Converting Simulations for the Online Environment: The New Ginseng Game

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ABSTRACT

Simulations and Games are useful for teaching principles associated with sustainability and other concepts related to the Tragedy of the Commons. As institutions expand their course offerings to support online education, games and simulations need to be developed or adapted to the Online Environment. The Ginseng Game is a personal computer-based game that can be played in a single class period with the learning objective of helping students recognize situations susceptible to resource depletability and prevent the adverse consequences associated with the Tragedy of the Commons. The game usually results in bankruptcy for all players due to high team interdependence and short sightedness by at least one team. This paper describes general principles related to the creation of online games and simulations as well as describing the conversion of the Ginseng Game from a PC version to a Web version.

INTRODUCTION

Simulations and games are useful for teaching principles associated with the Tragedy of the Commons (Hardin, 1968). The fixation on short-term performance at the expense of long-term survivability has been frequently demonstrated by overfishing, deforestation, and aquifer depletion. The same type of behavior has led to Enron, the Housing Bubble, and the Fiscal Cliff. Long-term success is always down the road, so the focus on short-term goals and results is used as a proxy for success. "Winning" is the concept of the day. Any fallout from today's winning strategies can always be dealt with tomorrow. It is important that students be made aware of the consequences of short-term goal seeking.

The Ginseng Game (Cassidy & Brozik, 2009) is a resource depletion simulation intended to teach students to think about the adverse consequences of using short-term goals while operating in markets with depletable resources. The simulation usually results in bankruptcy for all players due to high team interdependence and short sightedness by at least one team of participants. While the players are aware of the interdependence between the groups due to the common factors in the market, teams seem to value individual success over the sustainability of the market. The Ginseng Game follows the tradition started by Fishbanks, Ltd. (Meadows, 1990). It is a personal computer based game that can be played in a single class period with the learning objective of helping students recognize the Tragedy of the Commons and prevent the adverse consequences associated with the Tragedy.

In over 30 administrations of Fishbanks, Ltd. and the Ginseng Game, no class of graduate or undergraduate students succeed in averting bankruptcy. This evidence suggests the strong need for instruction in recognizing and preventing problems associated with the Tragedy of the Commons. Anecdotal evidence suggests that students in the natural sciences, especially those studying environmental science or biology, are more successful at recognizing the problem than students in Business and Economics.

PC DESIGN ISSUES

The PC version of the Ginseng Game organizes players into several different teams, each representing a company that commercially harvests and sells wild ginseng. Students are provided a manual that describes the objective of the game, the steps of play, and sufficient information on the industry that the observant student will recognize that sustainability issues are far more critical than competitive issues. Less observant students will ignore sustainability problems and engage in ruinous competition. The game is programmed on a set of Excel spreadsheets that make all the game computations. The computer takes team inputs and computes the amount of ginseng harvested using a dynamic population model that takes into account losses of ginseng from harvesting and death, growth, and replenishment of plants from the seeds of current plants. If the teams overharvest, the annual yield

will fall short of the maximum amount that can be harvested, and suboptimal performance will result.

Team inputs to the simulation are entered sequentially in a team tab in Excel. This process usually takes a significant portion of the time available for the simulation. The PC processes those inputs to compute annual team revenues, expenses, and profits. Revenues result from ginseng sales, equipment sales, and interest earnings. Expenses result from new equipment purchases, annual reoccurring expenses, interest payments, and new hiring. This information is displayed in aggregate summarizing the performance of all teams. This has the effect of focusing teams on the competitive nature of the simulation. Detailed performance information is also displayed for each team. When the simulation is conducted in a classroom, detailed team performance information is observable by all teams.

The key to successful performance is to understand the factors that affect the total ginseng crop. Ginseng population information is computable and can be displayed to teams if requested. This information is critical to early recognition of the problem. If displayed every season with the financial performance, teams might detect overharvesting earlier. The effect of placing this information on an infrequently used page is to further focus teams on the competitive nature of the simulation.

ONLINE DESIGN ISSUES

The Ginseng Game has been redesigned for the online environment. This provides opportunities to enhance important features of the game and steam-line play. Instead of having a single PC record, compute, and display simulation results, the online software is hosted on a server, and each participant or team uses an individual input device to enter and display the results. Information entered is the same as for the PC version except that each team can simultaneously enter its decision variables. Information displayed includes aggregate results for all teams, team results for each specific team, and population reports. Teams can search these displays, returning to information that interests them whenever they want. Teams can be prevented from examining the detailed financial condition of other teams, or such information can be made available to all participants.

GENERAL PRINCIPLES RELATED TO CONVERTING GAMES AND COURSE ACTIVITIES TO ONLINE SIMULATIONS AND EXERCISES

CONVERTING PC GAMES AND SIMULATIONS TO ONLINE GAMES AND SIMULATIONS

The ideal situation when creating an online game involves a development team composed of a designer, producer, programmer, artist, and audio specialist (Perdersen, 2009). In a university setting, team members may be located in several different departments with some members taking on more than one roll. The development team for the conversion of the Ginseng Game from PC to Online consisted of a College of Business faculty member acting as game designer and producer and a Graphics Coordinator and part-time student worker from the Distance Education Center acting as programmer, artist, and audio specialist.

The main educational concern when converting the Ginseng Game from PC to Online was how to motivate and engage students while still meeting the learning objectives. When analyzing the gameplay, it became increasingly important to understand the psychology of competition in order to develop strategies and methods to encourage and evaluate that factor in the online gaming environment. Graphics, in the form of charts and graphs, were used to illustrate comparative profit margins and encourage natural competition between teams. A countdown clock and environmental lighting cues were developed to create a sense of urgency, another important component of competition.

Collaboration and team interactions were also considered in the conversion of the Ginseng Game from PC to Online. Teams did not interact during gameplay except through a Twitter-like feed displayed at the bottom of the screen. Team members needed to communicate quickly and concisely with one another to create their harvesting plan which was displayed at all times. The financial analysis panel was prominently displayed at all times. Individual team members could explore relevant information by clicking on tabs and viewing different panels of information including ginseng population data and historical strategic planning data. Individuals could then choose whether to alert the other team members to any findings or not. Multiplayer gaming technology was used to facilitate communication between team members in the form of chat boxes and audio.

Each season lasted five minutes. At the end of the season the harvesting plan was automatically entered, and the results calculated which automatically updated the financial analysis information, population data, and historical strategic planning data. As the game progressed, the trends in the financial data were displayed for use by the players. Teams were identified by flags written into the program as teams that had exponentially increasing profits, teams that slowly gained profits, and teams that did not gain profits. Each type of team then received a different debriefing video at the end of the game to help them understand the true objectives of the game, which was the lesson of Tragedy of the Commons.

DESIGNING ONLINE GAMES

Budgeting and IT constraints in institutional settings set the limit for software and hardware purchases. Both a game engine, which is software used to build the game, and a game server, which is specifically set up to handle transfer of data between concurrent users, are required to build a fully functional online multiplayer game or simulation. There are several affordable game engines on the market today, but most of them focus on single-player game creation, have no real server solution, or have HTML5 or Flash client side interfaces. HTML5 game engines may be a good solution for some institutions because they are affordable, but HTML5 is still under

development, and the networking for multiplayer gaming is not fully supported by all browers at this time. Flash multiplayer gaming may also be a good solution for some institutions, but the expense of Flash Builder, Pulse SDK, and access to a Flash Gaming Server may be a deterrent.

Server and networking solutions are the biggest issues faced when hosting and delivering a multiplayer online game. University IT departments often will not allow the use of campus servers for game hosting due to vulnerabilities to the campus network created by multiplayer gaming communication protocols. Hosting games on departmental servers may be a better option, but maintenance and updates can be quite extensive which may require a dedicated employee. Several game engines and their respective server and networking solutions were compared on the basis of price, multiplayer capabilities, resources and documentation. Unity3D Game Engine and Photon Cloud Server were chosen because they offered a manageable online multiplayer gaming development, storage, and networking solution with a variety of highly affordable price plans.

The Unity 3D game engine required knowledge of JavaScript, and the Photon Cloud Server required knowledge of C#. Required knowledge of networking was minimal because the networking was seamless between the two products. In order to take advantage of the 3D capabilities of the Unity3D game engine, a 3D landscape of the West Virginia Mountains was created using assets available through Unity3D Store. The background environment changed from spring, summer, fall, and winter during each season. The use of the 3D landscape was intended to increase the sense of time passing and create depth to the game by immersing players in an environment described in the player's manual, something that was not possible in the classroom. A 2D graphical user interface (GUI) was created to allow players to enter harvesting data and view financial analytics, population data, and historical strategic data.

Translating the code from the PC game to the Online game provided a small challenge. A game guide document was developed to help track constants, variables, and formulas. These were then used to develop the JavaScript and C# code. The JavaScript was used on the client side to create the GUIs and to send the information to the server. The server side code, in C#, would run the calculations and formulas and then send information back to the client side code which would then update data presented to the teams and start the next season countdown sequence.

CONCLUSION

As universities and students demand more and more online classes, shifting instruction from a face-to-face venue to a virtual venue, faculty will increasingly need to convert the pedagogical tools they have used in the classroom. These tools, including experiential exercises, simulations and games, are generally ill suited for delivery using learning management systems and the internet. The technological barriers to the conversion of these teaching tools are significant and usually lie outside the competencies of most faculty. The need for good pedagogical tools, optimized for use in Learning Management Systems or the internet, necessitates involvement with experts in distance learning and programmers who can translate faculty needs into new pedagogical tools.

This game represents a first attempt at collaboration between faculty and distance learning experts in the translation of a computer game for use by students across the internet. The game will enter field testing in the spring of 2013 and should be deployed in fall 2013 to support distance learning instruction. Future projects include the development of one new resource depletion game and the conversion of Dennis Meadows original game, Fishbanks, Ltd.

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