

How Engineers are Game Makers

Subject Area(s)	Problem Solving, Science and Technology
Associated Unit:	A Fraction of Engineering
Lesson Title	How Engineers are Game Makers
Header	Insert Image 1 here, centered

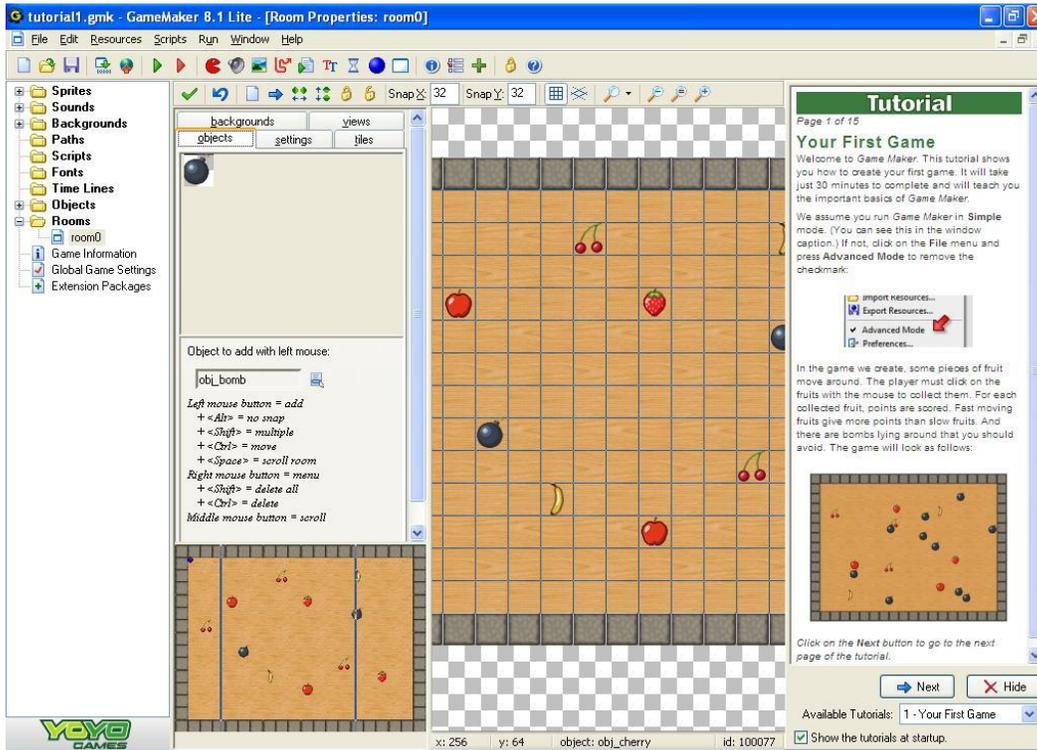


Image 1

ADA Description: This is a screen shot of GameMaker 8.1 Tutorial

Caption: None

Image file: gamemaker_title.jpg

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Grade Level	8 (6 - 8)
Lesson #	2 of 3
Lesson Dependency	None (leave blank)
Time Required	30 minutes for Discussion and Presentation 30 minutes for Scientific Error worksheet (assessment) 1.5 Hours for GameMaker Tutorial and worksheet

Summary

The goal of this lesson is to introduce students to the process of computer modeling as it applies to engineering. By relating different parts of computer programs to aspects of GameMaker 8.1,

students learn to create their own program while understanding the value of this process for engineers and scientists. In relation to the overall unit, the students will be introduced to the concept of error as a way engineers use fractions and score their model.

Engineering Connection

Engineers are constantly using models to understand and predict different phenomena that occur in our world. In order to understand and predict different scenarios, engineers play the part of a “game maker” by changing different inputs, boundaries, and interactions. When creating a game, it is important to work through a process that includes understanding the goal of the game, determining the properties and interactions of the aspects of the game, and the end game. Similarly, engineers use this process to test structures to different scenarios, to understand the human body by modeling blood flow and organ functions, and to predict the impact of hurricanes or extreme storm events on the waterways for a certain region. It is important for engineers to use computers to model in order to save time and money. The practicality and usefulness of computer models help engineers test and predict what might happen before it does happen. In all cases, engineers check (score) the model by calculating the error. This is an important step as models with low error provide strong justification for the conclusions made in that model.

Engineering Category = #1

Keywords

Computer, dam, gamemaker, high water mark, modeling, storm surge,

Educational Standards

ITEEA Educational Standard(s)

Standard 3, Grade Level 6-8, F. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.

Standard 12, Grade Level 6-8, H. Use information provided in manuals, protocols, or by experienced people to see and understand how things work.

Texas Essential Knowledge and Skills (TEKS)

Technology Applications

126.12. (c) (6) (A) determine and employ methods to evaluate the electronic information for accuracy and validity;

126.12 (c) (7) (D) demonstrate proficiency in the use of multimedia authoring programs by creating linear or non-linear projects incorporating text, audio, video, and graphics;

Math

111.23. (b) (13) (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;

111.23. (b) (14) (A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models; and (B) evaluate the effectiveness of different representations to communicate ideas.

111.24. (b) (14) (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;

Pre-Requisite Knowledge

None (leave blank)

Learning Objectives

After this lesson, students should be able to:

- List the process in creating a game and computer model
- Describe why engineers use models instead of experiments.
- Describe what engineers use models to do and give two examples
- Describe how engineers “score” their model.
- Calculate error and explain why we calculate error

Introduction / Motivation

Have you ever created a game? Why or why haven't you tried to create a game? What some of your favorite games are? What about those games make them so fun or interesting? Be very specific and focus in on answers to describe inputs, graphics, scoring, and how the game ends (these are all major steps that will be identified in being a “game maker”).

Engineers use the same process in order to predict and understand the world around us. Today, I am going to convince you that engineers and game makers have a lot in common and that the process that you will go through in creating a game is the same process engineers go through every day to test, examine, and analyze their designs and scenarios. It is a very important process.

But why do engineers use computer models? It is important to note that laboratory or model experiments can be time consumer and require a lot of material to repeat. In order to evaluate a multitude of scenarios (many runs), a computer model saves time and money.

(Discuss or present information in the Lesson Background & Concepts for Teacher section and perform assessment based on the worksheet. See lesson extension for information regarding GameMaker 8.1 tutorial)

Lesson Background & Concepts for Teachers

The steps in creating a game through the GameMaker 8.1 Tutorial are as follows:

1. You First Game

2. Adding Sprites
3. Creating Objects
4. Object Interactions
5. Creating A Room
6. Testing the Game
7. Adding Background, Sounds, and Music
8. Adding More Fruit
9. Adding the Bomb
10. Giving Help – Instructions for the Game

Each of these steps up through Step 6 is related to the process engineers use to create a computer model.

1. Your First Game

Game makers are encouraged to think about the purpose of their game before starting to create their game. What will be the goal and strategy? What are the players involved and how do they interact?

Similarly, the first step engineers take in creating a computer model constructing a plan and research all of the parts that are involved. It must be clear from the beginning what the goal of the model is and how to achieve this goal.

2. Adding Sprites

Adding Sprites is the first programming step in creating a game through GameMaker 8.1. All of the objects that will be defined need images that will be associated with them.

Instead of using sprites, engineers designate characteristics for the objects that will be in the game. Video 1 shows a model of the Hoover Dam break. A Dam is a barrier use to block and control above or below ground streams [1]. The “sprites” in this model would include the dam characteristics, the wall characteristics, and the water flow characteristics.

3. Creating Objects

In GameMaker 8.1, creating objects in the program is the same process as engineers inserting the sprites into their model with the correct position, distances, and proportions. The characteristics specified in the previous step on solidified into the model. Video 2 shows potential flooding in New York City. Have the students identify the sprites and show that how they were positioned represents created an object in Gamemaker 8.1.

4. Object Interaction

Object interaction is a key part in any game and model. Engineers must define how the interaction between two object (Video 1 with water and the dam) happens using the characteristics and now the movement. This can be the most complex part of a model just like in GameMaker 8.1, requires additional time and care to make sure it is correct.

5. Creating a Room

Once the objects are set, the boundaries are set for the level. In this case, the objects will bounce off of the walls defined by the boundary. Engineers use boundary conditions to define the study area and what happens when the model gets close to the boundary conditions.

6. Testing the Game

Testing a game or model is an important process in evaluating whether all the steps done before were done correctly. Engineers do this by evaluating how close their answer is to reality. Engineers use ratios (fractions) to examine the error associated with their computer model. Being able to calculate error is important to engineers because it allows them to evaluate the quality of the model they have created. The scientific error is the error between what a scientist measures in his experiment and what actually occurs. Scientific errors are found using a ratio between the difference of the actual value and the modeled (or predicted) value and the actual value (See Equation 1).

Figure 3 shows the results of the ADCIRC Hurricane Storm Surge model in the Houston Ship Channel, Texas. The results of the model were compared to actual high water marks recorded in the field. For example, at the station farthest to the northeast, the high water mark, or measured value, is 9.3 and the modeled (predicted) value is 10.6. Using Equation 1, the scientific error is 14%.

IMAGE Insert Figure 3 here, right justified

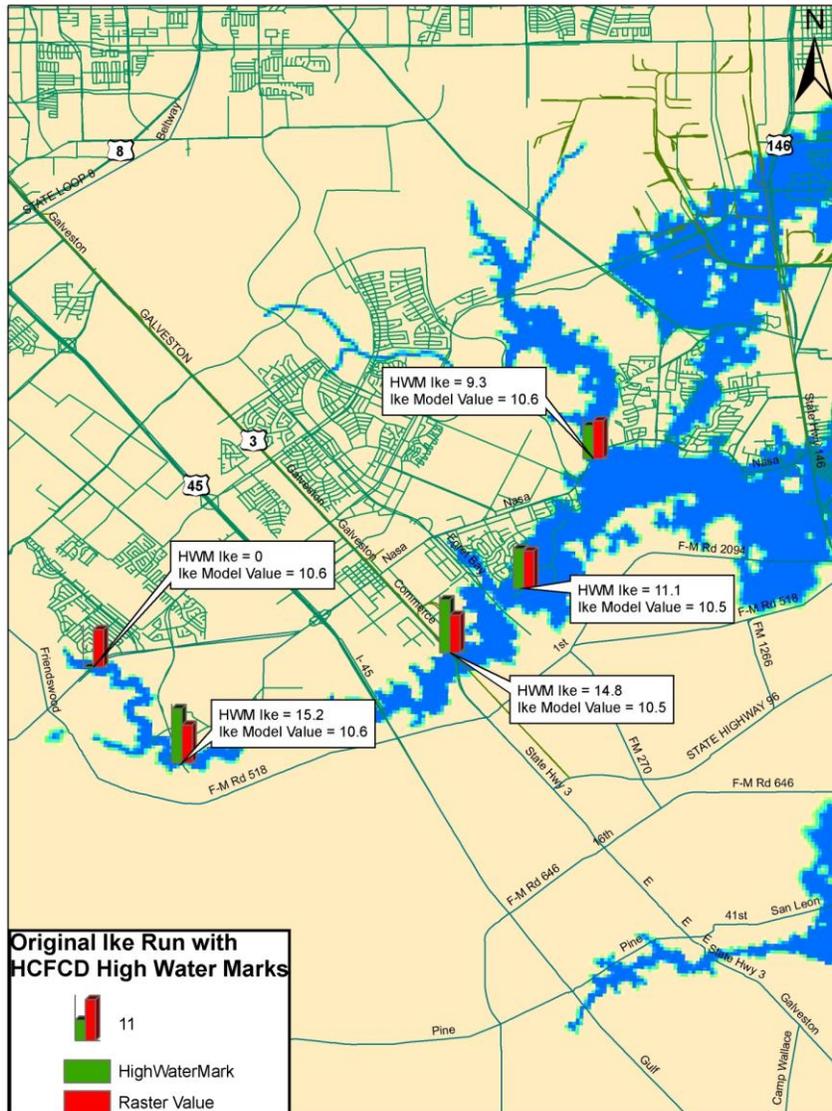


Figure #3

ADA Description: This is a comparison of the ADCIRC Hurricane Ike Model for the Houston Ship Channel at high water marks (HWM) collected in the field after the storm

Caption: Figure #3: Comparing model values with measured values. Note: HWM = High Water Marks

Image file: hurricane_model.jpg?

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Scientific error is an important ratio used to evaluate models. Have a low error allows engineers to support conclusions made from the model. The amount of acceptable depends on the situation and subject area but for the case of the hurricane model, the error is considered low.

Vocabulary / Definitions

Word	Definition
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Dam	Barrier use to block and control above or below ground streams
Scientific Error	The error between what a scientist measures in his experiment and what actually occurs. Scientific errors are found using a ratio between the difference of the actual value and the modeled (or predicted) value and the actual value
Computer Modeling	The use of computers to simulate an event
High Water Mark	The highest mark left on a structure or object from water rise
Storm Surge	The abnormal rise in sea level due to a severe storm system such as a hurricane

Associated Activities

None

Lesson Closure

Have students follow to the “Your First Game” tutorial (information in Additional Multimedia Support). As students work through the tutorial, remind them of the similar process engineers go through as discussed in the Lesson Background & Concepts for Teachers section.

Assessment

Give the students the attached worksheet and have them work on and complete in class or at home. There are two version of the worksheet. The first worksheet was created for the intent of the students re-creating it in Microsoft Word and filling in the blanks throughout. Filling in the blanks is the assessment of the objectives stated in this lesson while the students also learn new features about Microsoft Word. The second version was created for the teacher to print out and students to fill in with pen or pencil.

Lesson Extension Activities

Have students think of an idea for their own game. Have them work through the process as an engineer would then create it using GameMaker 8.1. Additional tutorials or features may be required depending on the level of difficult of the game design.

Additional Multimedia Support

Video 1: Hoover Dam Break Model http://www.youtube.com/watch?v=65D_E5SQqbo
 Video 2: Flooding over New York City <http://www.youtube.com/watch?v=LGAe2RqEHbk>
 GameMaker 8.1 Lite. Free to download at <http://www.yoyogames.com/gamemaker/windows>.
 GameMaker 8.1 Tutorials. Free to download at <http://sandbox.yoyogames.com/make/tutorials>.

References

[1] “Dam” Accessed May 3, 2012. <http://en.wikipedia.org/wiki/Dam>.

[2] Applied Science Associates. Accessed May 3, 2012.

<http://www.asascience.com/services/coastal hazards/>

[3] "Tutorial: Your First Game" Accessed May 3, 2012

<http://sandbox.yoyogames.com/make/tutorials>. Copyright YoYo Games 2007-2012.

Attachments

Worksheet - worksheet_error_for_word.doc
worksheet_error_for_word.pdf
worksheet_error_by_hand.doc
worksheet_error_by_hand.pdf

Other

Redirect URL

Contributors

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Supporting Program

University of Houston, National Science Foundation GK-12 Grant No. 0840889 and Research Experience for Teachers (RET) Programs