

## Game Development Class in 6 Weeks

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**Abstract:** This paper discusses a game development class held in a very successful summer science and engineering program called PREP. Each of 41 students designed and developed a computer game over a 6 week period, working around 2-3 hours a day for 4 days a week. The curriculum consists of playing, evaluating, designing, and developing a computer game. Students developed their games in a tool called Game Maker. Students were introduced to the idea of educational computer games and artificial intelligence in games. Through developing two simple games together and looking at another game that was already developed, students were able to develop complete games with some direction from the instructor and a PREP Program Assistant. 10 of the games had some educational component to them with 8 of these 10 dealing with logic skills and capabilities. This course can be reproduced with other high school and college students.

### Background

With our children putting in around 10,000 hours of computer game playing by the time they leave school (McGonigal, 2011), they would be considered masters at game playing (Gladwell, 2008). Games are important to us, and they have been in our culture for centuries. Some computer games even have educational purposes (Prensky, 2001). Gaither and Redfield, 2011, cataloged over 1500 such games at [www.wingz2fly.com/wp/search](http://www.wingz2fly.com/wp/search). Kids are interested in games, so why not capitalize on that interest and show them how to make them while learning about computer science? In a summer program, 41 students made computer games in just 6 weeks. This paper overviews the computer game development class for the PREP IV students at the University of Texas at San Antonio (UTSA) main campus in San Antonio, Texas during the summer of 2011 in a way that others can do the same.

The Prefreshman Engineering Program (PREP) was founded in 1979 by Dr. Manuel Berriozábal and “provides a challenging academic program designed to motivate and prepare middle and high school students for success in advanced studies leading to careers in science, technology, engineering or mathematics fields” (PREP-USA, 2011). PREP provides courses and other activities starting with middle school students over a seven week period during the summer. There are multiple years of curriculum in the PREP program. Students take PREP courses on a college or university campus for seven hours per day, four days per week. In addition to instructors, the program is facilitated by undergraduate students from around the country who have been selected as models of successful college students. These students act as Program Assistants (PA). Each PA leads a group of students.

In PREP IV, students have already had three summers of courses in math-based logic, problem solving, algebraic structures, and in basic sciences and engineering. For 2011, the curriculum was organized around courses in water science, pre-calculus with trigonometry, and computer science (game development). Other regular activities included a series of laboratory visits, and a research and study period. The 41 students in PREP IV were divided into two groups. The water science and computer science courses required individual computer access.

### Curriculum – What We Did

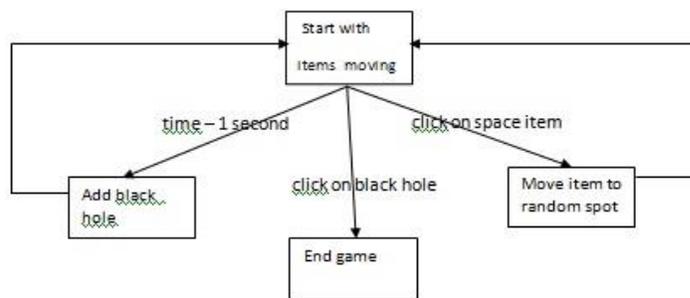
Students saw around 30 to 90 minutes of instruction daily. The instruction was often interactive. Later in the program, students would sometimes have 2 hour blocks to work on their games and documentation. PAs would work with students individually. The table below shows a breakdown of what the students should have seen, learned and done for the week-to-week work. The table also shows what students did or turned in at the end of the week.

Topics/Outcomes	Student Assignments
Understand what a game is and how to evaluate a game	<b>Show a game</b> (online or mobile) in class
Understand the design process of games with storyboarding; create sprites; create 2 games together in Game Maker (clicker, shooter)	<b>Evaluations</b> of 5 games with descriptions, images and rating for each game; say the idea of the game you will develop
Know how to create a game in Game Maker; see a multi-room game in Game Maker; Understand how to make an educational game	<b>Storyboard</b> document due and shown to class or the instructor
See how artificial intelligence is used in games; work on their games, especially images	Show the progress of the game to the instructor
See the business side of games and game development; work on their games	Show the progress of the game to the instructor; start the game manual
Be inspired about the future of games; Play each others' games	Present the <b>game</b> by playing it for the class; <b>game manual</b> due

**Table 1:** Curriculum and assignments

Each of the elements in bold above was given a grade that went into the overall grade for the game development class. The students really enjoyed selecting and showing a game to the class the first week, just 3-4 minutes each. It was no problem for them to find an online game that could be shown on the instructor's computer or a game on a mobile device that could be shown by a document camera. Some of the students had to be encouraged to write a bit about their games, creating the purpose of the game, how the game play went, and what a player actually did with the game, not just the meaning of what actions the player would do (just as 'press the right arrow' for move right). Understanding this difference between a player's physical actions and the result or meaning in the game was critical to them being able to design their games. The students had to write what actions the players could take for each of the screen and scenes in their games.

The storyboard document required a few pages that described the game and overviewed what a player could do in the game. Students made a flow chart that showed the sequencing of the rooms or levels or scenes of their games. For each room, level, or scene, they had to create a page that had a title for the screen, about half of the page for a mock-up image of what they wanted the screen to look like, a written description of what is going on in the scene, and a list of the actions the player could take in that screen. Figure 1 is an example of one of these scene pages for a game we created as a class with the Game Maker development tool. We called the game *Pick Your Space* (they could have other images if they wanted, so it could be *Pick Your Fruit*, for example). Figure 1 is an example of a flow chart for the *Pick Your Space* game, and Figure 2 is an example page with a draft screen.

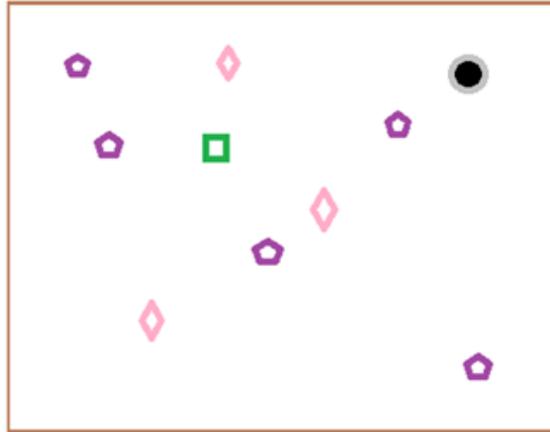


**Figure 1:** Example flow chart

After they fully designed the details of their games, students had about two weeks to develop their games in Game Maker. The students turned in the Game Maker source file (.gm81), executable file and the game manual. The game manual consisted of an overview, requirements (software and hardware needed), updated storyboard pages to show how the game actually was developed, instructions on making and using the game, a discussion of what they would do to improve the game, references, and an appendix with any code that they wrote including lists of objects and rooms, and screen shots of the development tool for each room that they created. The final assignment was to show the game to the class and to the first year PREP students at UTSA and the Director of San Antonio PREP.

### Moving-objects

Score: 0 points



The screen background is dark with some stars. There are 3 types of space objects moving in straight lines, some diagonally (a ship/rocket-purple item at speed 1 and score 5, a comet-pink item at speed 3 and score 10, and a moon-green item speed 5 and score 25). The score appears along the top and starts at 0. There is also a black hole at the start. The black hole should have a light or white edge around it. Note that the user cannot give any other input.

Either the user

- Clicks on a ship, comet or moon
  - Go to the Click-Item state
- Clicks on a black hole
  - Go to the End-game state

Or

- A second goes by
  - Go to the Add-black-hole state

**Figure 2:** Example storyboard draft screen page

### Game Maker and An Example

Game Maker is a game development tool that can be downloaded from [www.yoyogames.com/gamemaker](http://www.yoyogames.com/gamemaker). Students used the free version although the Standard edition is only about \$40. The Lite or free version shows a Game Maker watermark in the upper left of the screen and there are some things that can only be done with the paid version such as certain sound and graphic effects. There is plenty that the Lite version can do such as sound, image editing, drag and drop interface, scripting with the Game Maker Language, and make an executable so the game can be played on its own (YoYo Games, 2011).

To learn the Game Maker tool, the instructor presented the idea that you have to create an image or a sprite to tie to an object in order to put things in a room or screen. The game play happens in a Game Maker room. In order to have any behavior occur in a room, objects need to be put into the room that can do things like move around, collide with other things, be clicked on, be destroyed, add or take away points, health or lives, and so on.

The game we made together first, *Pick Your Space*, allowed a player to click on a moving object, except the black holes, to gain points. The black holes keep multiplying until nothing else can be clicked on and the game ends. The next figures show the instructions for making this game in Game Maker, a part of what the interface in Game Maker looks like with this game, and a screen shot of the actual game running.

The students also developed, with the instructor, a shooting game that had a scrolling background. A third game with multiple rooms and mazes was shown to the students so that they understood how to go between rooms and make mazes if they wanted. We also did a little with the Game Maker Language although it is much more

advanced. A few students did use it. Figure 6 shows how an object needs to be set up to move from one room to another when one object collides with another.

GameMaker (continue with Lite; click or select each -- )

create\_sound (speaker): Name *sound-hit*, Load sound, select *laser*, Ok (for clicking on object)  
 + sound: Name *hole*, Load sound, select *miss*, Ok (for black hole click)

create\_sprite (red ball): Name *sprite-wall*, Load sprite, select *wall*, Ok  
 + sprite: Name *planet*, Load sprite, select *planet*, Ok  
 + sprite: Name *capsule*, Load sprite, select *capsule*, Ok  
 + sprite: Name *blackhole*, Load sprite, select *blackhole*, Ok

create\_background (pic): Name *background-nebula*, Load sprite, select *nebula*, Ok

create\_object (blue ball): Name *object-wall*, Sprite list, select *-wall*, Solid, Ok  
 + object: Name *capsule*, Sprite list, select *-capsule*,  
 Add event - Create; drag Action- *move-MoveFixed*  
 Click all directions (blue arrows), Speed 3, Ok  
 Add event-Collision-- *object-wall*; drag Action- *move-Bounce*  
 Add event-Mouse- *LeftPressed*; drag Action- *score-SetScore* 25, Relative, Ok  
 drag Action- *main1-PlaySound*, *sound-hit*, Ok

Ok

right click on *object-capsule*: Duplicate:  
 Name- *object-planet*,  
 Sprite - *planet*,  
 select *Create*, double click *MoveFixed* - click directions, speed 1, Ok  
 select *LeftPressed*, double click *SetScore* - 5, Ok

create\_room:  
 Settings: Name *room-space*, Caption *PickYourSpace +*, Width 400, Height 400  
 Background: select menu *background-nebula*  
 Objects:  
 Object to add menu: *object-wall*, click to add around (right click to delete)  
 Object to add menu: *object-capsule*, click to add 5  
 Object to add menu: *object-planet*, click to add 2

[double click to edit an item]  
 (repeat to test each time) File | Save; File | Run normally (F5) - TEST IT  
 File | Create Executable - *PickYourSpace.exe*  
 Create object:  
 Name *object-blackhole*, Sprite list, select *blackhole*  
 Add event - Create, drag Action *move-JumpToRandom*, Ok  
 drag Action *main2-SetAlarm*, number of steps 90, Ok  
 Add event - Alarm, Alarm0, drag Action *main1-CreateInstance*, object *blackhole*, Ok  
 drag Action *main2-setAlarm* - number of steps 120, Ok  
 Add event - Mouse- *LeftPressed*; drag *main1-PlaySound*, *sound-hole*, Ok  
 drag *main2-Sleep* (2000 for 2 seconds), Ok  
 drag *score-ShowHighScore*, may change colors, Ok  
 drag *main2-EndGame*

in (double click) *room-space*: select *object-blackhole*, click in room to add 1  
 double click *Game Information*: type in game information and help instructions (for F1)

Figure 3: How to make *Pick Your Space* with Game Maker

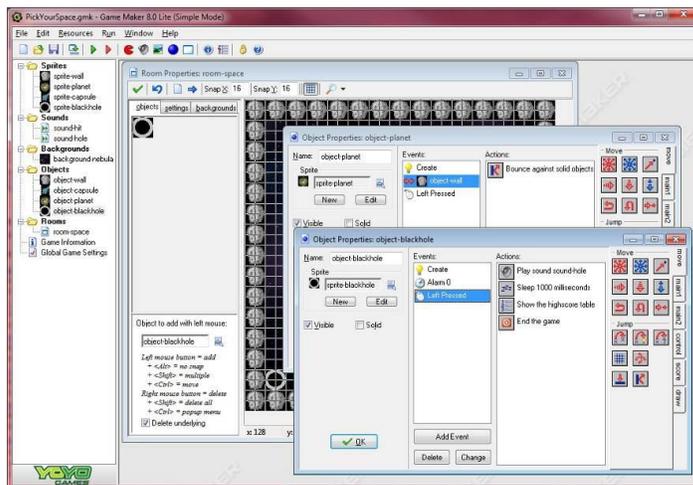


Figure 4: *Pick Your Space* in the Game Maker development tool

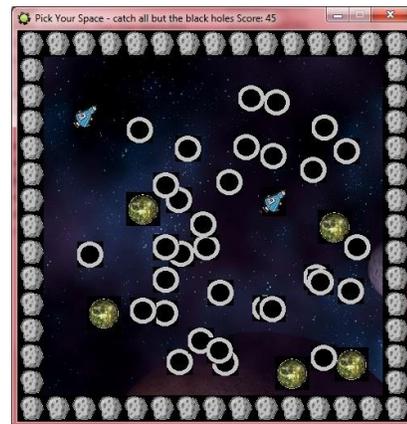


Figure 5: *Pick Your Space* Game

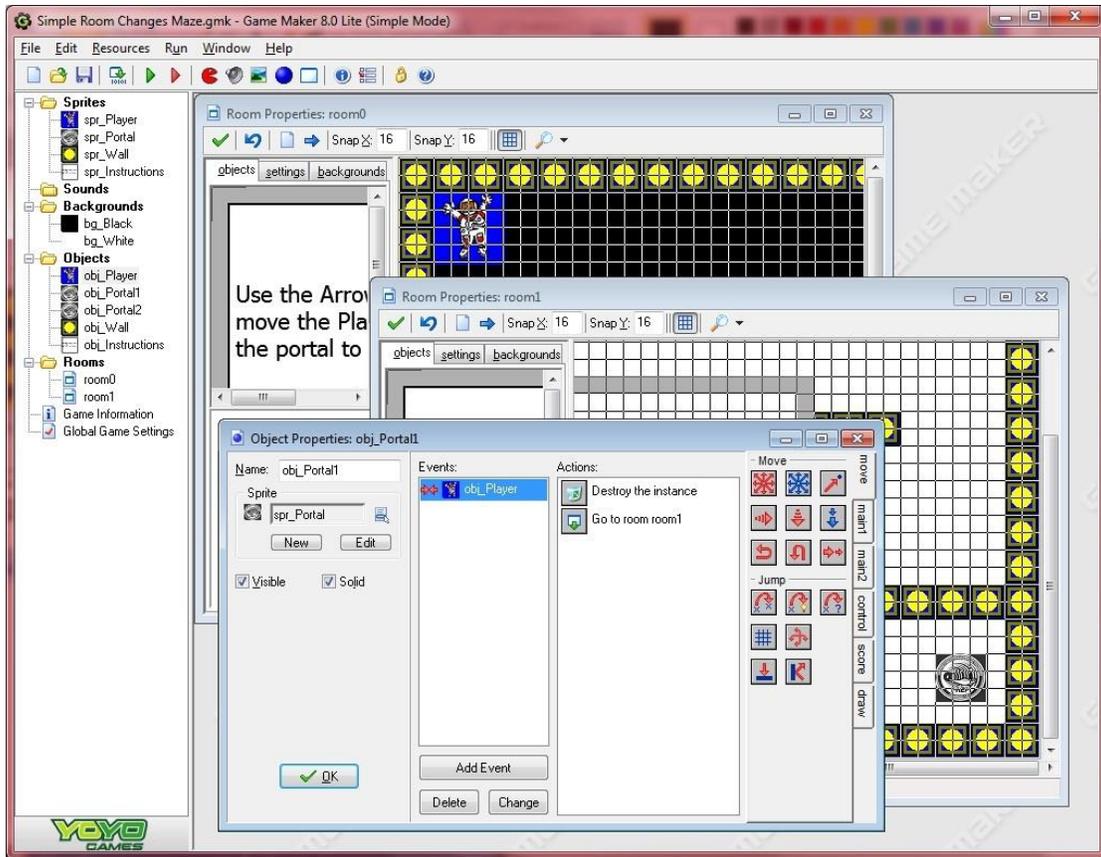


Figure 6: How to move between rooms in Game Maker

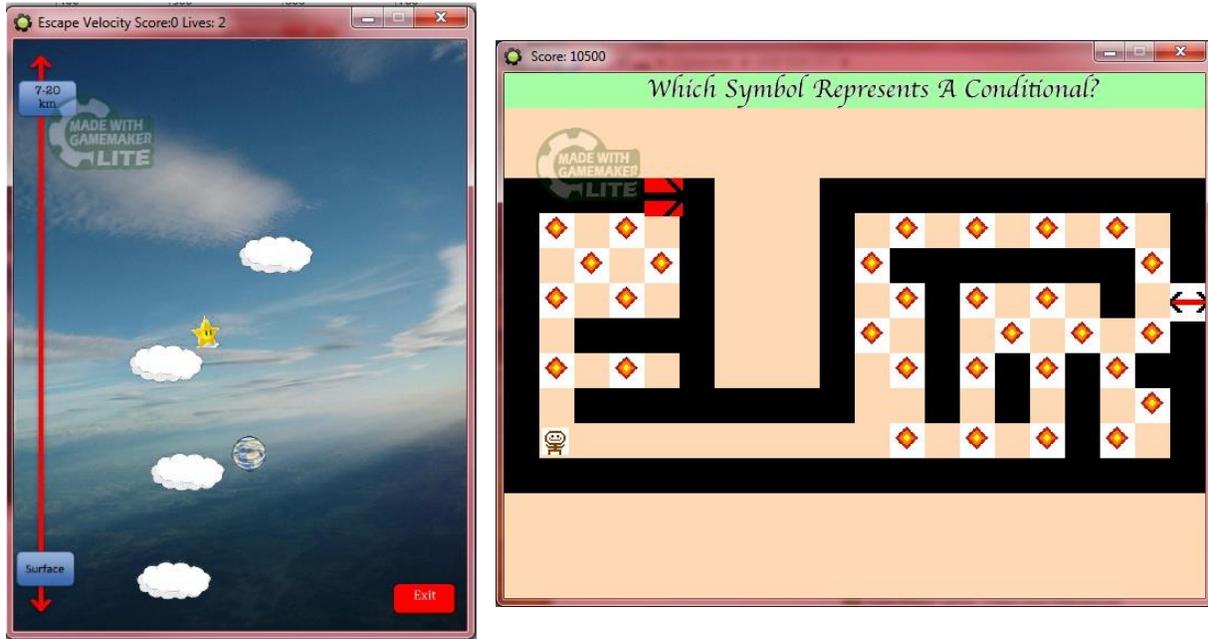
## Results – What They Did

Of the 41 students in the course, all 41 developed a working game. Only one student had major issues in terms of what was designed and then getting something to work. The student had created his own artwork by hand-drawing people, objects and scenes and scanning them in. He developed 38 rooms and 74 objects from his 9 backgrounds and 62 sprites/images. He had a law-related storyline set in a courtroom where the player could select evidence to present and question people in the room. The executable game only advanced to one scene with one piece of evidence and one line of questioning.

On the other hand, there were students who created games with 43 rooms (28 distinct scenes) and over 60 objects. Each student was required to have a minimum of 3 levels. Most students had 5 or more levels or rooms or scenes in their games. A fair number of students had over 50 objects in their games. The topics of the games ranged from catching food to collecting jewels, to navigating mazes with all sorts of obstacles. 8 of the 41 games involved the user of logic in some way to advance in the game (using logic was extra credit as we wanted games for the first year of PREP). 2 other games had or used science in the themes of the games. The games required that a player either select things with the mouse or move something with the arrow or other keys on the keyboard. A few students worked in pairs and were required to have more content in their games. Below are screens from two of the student-created games.

Beyond presenting the material and working with the students both as a group and individually, the instructor should help refine the scope of the student games to be both something that is substantial and interesting and yet be accomplishable within the time frame of the course. A few students need to be steered, cajoled, and pushed to develop at least the minimum requirement. The students were expected to have at least 3 levels or 3 different scenes with something different or interesting in the game play or within each room. On the note of the PAs, the authors must acknowledge their great work with the students and collaboration with the instructor and PREP site director. Daniel Quinones and Joshua Wolfe are a large reason the students were so successful. And of

course, we must acknowledge the PREP organization and structure without which no one would have made any games and probably would have had a much less productive, if not dull, summer.



**Figure 7:** A games about the biosphere and one about logic

Students should know how to email, what it means to save a file, and have a sense of what files and folders are. Students saved their work at the end of a session on the PC and to a memory stick. Some students would email their Game Maker source file (\*.gm81) to themselves. Everything is in that file for a student to continue to work on their computer game with Game Maker.

You can conduct this class if you have some high school students who are moderately interested (half of the students said at the start of PREP IV that they were there because a parent or guardian said that they had to be there!). For each student, you need to have a PC with Game Maker running to create and test games. You also need to have created your curriculum and at least a couple of simple games in Game Maker. The tutorials that come with the tool work well. You can learn more details of how Game Maker works along with the students.

## References

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