Samsung emPower Tomorrow Training Guide

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Overview

The Samsung emPower Tomorrow curriculum focuses on programming and engineering for 4th and 5th grade girls. As you implement this program, there are a few big ideas we want your students to know.

1. Computers only do what they are programmed to do.
2. Anyone can learn to code and have fun doing it.
3. Female scientists have had and continue to have important contributions to scientific and technological advancements.

The Samsung emPower Tomorrow curriculum is divided into two parts. In the first part, students will spend lots of time on a computer, using fun software called Scratch. Scratch is a computer coding software, that students can use to program games and animations.
https://scratch.mit.edu/

Students will also play a coding game called Code Combat. Code combat is an online game that teaches students how to write code in real programming

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languages. There are over 100 game levels approximating 25 hours of free content. http://codecombat.com/

In the second part of the program, students will work with electronics to create a light-up patch they can attach to a book sock, a backpack, or anything else. The light-up patch, known as an E-Textile, is a culminating project after students learn the basics about series and parallel circuits.

Each module in the curriculum is designed to be about 2 hours long and is broken up by teacher-led instruction, hands-on learning and explore time. Download the Curriculum Modules Document, which will be your teacher's' guide. The students will have their own copy of a student workbook to record answers to discussion questions and reflect on their progress throughout the program. This workbook provides students with illustrations and screenshots of the activities so that they can work independently in the explore time.

The Samsung emPower Tomorrow website provides tools to help you implement the emPOWER Tomorrow curriculum in your school. These include awareness flyers, social media outreach information and certificates of participation.

Module 1

Teacher Led

In this first module, spend some time getting to know the students and explaining what they will be learning over the next few weeks. Introductions will be important to begin to create a cohesive group. It will also be important to create ground rules or norms with your group to develop a safe environment in which students feel supported and are enabled to collaborate, learn new things, and most importantly make mistakes.

There is a suggested ice breaker activity (Name Sort) that gets the students immediately collaborating and working out a problem in teams. They are tasked with writing their names, one letter per index card, in groups of 4. Then they will shuffle up the cards and begin to reconstruct each person's name from the stack of cards. This is a fun activity, and directly connects back to one of the things computers do best - sorting data. After students have completed the activity, make sure you connect the sorting activity back to the goals.

Hands On
During the Group Collaboration time, you will present the students with a fun challenge! They will get back into their groups of 4 from the beginning activity, and designate one person in their group as the robot. The remaining 3 "programmers" will have to write directions to get the robot to successfully reach a designated spot in the room. As the programmers are planning, you will want to chat with the "robots" to make sure they take the directions very literally. When groups come back together and attempt to guide their robots, they will learn a very valuable first lesson in programming - that computers only do what they are told to do!

Explore
At the end of the session, you will introduce your students to the programming game, Code Combat. You will have to spend some time getting them acquainted with accessing the game, and then will have some time for them to play in pairs.

Also, an important goal for the students is to understand the prominent role women have had in computer science. You will discuss female contributions to the sciences throughout the program, and in this first module, you will start with Grace Hopper, the developer of the very first computer language, COBOL. You don't need to go into great technical detail in your discussion, rather, you will want to focus on the fact that she was instrumental in developing foundational elements of the technologies we use today. You will also watch a video, "Girls in a Tech World: Endless Possibilities of Computer Science" and reflect on the video when finished.

Teacher Led
You will end the day with a brief reflection on what surprised the students most about the session. Reflection is one of they key elements to determining the level of your students understanding.

Reminders, Best Practices, Tips, etc.
- This is a good time to remind you to schedule your Samsung female scientist visit at some point in the coming weeks.
- You will most likely connect with a Samsung scientist or engineer virtually. You may use Skype if you have the application installed on a computer. If Skype is not an option you may use Google Hangouts on one of the student Chromebooks.
- Media links for this module:
  - https://www.youtube.com/watch?v=DYBPotROKC8

Module 2

Curriculum Modules document pages 12-18

Teacher-led Instruction

In Module 2, *Hello World*, students will build their first computer program. Play the following video to introduce Scratch to the students(http://vimeo.com/65583694). After watching the video divide students into pairs, distribute Samsung Chromebooks, and lead students through the process of creating their own account in Scratch(http://scratch.mit.edu).

Once the students have created accounts, you will take them on a tour of the Scratch commands at the top of the page. Have one student point out the commands while the other student navigates. You will briefly explain each of the commands to give students an overview of the program. You will find a description of these commands in the Curriculum Modules document.

Once you have completed the tour, you will lead the students through creating a "Hello World" program. Students have the directions for this activity in their workbooks, and can follow along with you. In this activity, students will create their first "sprite" or character. They will choose what it looks like, and program it to say, "Hello Scratch Cat."

Once all students have had a chance to create their sprites, celebrate their first programming success by showing off their work to the whole group. While the sprites will all look and say more or less the same thing, each student will be excited to see their first project in front of the class!

Student Sharing

Provide time for student to share their "Hello World" project. Use the URL example below as a model to share the student's work.
http://scratch.mit.edu/users/studentusername/

Explore

Students can use their explore time to explore the projects in the "Featured Project" section of Scratch OR students may use this time to play Code Combat.

Reminders, Best Practices, Tips, etc.

- Scratch is a free program created by the Lifelong Kindergarten Group at the MIT Media Lab
- Students will be creating accounts on this site, so that they can save and show off their work.
- Media links for this module:
  - Http://vimeo.com/65583694

- Students will need an email address in order to register for an account.
- You may choose to register the student yourself. If so, you can use the same email address for all of the accounts.
- You will want to decide what email address you will use prior to meeting with the students.
- Another consideration to remember ahead of time is that students will be working on the Chromebooks in pairs.
- Depending on your group, you may want to spend a few quick minutes reminding them about the collaboration and sharing etiquette you expect to see.

Module 3

Curriculum Modules Document, pages 19-23

Teacher-led

Module 3, *Cats Can Dance*, will start with a mini-dance party to engage the students and get them thinking about dances for their sprites using Scratch! As students come into the room, have some dance music playing and encourage them to join the dance party. After a few minutes, explain that their goal for today will be to teach their sprite how to dance.

Start by showing students how to create backdrops and choose new characters for their dance floors in the Setting the Stage segment. Read the detailed steps aloud as students follow along with their student guides and complete the tasks. This segment will take approximately 20 minutes to complete. Make sure that all students have tried choosing new backgrounds and characters, before moving on to the next segment, *Teaching the Character to Dance*. For the next segment, you will read aloud the step-by-step instructions as students follow along and create. After all students have had a chance to interact with the Motion, Control and Events features of Scratch! in this segment, make sure you spend some time reviewing what they have learned prior to continuing on to the next portion of the day. Some specific questions are listed in the Curriculum Modules document to help guide your reflection discussion.

Detailed directions are written out for you in your Curriculum Modules document so that you can easily walk students through these processes step-by-step.

Hands-on

During their hands-on time, students will get to choose their dance party teams and begin collaborating on the *Choreography of the Dance* task. Groups should be 2–3 people in size. Students will start this work in a graphic organizer describing the dance

moves they want to use for the party, before doing any programming in Scratch. They should not be thinking about coding at this point, just brainstorming actual moves (i.e. move 3 steps forward, turn to the right, etc.). They will begin to learn about coding these moves in subsequent sessions. They will have approximately 30 minutes for this segment.

Explore
Students may use this time to play Code Combat, or continue to learn more about Scratch. This segment may also be used for the Samsung scientist visit.

Teacher-led
Bring students back together briefly to wrap up the day. Point out to them that they have just completed their first program that completes a full task! Ask them to reflect on the skills they have learned. End the day by having them write a question they might want to ask a Samsung scientist about their career in coding. Have them write the questions down so you can collect them.

Reminders, Best Practices, Tips, etc.
- Consider requiring the students to choreograph simple dance moves on paper first.
- Watch this short video of a student creating a variation of the dance party with two sprites. https://www.youtube.com/watch?v=4coOaY-Fxvc

Module 4

Curriculum Modules Document, pages 24-26

Teacher-led
In Module 4, Dance Party Setup, welcome students to the module and do a brief review of their last session. Then have students move into their collaborative groups and begin working on "Building the Dance." Remind them not to spend too much time on the physical characteristics of their sprite or background, since that can be changed later. This task will involve students translating their dance moves into code using Scratch, and so be prepared to step in and guide groups, as needed. Remind students to share their program so that they can show it to their classmates.

Hands-on
Students will go to http://Scratch.mit.edu/ to work on creating a new sprite and coding the dance moves they planned out in the previous session and refined during the collaboration time.

Teacher-led
Next you will teach students how to loop their dances so that the movements repeat themselves. You will have detailed instructions for looping in the Curriculum Modules document. This segment of the session will take approximately 20 minutes, and students will then have additional time to practice coding the new dance moves during the additional hands-on time provided.

Hands-on
Students will have 35 minutes to continue to develop their dance moves in Scratch adding in the newly learned content from the teacher-led time. As students work, make sure you encourage students to plan first! You will also want to make sure that dance move scripts are all in the same script tab window, and make sure students are testing their dance moves in the 'forever' loop.

Explore
Students may use this time to play Code Combat, or to continue developing their dance parties.

Teacher-led
As you close out the day, have students reflect on Code Combat, asking them what career skills were needed to make that game look and sound good. Continue the discussion by asking what careers students have learned about that they might be interested in exploring more.

Reminders, Best Practices, Tips, etc.
- Encourage students to choose a sprite and quickly move to creating the dance moves.
- Sprites and the background can be changed in the explore time.
- Remind students to share their project so others can view their dance.

Module 5
Curriculum Modules Document pages 27-30

Teacher-led
Module 5, *Making Decisions*, has students learning how to make their dance party environment interactive through the use of keyboard commands and "if-then" statements. Start by welcoming students and telling them their goal for the day is to create a keyboard-controlled dancing character. Tell them they will be learning how to animate their sprites. You may choose to navigate to https://scratch.mit.edu/projects/21104409/ as a visual for students to fully understand these concepts.

Anticipate providing more direct instruction on this day, as students begin to navigate and understand this more complex operation. Step-by-step directions are provided for you in the Curriculum Modules Document, and students will also have step-by-step assistance on their Student Guide handout that goes with this module.

Hands-on
Students will have approximately 20 minutes to explore keyboard commands on their own, and reflect on what they have learned. As they are working, encourage them to think about what keys work best for the dance moves.

Teacher-led
In this segment, introduce students to the important career of User-Experience designer. Have students consider the questions you asked in the previous Hands-On segment where they were considering the keys that worked best. Make the connection to the career and the people who focus on the computer interface so that people can have the best experience or UX. (UX is the abbreviation for user experience).

Explore
Students may use this time to play Code Combat, or to continue developing their dance parties.

Reminders, Best Practices, Tips, Etc.
- You may consider separating the steps and having students make 3 different copies; one copy for sound, one for movement, and one for backgrounds.
- Media links for this module:
  - https://scratch.mit.edu/projects/21104409/

Module 6

Curriculum Modules Document pages 31-35

Teacher-led
In module 6, *Making it all Look Good*, students continue to work collaboratively to fine tune their dance parties. Start the day by reminding students that not only do their dance programs need to work well, but they also need to be visually interesting so people will want to interact with them. Start by showing them an example of a current dance program without music (use an example volunteered by one of the groups or show them the previous week's example at https://scratch.mit.edu/projects/21104409/). Ask students to identify what elements could be added to make the dance party even more interesting and exciting. After a brief discussion, tell the students they will be learning to add music, animate the background, and change costumes. You will be

starting the session learning to add music. Remind students that many computer careers do include designers, graphic artists and even music producers.

As in module 5, you will have more direct instruction with students as you help them navigate the increased complexity of their tasks. Step-by-step directions are provided for you in the Curriculum Modules Document, and students will also have step-by-step assistance on their Student Guide handout that goes with this module.

Explore
Students will have this block of time to continue to work on their Dance Parties in their collaborative groups, or they may choose to play Code Combat. Remember to weave in reflection time with students as you are working to help students make important connections to Scratch/coding and their everyday lives.

Teacher-led
Before students leave for the day, make sure you guide a brief reflection on what they have learned. Include some discussion on what students would make next using Scratch, and/or what types of projects they could create with the new skills they have learned.

Reminders, Best Practices, Tips, etc.
- Remind students to make their dance visually interesting as they create.
- Students will have only one more day of class instruction on Scratch.
- Media links for this module:
  - https://scratch.mit.edu/projects/21104409/

Module 7

Curriculum Modules Document pages 36-39

Teacher-led
Finally, in module 7, *Putting It All Together*, students will have the opportunity to add those finishing touches and interact with each other's dance parties. Students will continue enhancing their dance parties by trying more complicated moves, music, or backgrounds or including new or different costumes. A completed example can be viewed at https://scratch.mit.edu/projects/21104409/. You may share this sample with students to have them assess what they might add or enhance before they begin to look at their own work.

Reminders, Best Practices, Tips, etc.

- Media links for this module:
  - https://scratch.mit.edu/projects/21104409/
- Students can revisit Scratch if they have completed any of the modules in Part Two.
- Encourage students to share their project so they can be viewed whole class.
- Teachers may have to help students copy and paste the URL of their shared project.

PART ONE NOTES:

Part Two

Overview

In part two of the Samsung emPower Tomorrow curriculum we will focus on electrical engineering. Students will learn the basics of series and parallel circuits, conductors and resistance. The hands-on part of these modules will focus on the Lilypad circuit board. Students will explore the basic uses of these devices and identify their parts.

Module 8

Curriculum Modules document pages 47-53
Teacher-led Instruction

In Module 8, *The Flow of Electricity*, you will start with a conversation about the advancements in computers and electronics. You may use the example of the Samsung Galaxy S5 phone that is small enough to fit in the average pocket. If you use this example you can also share that this device is hundreds of times smaller than the computer that took us to the moon more that 50 years ago. We suggest that you show the video, "Aspire To Inspire: Women in Engineering" (https://www.youtube.com/watch?v=QhunCy-8L9Q). You will find discussion questions in the curriculum modules document that will help transition to the module activities.

In the next teacher-led section you will introduce the LilyPad circuit kit. The curriculum modules document has a detailed discussion guide to walk you through the introductions to the LilyPad kit and the concept of conductivity.

Explore

During the explore time the students will have their first hands-on experience with the LilyPad circuit board. Students can insert the battery and use the switch and button to turn on and off the LEDs. After the students have explored the LilyPad circuits distribute the Samsung Chromebooks and direct the students to (http://www.learningcircuits.co.uk/flashmain.htm) This Interactive website will prompt students to create an avatar and a favorite color as they "customize" the environment. Students will have six sections or components to complete as they learn more about electricity, circuits, switches, insulators and conductors. We have found that it should take most students 15-20 minutes to complete all the components on the website. There is an optional worksheet that you can decide if you want the students to record their findings. The worksheet will require students to record the new information as they work through the components.

Reminders, Best Practices, Tips, etc.

- You will want to decide if the students will break apart the LilyPad components during this module or wait until the beginning of Module 9.
- Other teachers have suggested that the students have, if possible, their own workspace while completing these modules. They found that the very small pieces of the LilyPad kit were easy to mix up with other kits when students were sitting close together.
- The Learning Circuits website (below) is a United Kingdom website. Therefore students will see different spellings and use of words for common items.
- Media links for this module:
  - https://www.youtube.com/watch?v=QhunCy-8L9Q
  - http://www.learningcircuits.co.uk/flashmain.htm

Module 9

Curriculum Modules document pages 54-63

Teacher-led Instruction

In Module 9, *Our First Circuit*, you will begin with a short discussion and reflection on electricity and the information presented in the last module.

In this module you will demonstrate to the students how to build a simple circuit. Prior to the start of this module you will want to tie the conductive thread to the components (battery - positive and negative side, LED - positive and negative side). The curriculum modules document will guide you through the demonstration process in detail.

Explore

(Note: If the students did not break apart the components on the LilyPad circuit during the last session have them do this now). Now, based on your demonstration, the students will begin to tie the conductive thread to the components. After tying the conductive thread the students will construct their own circuit by allowing the threads to touch.

Reminders, Best Practices, Tips, etc.

- Try to work through the kit steps presented today prior to delivering the instruction to students.
- Leave plenty of time for students to tie the knots on the components.
- When tying the conductive thread on the components loop the thread through the hole on the board and tie a tight knot.
- If the conductive thread becomes frayed it is possible that the LED will be dim or will not light.

- If the LED does not light up check to make sure the battery is in correctly.
- If the LED does not light up make sure the positive side of the LED is connected to the positive side of the battery AND the negative side of the LED is connected to the negative side of the battery.
- Media links for this module:
  - http://www.sparkfun.com/tutorials/307

Module 10

Curriculum Modules document pages 64-70

Teacher-led Instruction

As you begin Module 10, *A Question of Brightness*, have students reflect on the activity from the last module. Some students may have had difficulty with tying the conductive thread tight or with their circuit not lighting properly on the first try. As students reflect on the process they should have a greater understanding on the importance of a good connection in order to prevent an open circuit.

This module will also introduce the students to Ohms Law by experimenting with different lengths of conductive thread. As you demonstrate the use of longer conductive thread in the circuit have students predict how this will effect the brightness of the LED. Students can use the equation (Voltage = Current X Resistance) to make rough calculations for Ohms Law.

Hands-on

Students will now work in teams and will take out a battery holder, conductive thread, and one LED for this activity. Students will now build a circuit as demonstrated. In this activity students will experiment with different lengths of conductive thread to eventually shut off the LED completely and then to light the LED approximately half as bright as previous experiments.

Teacher-Led Discussion

As you transition into the explore time guide the students into a reflection on the process. Discussion questions are found on page 70.

Explore

Students may choose to end the day with more hands-on time with the LilyPad kit OR playing Code Combat.

Reminders, Best Practices, Tips, etc.

- Try to work through the kit steps presented today prior to delivering the instruction to students.
- Leave plenty of time for students to tie the knots.

- The voltage in the battery is 3V (volts) and the resistance (R) is determined by the length of the conductive thread.
- Students should now be able to predict the amount of power, indicated by brightness, that is going to the LEDs.
- Unwind the conductive thread from the spool for the experiment. This will save thread and make it more manageable.
- Have students work with plenty of room to create longer circuits with the conductive thread (floor or tables).

Module 11

Curriculum Modules document pages 71-80

Teacher-led Instruction

As you start Module 11, *Multiple LEDs*, have students reflect on the results of the last module's activities. You want them to make the connection to the length of the conductive thread and the brightness of the LED as it relates to resistance (Ohms Law).

Hands-on

There are two activities for this module. First the students will be guided to create a series circuit by adding another LED to their circuit and make observations. Then students will add another battery (from another LilyPad kit) to the series circuit as illustrated and make further observations.

You will then guide students to form groups of four. With the additional resources in the LilyPad kit the students can now complete the additional activities and make further observations.

Teacher-led Instruction

In this second part of the module you will demonstrate to students how to create a parallel circuit. Construct the parallel circuit as illustrated in the Curriculum Module document and prompt the students to make observations and predict what will happen as you add more LEDs to the circuit.

Explore

Students may continue to explore with LilyPad kits and circuits or play Code Combat as time allows.

Reminders, Best Practices, Tips, etc.

- Try to work through the kit steps presented today prior to delivering the instruction to students.
- Remember that it may take longer than planned for students to tie knots as they attach the conductive thread.
- The LEDs in the first activity should not light because of the additional resistance of the conductive thread. Each LED requires 1.5 volts of power and the battery puts out 3 volts.

- Remind students to take out the battery to prevent a power drain as components and conductive thread may accidentally touch.

Module 12

Curriculum Modules document pages 81-85

Teacher-led Instruction

In Module 12, *Making Our Patch*, explain that today students will begin to put everything together that they have learned. Begin by passing out the Samsung Chromebooks and have the students follow along as you show them the website (https://sparkfun.com/tutorials/363).

Hands-on

Students will be guided through the process of sewing the battery holder, button switch, and LEDs to the fabric. After sewing each side of the circuit student should insert the battery and test the circuit.

Reminders, Best Practices, Tips, etc.

- Try to work through the kit steps presented today prior to delivering the instruction to students.
- Sew each side of the circuit separately making sure the positive side and negative sides do not touch.
- Students should be reminded to pull ***gently*** on the conductive thread to avoid breaking the thread.
- If the thread breaks help the student tie new thread and continue sewing.
- Encourage students to bring something to attach to the E-textile during the next module.

Module 13

Curriculum Modules document pages 86-90

Teacher-led Instruction

Module 13, *Sew In The Stitch*, should start with students reflecting on the experiences from the prior module. Find out if they have difficulties with sewing or breaking the conductive thread. Ask if the LEDs light up indicating a complete circuit. Your role today is more of a facilitator as the students begin to finish their E-textile project.

Hands-on

The students will continue sewing the second half of the E-textile, the slide switch, and the remaining LEDs. After sewing, students will insert the battery and test both sides of the circuit.

Teacher-led Instruction
As students complete their E-textile project you will want to guide them into making final adjustments to their Scratch program and and adjustments to their E-textile such as trimming up excess conductive thread. When adjustments to the Scratch program and E-textile are complete direct students to pages 65-66 of the Student Workbook to complete the reflection questions.

PART TWO NOTES: