Teacher's Guide

Course overview

There are a few common threads that we hope to carry through this entire course. It is the "spirit" in which we hope this course can be taught. If nothing else, we want to inspire students to learn a little more about STEM. For lack of a better phrase STEM can and should be fun, it should be cool! STEM Fuse was founded for the single purpose of inspiring more K-12 students to consider taking additional STEM education and pursuing a STEM career.

In order to produce a STEM / 21st Century skilled workforce we need to reach more students at lower grade levels. It starts at the beginning!

So as a teacher or facilitator please keep these concepts in mind as you lead your class. This is why we created GAME:IT Elementary.

- Games are a great way to teach
- Games are an even better way to teach STEM skills and concepts
- Today's cool things (TV, i-phones, computer games, Xbox) are products of STEM
- STEM is also going to create the cool things of tomorrow (Google glasses, self-driving cars, a trip to Mars)
- STEM solves problems: cures diseases, grows better crops, conserves energy, cleans our water and the environment and so much more
- STEM is where the jobs are now and will be in the future, everyone will need at least some STEM skills in the 21st Century

More on Games & STEM

Games have been an educational tool since the dawn of humankind. There is evidence of cultures using games for entertainment and educational purposes as well as a model to test strategies almost 20,000 years ago. Games hold attention, games demand interaction and games teach!

Let's fast forward to the 21st Century. MIT, Stanford, Georgia Tech, Harvard, UCLA, USC and many, many other institutions of high learning are championing the benefits of teaching with games. If you think about it, the games we play – Angry Birds, Friends With Words, Super Mario – are simply a terrific example of science, technology, engineering and math.

A note about "Scratch"

Scratch is a simple programming language and game design platform that was developed by MIT. It was created for much the same reason STEM Fuse was started – to get young students interested in STEM (computer science specifically). It features a drag and drop interface that makes it easy to use. You DO NOT need any programming or computer science experience!

We have designed this course to be self-contained – everything you and your students need is included. However, Scratch does offer many fine resources, teaching tools and opportunities for teachers and students to engage with each other from all over the world. As you start to become familiar with Scratch we encourage you to check out these additional features.

This course will first go over some basics of how to operate Scratch and how to create scripts. We will then go through how to make a story of a day on a farm. Then, we will create a simple race car game.

Starting GAME:IT Elementary

The **first** step in implementing GAME:IT Elementary is to download Scratch

- See our Scratch Download Instructions PowerPoint for easy, step by step instructions

The **second** step is to review our STEM Education PowerPoint with your class

- Defining STEM
- Learning about why STEM is important
- Learning to use STEM to solve problems
- Learning to use STEM to build games

Now… let's build some games!

Unit 1: The Scratch Introduction and Scratch Basics PowerPoints

Start with the **Scratch Introduction PowerPoint.** This provides an overview of the Scratch Interface with screenshots of each section.

Next, move onto the **Scratch Basics Powerpoint**. This is a hands-on exercise, so have the students jump onto a computer and follow along! As you work through this exercise, we introduce the functions

of Scratch which leads to animating sprites and eventually creating stories and games. It is these basic tools within Scratch that we will later use to program our Farm & Race games.

Hint: as you start getting familiar with Scratch your blocks may disappear (time-out function). That's fine…just save what you have done, restart and build from there.

Unit 2: The Farm Game

Open your Unit 2 Folder of files and you will see:

- **Resources** - (sprites, sounds and graphics used to build The Farm)

- **Teacher Solution** – This is the completed Farm game based on the lessons provided. You may wish to show the students this before they start working so they can see the final project in action. Or you can use this to compare their project against how it's supposed to work.

  This also acts as an answer key, as all the coding is right there in this game. This provides an easy way to pinpoint where a student may be struggling.

- **The Farm Game PowerPoints** (1-5) – These PowerPoints must be completed in order. These are hands-on lessons teaching the students the steps to build the Farm game. You can project these and lead the students through the steps to build the Farm game or print or provide digitally for the students to follow on their own.

- **Vocabulary Sheet** – terms and definitions that are important to this unit, excellent worksheet or in class discussion

Starting in this unit, when actions need to be performed a **black arrow** will appear on the slide next to that action.

One of the reasons we chose Scratch to build this course around is that it is very user friendly and allows for creativity. You can certainly choose to have students obtain pictures for sprites off the internet as substitutes for what we have provided. In fact, this might be a terrific project and a great way to personalize their farm.

*If you choose to allow your students to do this please note **some pictures off the internet may contain white backgrounds that can be eliminated by using the fill tool and filling the white with the checkered transparency color. Also, these images may require adjusting the coordinates where other sprites are located to make sure they aren't touching before they need to be.**

**After a block has been used a few times a screenshot is not always provided to show where the block is located in the menu and how the block is specifically located in a script. Finished scripts will have screenshots provided.

Unit 3: The Race Car Game

Open your Unit 3 Folder of files and you will see:

- **Resources** - (sprites, sounds and graphics used to build The Race Car)

- **Teacher Solutions** – This is the completed Race game based on the lessons provided. You may wish to show the students this before they start working so they can see the final project in action. Or you can use this to compare their project against how it's supposed to work.

  This also acts as an answer key, as all the coding is right there in this game. This provides an easy way to pinpoint where a student may be struggling.

- **The Race Game PowerPoints** (1-4) – These PowerPoints must be completed in order. **Please note:** The 4th PowerPoint contains "extras" for the racing game. These are not essential to make the game function properly but add another element to the game. This is great for students ahead of the class or if you have additional time to spend on this course.

  These are hands-on lessons teaching the students the steps to build the Farm game. You can project these and lead the students through the steps to build the Farm game or print or provide digitally for the students to follow on their own.

- **Vocabulary Sheet** – terms and definitions that are important to this unit, excellent worksheet or in class discussion

Unit 4: Final Project

It is now time for the students to build their own Scratch game! Using the skills learned from the previous two lessons, we want the students to use their imagination to create a unique game. Students will need to "design" a game from scratch using the skills covered earlier in the course and be sure to implement components of a game like:

- Characters
- Rules
- Score or a determined outcome measuring "success"

Additional projects, ideas and resources

These projects can be added anywhere during the course. You can assign these as homework projects or use as class discussions.

1. **Have students interview an adult (parent / grandma or grandpa / adult friend / other teacher) about STEM**
   - o Do they use STEM in their jobs?
   - o Do they think STEM skills will important to know in the future?
   - o What will STEM workers invent in the next 5-10 years?

2. **Have students explain what math & physics concepts are used in video / computer games?**
   - o Gravity
   - o Speed
   - o Acceleration
   - o Collisions / force
   - o Angles & geometry

3. **Have students think about the skills they use in Scratch and what other jobs they might be able to do with those skills.**
   - o Program other things
   - o Graphic design
   - o Audio editing
   - o Project manager / team leader

4. **Search "STEM education" / "STEM careers" / "STEM games" on You Tube and watch some of the related videos in class – some are excellent for young audiences.**

5. **Play video / computer games in class and have the students critique them.**
   - o Did the game have rules?
   - o Did the game make sense?
   - o What problems or obstacles where there?
   - o What STEM skills were used in making the game?
   - o Did the game have 'real life" features – Did gravity have an effect on the game characters or sprites? Did collisions cause damage? Was speed or acceleration used?
   - o Could you make it better? How?