

Developing Games-Based Learning Activities: Early Days and Lessons Learned

Abstract

The Department of Mathematics and Computing introduced the course CSC3418 Computer Games Programming in 2006. The development of the course material was an opportunity to replace the traditional content of readings and lectures with Game-Based Learning (GBL) activities. To this end the course material includes a 3D computer game, classroom-based game activities and an online exam-revision game. This case study describes the GBL activities in CSC3418, explains their development process, evaluates their use over two semesters and suggests directions for future revisions.

Background

There is a growing community of educators who believe computer games may be effective tools for education (Gee, 2003; Prensky, 2001; Aldrich, 2004; Elliot, Adams, & Bruckman, 2002). Good games are not easy to design and educational games are even more difficult because of the lack of content and pedagogy knowledge on behalf of the games companies and the lack of technical ability in educators to create such application.

Games-Based Learning (GBL) addresses many educational issues including *student engagement, immersion and authentic professionalism*. Computer games provide educators with a means of student engagement by supplying action based, discovery experiences. The medium produces high, sustained levels of engagement and a deeper understanding of subject matter (Carswell 2004).

Gaming also fits best with instructivist, social and problem-based learning methodologies. Students are able to do expensive and inconceivable activities virtually. Games offer students an identity in the virtual environment and provide them with rules, allusions and other concepts and objects which immerse them in the world (Miller 1993).

Authentic professionalism is achieved through effective learning environments which help students to think and act like practitioners (Buchanan & Sheridan 2004). Role-playing is a valuable exercise for students to practice the skills involved in their chosen profession. In addition, virtual gaming environments can closely approximate a work place that may otherwise be inaccessible to students while they are studying. This provides a level of knowledge about how people interact, dress, use profession specific terminology and daily routines not available elsewhere.

With the introduction of CSC3418 (Computer Games Programming) into the third year curriculum of the Bachelor of Information Technology at USQ, it was an opportunity to develop and trial GBL in a course developed to teach the programming of games. The aim was two-fold; 1) to showcase the game development tools used by the students in CSC3418 by delivering a functional computer game and 2) work towards a methodology to be used by educators for creating effective GBL activities.

Process

The first GBL activity is a computer game called *CSC3418 The Game* (shown in Figure 2.1) which I developed and programmed especially for the first offering of this course. The objective is to make it through a series of 3D game levels each representing a module from the course. In the levels, the students explore the environment with the assistance of a virtual tutor (Figure 2.1a) to find information cubes (Figure 2.1c) containing readable course content and quest bubbles providing students with a practical activity. To progress to the next level students can take fill-in-the-blank quizzes (Figure 2.1d) or successfully complete quests to accumulate enough points to get to the next level. Each time a quiz question is answered incorrectly a green droid appears somewhere in the environment and begins chasing the player (Figure 2.1b). If the droid catches the player the points for the incorrect answer are deducted from the player score. The Game also includes animated slide presentations with text-to-speech capabilities (Figure 2.1e,f).

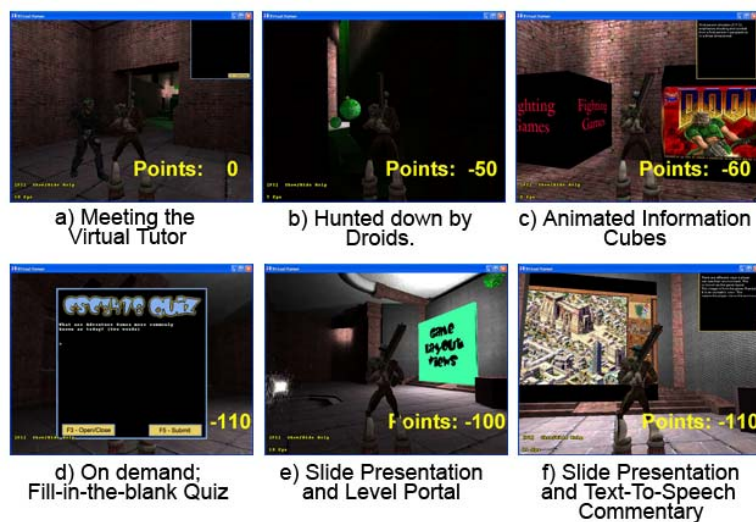


Figure 2.1. Screen captures from *The Game*.

The next GBL activity is a card game called *GameGame*. In class teams create a game idea by addressing game design elements on cards. Teams take turns to pick up and trade these cards. The four cards of goal, mechanic, component and victory represent compulsory game elements which each player must try to possess. At anytime a publisher card may be revealed. At this time any player with the four compulsory cards can pitch their game idea to the person holding the publisher card. A successful pitch results in a token reward. These tokens can be used to buy more cards.

Following the lead of *GameGame*, I developed a board game called *Game Engineopoly* (shown in Figure 2.2). This game is played in class with the students divided into teams. The

teams make their way around a modified monopoly board by rolling dice and moving tokens. The goal is to buy coloured squares (the original monopoly properties) which represent game program modules. Once purchased, the complete source code for the module must be written by the team before they can charge extra rent if another team lands on their square. Teams can obtain hints for writing their code by landing on other squares providing free hints or purchasing code segments from the bank.



Figure 2.2. The board used for *Game Engineopoly*.

Finally, students have access to an online game called *CSC3418 Jeopardy* (shown in Figure 2.4). (This game was originally developed for revision in CSC3406 Computer Graphics). Each time the student loads the game they receive a game board with 30 questions randomly selected out of a database of 400 questions created from content in the study materials and textbook. The questions are divided into categories and given different weightings according to difficulty. At the end of the game the student is given a list of the sections of the course material they need to concentrate their study efforts on before attempting Jeopardy again. The questions in the database are included in the final exam.

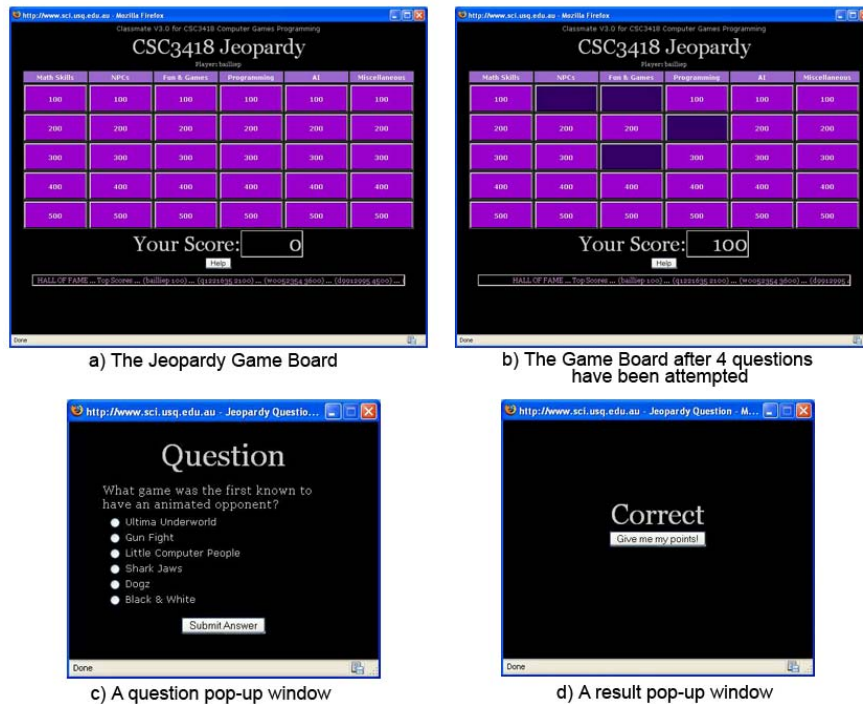


Figure 2.4. The online exam revision game: *CSC3418 Jeopardy*.

Evaluation

CSC3418 The Game was created using a top-down approach, which is similar to that taken by major players in the game industry. Starting with the technology and a story, the game play is build-in and manipulated to fit the genre. Unfortunately, this results in a less than compelling game with monotonous activities. Although *The Game* is useful for programming students to examine the code, it is not a particularly engaging teaching device. What we learnt from playing *GameGame* was the need to instigate a bottom-up approach for effective game development, especially in the case of educational games. We also found returning to basics was not only essential in defining an educational game, such as *Game Engineopol*, but this type of game creation methodology was accessible to all educators.

By considering the four compulsory elements of game design, (goals, mechanics, components and victories) we designed *Game Engineopol* with the goal of being the team with the most money at the end of the game, the mechanics as per monopoly (e.g. rolling dice, moving around the board, purchasing squares etc.), the components of a game board, code segments, money, tokens and chance cards and the victory of being the last team standing by completing all game code and buying out the other teams. This game was enjoyed by all participants. Although no formal evaluation of the game play took place, it was evident students engaged in the content as they returned to the tutor asking for copies of the game components to integrate into their assignments. In addition, in the 2 semesters the course has run lecture attendance has been consistently close to 100%. We would attribute this to the collaboration, interaction and *fun* the students experience during the lectures.

Jeopardy has also proven to be successful. In 2005, when the game was first released, in the course CSC3406 web statistics show 28,380 questions accessed (46 students enrolled) and in CSC3418 2747 questions (14 students enrolled).

Replication

Developing a computer game is beyond the expertise and time/resource constraints of most educators. However as good game design theory teaches, the same principal game play elements should be reproducible in a card, board or other table top game. The first question an educator should ask before investing the time in developing a computer game should be, *Will this game work as a card or board game?* The crucial game elements of *goals, mechanics, components* and *victories* are best developed and analysed on a table top where the game play is not clouded by hollywood-like photorealistic graphics, special effects and surround sound found in most of today's computer games.

Having been involved in the development and use of games as a part of educational content we can suggest the following pointers for others interested in trialling GBL in their own courses:

- Don't make the ultimate goal of the game to learn about the subject matter. The subject matter should be part of the game mechanics or components. It will be passively taken up by the students.
- If you have the skills to program a computer game, don't jump straight into the programming. Cardboard, sissors, a ruler and some pencils is a less time consuming way to implement your game ideas and have them played by the students. For example, *CSC3418 The Game* took approximately 2 months to program, *Game Engineopoly* took 2 days.
- A computer game with traditional written educational content cannot be classified as GBL. It simply becomes a glorified webpage. The content must be interactive and applicable to problem solving activities within the game.
- A student's primary goal is to pass the course. Anything distracting from this goal is likely to be bypassed. The same principle is applicable to game design. Any parts of the game which do not help the player satisfy the goal of the game will be ignored.

Implementing GBL in CSC3418 has been an eye-opening and satisfying experience. It is hoped that through the development and use of more GBL activities we can begin to develop a methodology for translating educational content from other fields of education (not just games programming) into effective GBL activities. In the future it is hoped these classroom activities can be translated into online computerised versions available for play by external students.

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