if they obtain a grade of C. Throughout the rest of the game players will be completing S-turns in races, allowing their skill at S-turns to grow. Later on, many players will return to the license area and attempt to get a better grade on the S-turn course using the skills they developed from later on in the game. This system could conceivably work within the existing course framework, by allowing students to return to previous assignments and reattempt them once they have gained a certain amount of mastery by using those concepts in other areas of the course.

Challenge

Game players prefer to stay on the outer edge of competency. Tasks are most engaging when they are challenging, but allow the player to accomplish them without great frustration (Schell, 177). Game designers have developed many techniques and strategies to keep players on the outer edge of their competence. Courses by contrast tend to require all students to complete tasks of the same difficulty, regardless of the student's current competence level (Gee 2003, 2). Some of the techniques that game designers use to keep players on the outer edge of competence are (Schell 177):

- Difficulty levels: Many games allow users to choose their difficulty from the start of the game. Some games also allow players to change the difficulty level part way through the game. This could be applied to courses simply by letting students choose which grade they would like to strive for. Tasks could be created at an A, B or C level difficulty. If a student feels that they would like to switch grades partway through the course, then they could simply switch the level of the tasks that they are doing.
- Let players get through the easy parts Quickly: Game designers will design ways for players that have mastered the skills of a certain level to move to new challenges quickly. This type of interaction would be very difficult to achieve and maintain the ability to have students work collaboratively, but allowing some sections of the course to be self-paced or even using a self-paced introductory model to allow students to select difficulty levels may be feasible.
- Creating layers of challenge: This method is very similar to the current educational grading method. Players complete a challenge and are awarded a grade and are then allowed to move on to new challenges if they have met a certain threshold. However, players are then given the chance of returning to a challenge in order to get a better grade for that particular challenge. Examples of games that use this style of gameplay are "Gran Turismo 2" and "House of Dead 2". In this method students would not pre-select their difficulty level, but would be allowed to return to modules that they scored badly in to improve their score.

Tutorials.

Modern games are often very complex. As such players need to learn how to play the game. Games tend to use the process of in-game tutorials in order to accomplish this learning. Games will start off with slow introduction of game mechanics, allow players to practice those mechanics and then move on to harder problems (Gee 2008). This is very similar to the concept of "just in time teaching", a very successful teaching methodology where students are presented with an assignment just before instruction and the instruction is delivered as a reaction to the student's performance (Novak). Game designers will endeavour to reduce "lecture time" as much as possible, instead only providing instruction when absolutely necessary, instead creating ways for players to discover the answers themselves. A possible way of using this in the classroom is to replace much of the lecture time with other learning activities that have been created in a way that lead students to the same answers that lectures would have.

Story

Story is not unique to games, but it does play a large role in most successful games. Story is a prolific form of art, found in almost all activities including games, bedtime stories, barroom bragging, broadcast news, films, books and even school. In any given course, an educator is telling a story of the content and the discipline (McKee, 11). Indeed, before the advent of school, story was the way in which humans would educate each other. Of course there are good stories and bad stories. The gaming industry has been slowly discovering techniques to make their products more compelling through the use of story.

Structure:

The structure of story is incredibly important. There are several types of structures, the most common being the linear three act structure (Dunne). The first act includes two key elements, a hook and an inciting incident. The hook occurs within the first few "pages" of your story. It is essentially what grabs the audience's attention and usually sets the tone of the story. It can be any type of event but it must be bold and hook the audience. The inciting incident occurs slightly later than the hook. It is an event that changes the story forever and sets it off. Until the inciting incident you are viewing normality. For example in the game "Assassin's Creed 2", the inciting incident is when Ezio's father and brothers are hanged and he has to flee the city. It changes the character's world forever and sets them on a new path. Finally at the end of act one you get the first act turning point. This again changes the direction of your character, setting them up for the beginning of act two. In Assassin's Creed 2, the first act turning point is when Ezio discovers that his father was an assassin and he decides to become one himself. The second act is centered around conflict. A series of obstacles your protagonist needs to overcome to reach the final goal. In Ezio's case, he has to track down those involved in the conspiracy that led to the death of his family and assassinate them. The third act is where it all comes to an end, it consists of a climax and the resolution. For Assassin's Creed, the climax is when Ezio discovers that the leader of the conspiracy is Rodrigo Borgia and the resolution is when he succeeds in foiling the Borgia's plot. The three act structure is a simple framework that a course designer could use when designing their course. Having a student's activities follow the same pattern as Ezio's could lead to a very engaging course.

Set ups and Payoffs

An element that needs to be continually referred to when crafting a story is the idea of set up and pay off. For every element in a story, there has to be a problem that is set up and a pay off. Field argues that this is in fact "one of the principles of all writing" (Field). Essentially, this is an act of problem solving for the character, the set up presents a problem and the pay off is the resolution of that problem. The fact that story can be expressed as a series of problem solving activities for the character could explain why it is easy for game designers to add arbitrary story to their game design. An example of the grafting of story onto games is the game of chess. What could simply be an abstract game, is actually a game about warring medieval kingdoms

(Schell 262). The layout of a typical course lends itself to this kind of story craft, as each section of the syllabus or learning goal can be seen as a problem that needs to be overcome. It is really important though to provide a way for the learner to experience the payoff, for them to be provided with a way to show themselves that they have actually overcome the problems that have been set up. This has partially been accomplished with the use of Case based learning, which, is used primarily in professional schools at the moment, but is starting to become more prevalent in the wider educational setting (Dickey, 74). Case based learning creates a problem scenario for students and helps them to walk through the steps of solving that problem. Since this story technique is already part of established pedagogy, it would not be too hard to integrate into a course.

Community

Community helps provide pleasure to players motivated by “socialization”. There are games that do not make use of community. However, those that do are often far more successful than those who do not. This has recently been shown by the remarkable success of Zynga, a game company that creates games like “Farmville” that are based on social interactions. After four years of business, Zynga has a higher market valuation than Electronic Arts, the world’s second largest game company (Levy). Other human beings seem to be an incredibly motivating force.

The way in which games increase player interaction and thus to create community is through cooperation and competition (Schell, 187). Successful games try to provide both cooperation and competition in a balanced way. Competition allows games to appeal to Killers and Achievers and cooperation allows them to appeal to socializers and explorers. Players are given the choice to advance through the game cooperatively or to compete against each other in the game world. Many games become successful by marrying the two concepts, allowing players to compete against each other in cooperative teams. For example, in the game World of Warcraft, players form groups called guilds and cooperate to face the game challenges together. Guilds and players then also have the ability to battle other guilds and players in the game.

Interestingly, fears of the negative effects of competition have made educators less likely to use competition on the classroom. This is despite evidence that competition which is held between teams of cooperating individuals (as is the case in the most popular games) provides all of the positive performance and behavioural effects of both cooperation and competition while reducing the negative effects (Slavin, 318). In courses there are many ways that competition and cooperation could be created. Care has to be taken to avoid any harmful effects of competition, but if done properly it can be used to strengthen the community within the classroom.

Freedom

Freedom grants a sense of control to the player. Having control is something that feels good and allows a player to project themselves into the character that they are playing, creating much

deeper engagement into the environment (Schell, 284). Game designers will often try and give the players as much freedom as possible, without hurting their story. The first manifestation of freedom in a video game is that in general, people play games because they choose to. This is not the case for school. If we return to the different key motivations for attending university, only the “personal-intellectual development” category of students are attending university as an end in itself. The “careerist-materialist”, “default”, “expectation-driven” and “humanitarian” students are either attending university as a means to an end, or attending university because they feel they have no other choice (Cote). In order to accomplish their goals they feel that are not free to choose to not go to university. Even those who attend university because they enjoy the learning experience do not have much freedom when it comes to choosing courses. Most university programs have a set of required courses and prerequisite courses. Finally, within a given course, there is very limited freedom to choose which activities to participate in and in which order. All of this lack of agency around the university experience means that in order to create an enjoyable course experience, it may be necessary to create as much agency as possible within individual courses.

There are two types of freedoms that games allow players, one is branching freedom and the other is ordering freedom (Dickey, 73). Branching freedom occurs when players are given choices that may exclude other choices. These include choices like picking your character type in a role-playing game, or making plot decisions for the character. Ordering freedom occurs when players are given a choice of what order to engage problems in. Although many educators to recognize a value in providing freedom to students in a course (Assor), most courses do not include much freedom. Branching freedom is sometime provided in the ability to choose who to work with on a group assignment or in the choice of an assignment topic, but there are very few examples of ordering freedom. One of the main reasons for this is probably the linear nature of courses. Having all of the course material set in linear lectures leaves little room for ordering freedom. Game designers have found interesting ways of overcoming this problem though. They will have sections of linear gameplay, followed by gameplay that allows for ordered choice. For example, in “Dragon Age: Origins” the player plays through a linear story starting from their homeland and ending at the battle of Ostagar. After the battle the player is then given the choice of whether or not to go to Redcliff, Orzammar, the Brecilian Forest or the Circle Tower. There are tasks to complete at each location and the player can choose in which order they go to each location. Once the tasks are completed at all four locations, the gameplay becomes linear again and the players have to go to Denerim. This technique could be inserted into courses without too much difficulty. The instructor would teach the introductory material, then allow students to choose the order in which they would like to self-study some subsequent topics. After those topics have been studied by the students, linear lectures would resume with more advanced material.

Challenges

Dealing with Cheating:

Cheating is a phenomenon in both video games and courses and both systems attempt to minimise it as much as possible. Game designers want to minimise cheating as it disrupts the delicate balance of challenge and fun that the designers have worked so hard to achieve. The incentive to cheat can be much higher in education though, especially considering that many students do not attend university as an end in itself, but rather as a means to an end. Some of the gameplay dynamics discussed in this paper could enable more cheating if not treated correctly. Ordering freedom and allowing students to repeat sections of the course later on are two obvious examples of this. However, as long as the course designer is aware of this issue, they can come up with steps to mitigate it. An example would be providing an alternative reward to grades for sections of work that contain ordering freedom, or creating a large database of questions that and having students tested on a random subset when retrying a section of the course.

Simplicity

A very important consideration not only in game design, but for design thinking in general, is the concept of transfer effects. In games, life bars are typically red, because that is what the player expects. When looking at redesigning a course, we need to ensure to consider how we can use existing mental models. In order to not overwhelm students and instructors the changes need to be made in a way that utilize as much of the existing course design as possible. One way to accomplish this is to use as many of the current technological platforms such as clickers and institutional learning management systems for any technological support. Another consideration is to not introduce too many new mechanics into the course at a time and to initially choose those that are the least cognitively disruptive. Any course design will have to take into account the workload of the instructor and the student, ensuring that if pieces of work are added, that others are removed so as keep the workload the same of a traditional course.

A look of how these elements could possibly be applied to a university level Computer Science course:

Just as every game finds different ways to apply the principles, each course will have to be looked at independently to figure out what the best design will be for that course. Here are two Computer Science courses with some of the game dynamics applied to them in different ways.

CPSC 430: Computers and Society

Reward:

Points: Points can be awarded for tasks done. A student needs a certain amount of points within a learning goal in order to move on to another learning goal (completion).

Power: If students do well really well on clicker quizzes then they will be allowed to work on certain tasks collaboratively.

Challenge:

Choosing the types of tasks that they would like to accomplish helps students to moderate their own challenge by choosing the tasks that they feel are more appropriate for themselves.

Story:

Make the course based on the following storyline: You are a freshly graduated student from UBC that applied for a junior programming position at Google. However, someone in HR was careless with the resume piles and you were hired to be in charge of Google's new location-based service. In your day-to-day life in the new job you will have to face many ethical dilemmas based on how your product interacts with society.

Community:

Allow students to accomplish some tasks as teams. They would only be able to perform tasks with students that are on the same set of learning goals with them. Battles (described below) would also facilitate community between teams.

Freedom:

Students will have a choice between several tasks that they could accomplish at one time, as well as being given choice over which decision their characters make. A subset of the learning goals will be ones that the students can choose from.

Tasks that students can choose from:

- Writing quizzes. - Students will write quizzes of a predetermined length. They will receive points if their quiz is acceptable, no points if it is not (high risk, high reward task).
- Taking quizzes. - Students will take quizzes written by their classmates. They will receive a certain amount of points, based on their score.
- Grading quizzes.
- Have the same set of tasks for assignments, but instead make these open-book and make them be really difficult.
- Writing blog posts.
- Commenting on blog posts.

- Battles - Students will be divided into teams (based on their character's current situation) and debates will be held. Teams that win battles will receive points and students that do exceptionally well during battles will win bonus points.

Simplicity:

Having students do all three facets of the quizzes reduces the need to have TA's and the professor writing and grading quizzes, allowing them to focus their attention on promoting understanding of concepts amongst students and to support the other game mechanics.

CPSC 221: Basic Algorithms and Data Structures

Freedom:

Ordering freedom will be provided by allowing students to choose in which order they study the algorithms. After the introductory material on recursion and complexity, the students will then choose between the sorting algorithms. After all the sorting algorithms are completed, there will be some lectures on storage, at which point students get to choose which storage algorithms they would like to study in which order. Assessments would be conducted at the end of the ordering free sections in order to minimize cheating.

Reward:

Completion: Provide a blank grid or tree of the different learning outcomes. Have it be filled in if students accomplish the learning outcomes of that particular piece.

Power: At any point let groups write a test to show their proficiency in an algorithm. If they accomplish this then they are free to move on to another algorithm.

Punishment:

Provide a time limit for the ordering freedom sections. Groups that are not done with their learning objectives in that time will not be able to complete those objectives.

Challenge:

At any point let groups write a test to show their proficiency in an algorithm. If they accomplish this then they are free to move on to another algorithm.

Story:

Rather than present the algorithm as is, use a case-based learning approach. Devise a problem that would be best solved by the algorithm and ask students to find what algorithm would best be suited for that problem and create an implementation to solve the problem.

Community:

Instead of lectures, have groups of 4 teach each other the concepts in real time. Mini quizzes at the end of the lecture will assess student/group ability. Points would be awarded for doing well and bonus points would be awarded for the group doing well. At points with ordering freedom the group decides which algorithm it would like to work on next.

Simplicity:

The only new dynamic to be introduced will be ordering freedom. All the other dynamics will be used to support this unique piece of learning.

Conclusion:

Game designers and course designers face very similar challenges when conducting their work. They are charged with creating a system that will hold the attention of their audience for an extended period of time, while at the same time asking the audience to work hard to solve very complex problems. The game design industry has invested much time and effort in coming up with ways to make their games as engaging as possible. Although educators also put in a lot of effort to improve their courses, they simply do not have the resources available to research and test all the ways possible to make an engaging class. This paper argues that educators can simply re-purpose much of the work game designers have done in finding ways to keep an audience engaged in problem solving activities. All of the major design techniques that game designers use can be applied at least partially to the design of a course. The example designs of CPSC 430 and CPSC 221 show that it is at least theoretically possible to apply these designs. Moving forward, it is important to test these ideas out in a real classroom environment and compare the experience that students and educators have in a course designed using these techniques. In order to do this the first step is to go through the process of designing a course using these techniques.

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