STEAM Challenge
Digital Storytelling Unit

More Bang for Your Byte!

Designed for Middle and High School Students

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Range of Activities

- Primary and Secondary Source Research of a Computer Science Breakthrough
- Programming of a Computer Graphics Animation
- Production of a Documentary to Educate and Engage
- Digital Literacy Skills - Video - Pre-production, Production and Post-production

CC ELA - W3, W4, SL1, SL5, RH9	• Human Skills: Creativity, Collaboration, Critical Thinking, Presentational Skills

Introduction

This Digital Story Telling Challenge will take two to four weeks to complete. This Challenge targets key Human Life Skills – creativity, collaboration, critical thinking, digital literacy, and presentational skills – in equal measure with the curricular content. Delivering on all those learning goals requires student immersion and time. The results, as based on our research, are a high level of student engagement, deep learning, and 100% teacher endorsement.

The following Challenge:

- Should be completed by collaborative teams of two to four students but can be completed independently, if desired.
- Is aligned to nationally recognized Curricular Standards.
- Contains an Evaluation Rubric that allows the teacher to clearly score and appraise the students' work.
- Is designed to be integrated into the classroom in alignment with existing curricula.
- Can be assigned as an extra credit project to teams of students that you think would benefit from this kind of immersive, deep learning experience. Additionally, will work well in informal educational settings.
- Should follow the rules of Digital Citizenry in their proper usage and/or citation of images, music and text taken from other sources. See the Digital Rules area in the free Media Resources section of the Meridian Stories site for guidance.

The **Media Resources** section also contains many other **free support materials** from short videos featuring professionals in the field – Artists and Innovators– to short written documents that cover everything from storyboarding to creative brainstorming, interviewing techniques to game design.

While it is helpful to have a Technology Integrator involved, they are not usually necessary: the students already know how to produce the media. ***The teacher's***

primary function in these Challenges is to guide the students as they engage with the content. You don't need to know editing, sound design, shooting or storyboarding: you just need to know your content area.

At the end of the Challenge, it is often fun and useful to have a screening of all the media productions – they are all designed to run under 4 minutes each. Students can vote for their favorite videos that can then be screened in a larger assembly-like setting for the whole grade to see. Or this work can be presented as part of a student showcase for parents and friends. Presentational Skills is another Human Life Skill that this project enables.

Our research indicates this to be a really useful exercise for two additional reasons:

1. Students actually learn from their peers' presentations – it is useful to hear a perspective that is not just the teacher's; and
2. The public setting – painful as it is for some students – provides them with an opportunity to 'own' their work and to be more accountable.

Finally, if you are interested to learn more about the community of schools who annually participate in the **Meridian Stories Competitions** – a community that is characterized by a friendly competitive spirit; feedback from Mentors on each submission; and the rewarding of digital badges in content, storytelling and digital literacy – please return to the Competitions section of the website or inquire at info@meridianstories.com.

Let's get started.

The Challenge

They delight children, scare dogs, and are illegal in most states. What are they? Fireworks of course! Fireworks and their derivatives have been used to celebrate various occasions throughout history in a wide variety of cultures.

Of course, the friendly neighborhood incendiary device is probably not something you want in your schools. You could try *drawing* a firework display to capture the joy, but it's not quite the same. Why not draw it, but add a little extra life with computer animation?

So, what are we celebrating? Computer science itself. For this challenge, bring to life the story of someone who made a big breakthrough in the field of computer science

with a brief documentary, and punctuate it all with a custom-programmed fireworks display!

Deliverables include:

- Computer Science Breakthrough Digital Story with Fireworks Display
- Research Outline (at teacher's discretion)
- Fireworks Pseudocode (at teacher's discretion)
- Documentary Storyboard (at teacher's discretion)

Process

Below is a suggested breakdown for the students' work.

During Phase I student teams will:

- Decide on a computer science breakthrough to focus on for the challenge.
    - A good place to start is by researching how some of your favorite technologies came about. How is it that your phone screen can detect your finger's touch, or that your texts can be sent wirelessly across the airwaves? Examine the tech around you that you take for granted and question its inner workings.
- Research your chosen breakthrough by analyzing primary sources (where available) and secondary sources.
    - Since many of these events have occurred relatively recently, it can be surprising how many papers, letters, emails, and various other records you can find from the pioneers of modern technology. Examine these primary sources so you are better able to understand how the scientist was feeling as she or he progressed towards discovery.
    - Secondary sources can be good to understand the impact of the technology months or years down the line, another important component of the story you are going to tell and celebrate.
- Outline your research with a focus on the key points that you want to communicate in this documentary. We recommend aiming for between three and six main story ideas to carry your narrative forward. Include samples of proposed visuals that will assist your narrative.
    - ***Teacher's Option***: **Research Outline** – The teacher may require teams to hand in an organized outline of their research, citing primary and secondary sources.

- Research what it takes to use computer graphics to create a fireworks display and select a programming language to use.
    - For those new to coding, MIT's Scratch is a graphical coding interface that will get you up and running quickly, with an easy-to-use interface that creates graphical output and a wealth of help online if you get stuck.
    - If you have a programming language or framework with which you're already familiar, use that instead. Just make sure you can get a visual output. Some possibilities include PyGame for Python, Love2D for Lua, CSS animations in Javascript, or Processing for Java or Python.
        - ***Teacher's Option*: <u>Pseudocode</u>** – A common practice in programming is to outline a solution to a program in 'pseudocode' before actually programming the implementation. This pseudocode is similar to a real program, with 'if' statements and the like, but is closer to plain English and lacks the complex syntax of programming languages. The teacher may require teams to hand in a pseudocode implementation of their fireworks to show planning.

During <u>Phase II</u> student teams will:

- Brainstorm ways you can tell the story. For instance, consider how you can play with voice – who is telling the story? The featured scientist? An uninvolved onlooker? An arch nemesis? Seemingly straight forward stories can be more engaging when looked at through a new lens.
    - Think about content, too. Are you focused on the breakthrough itself, or the ramifications of the breakthrough on society? The latter could provide an opportunity to work in interviews with teachers or community members. (If you are interviewing, your interviewees may need to sign a Release Form giving you permission to record, edit and post this discussion online. Research generic and simple Release Forms online to find the right language for you.)
    - Even though it's a story about science, we recommend focusing on the human aspect. It's often easier to make your viewers care about other humans than computer algorithms. Use this to your advantage.
- Draft a script and storyboard for your documentary
    - ***Teacher's Option:* <u>Storyboard</u>** – The teacher may require teams to hand in a storyboard, with proposed voice over and/or interview candidates, that details the rough skeleton and narrative arc of their documentary.

- Create your fireworks show in a manner that fits whatever computer science program you have chosen.
    - While you won't have finished the documentary yet, you should have a fleshed-out storyboard. Think about how your fireworks display can feed into your story. Maybe your chosen scientist unveiled their invention at the world's fair, and the fireworks display comes on as the sun sets and they reflect on their work.
    - Keep in mind the advantages of making the fireworks in code. Don't just do one firework, make it a whole spectacle with changing colors and different patterns. The medium is as limitless as you make it.
    - Make your code **modular** and **general.**
        - Modular code doesn't just function as a whole but is composed of a series of smaller parts that could also function independently. Designing code like this makes it reusable, which is a hallmark of good code. Planning out your approach before you begin is a good way to make your code modular and save time later on.
        - General code is code that works not just for one case, but for many. Rather than make a set of blocks in Scratch that moves an image in a square 10 pixels wide, make a set of blocks that takes a number as an input and then moves an image in a square the size of the number. This allows you to reuse your code, as addressed above.
        - By making your code *modular* and *general*, you are taking advantage of the unique opportunities that the medium of programming provides. With other methods, each additional object added to the scene takes equal effort. With programming, you can make a style of firework once and then reuse it. With this in mind, a fireworks display demonstrating *modular* and *general* code will likely not have many unique fireworks fired once, but rather many of the same fireworks fired repeatedly but in different patterns. The unique element comes not from the individual item, but the composition of many similar items.
    - Remember to draw on math to help make your fireworks. If you know that gravity pulls things down at 9.8m/s/s, then doesn't it seem sensible to have the particles of your firework fall in a realistic manner? Just make them move down 9.8pixels/s/s. While the translation may not always be

this literal, remember to draw on what you know about the physical world when trying to construct simulations of it.

- Package the fireworks display for inclusion in your documentary.
    - The simplest way to get your fireworks into your documentary is likely to be using your device's in-built screen recorder and then adding that video to your documentary in post-production.
- Finalize your documentary script and image research.
- Pre-produce the video:
    - Scout locations for shooting (if some of this is being shot on location);
    - Create costumes, props and other set pieces, as needed;
    - Prepare the logistics for the actual shooting of the video (including securing the details for interviews, if relevant); and
    - Rehearse the scenes that will comprise the video.

During Phase III student teams will:

- Shoot the video.
- Record the voice-over or narration, as necessary.
- Edit the video, adding stills and graphics as desired.
- Post-produce the video, adding music, sound effects, and your fireworks!

Meridian Support Resources

Meridian Stories provides two forms of support for the student teams:

1. Meridian Innovators and Artists – This is a series of three to four-minute videos featuring artists and innovative professionals who offer important advice, specifically for Meridian Stories, in the areas of creativity and production.
2. Media Resource Collection – These are short documents that offer student teams key tips in the areas of creativity, production, game design and digital citizenry.

Recommended review, as a team, for this Challenge include:

Meridian Innovators and Artists	**Media Resource Collection**
The Importance of Character in Storytelling – Scott Nash ***Documentary Films*** – Sarah Childress ***Interviewing Techniques*** – Tom Pierce ***Nonfiction*** – Margaret Heffernan	"Creating Storyboards, Framing a Shot" "Creative Brainstorming Techniques" "Creating a Short Documentary" "Six Principles of Documentary Film Making"

Evaluation Rubric – More Bang for Your Byte

CONTENT COMMAND	
Criteria	**1-10**
Modular Code	Code is written in a purposeful manner, with many separate functional components working together towards the end goal
Algorithmic Thinking	Fireworks display takes advantage of unique medium presented by programming in order to make complex visuals comprised of many similar component parts
Comprehension of Topic	The documentary displays compelling evidence of understanding the importance and impact of chosen scientific breakthrough
STORYTELLING COMMAND	
Criteria	**1-10**
Narrative Clarity	The documentary has a clear and consistent tone that is well organized, lively, and delivers an engaging narrative
Integration of Content	Scientific concepts are integrated into the story and do not detract from, but instead enhance, the pacing of the narrative
Pathos (appeal to emotion)	The documentary leverages the human characters driving the story to connect with the viewer
MEDIA COMMAND	
Criteria	**1-10**
Use of Mixed Visual Media	The use of video, stills, animation, graphics, and/or text was creative, visually interesting, and relevant to the topic

Editing	The documentary is edited cleanly and effectively, resulting in an engaging viewing experience
Integration of Documentary and Computer Programming	The mix of documentary style media production and computer programmed fireworks was smooth and creatively presented
HUMAN SKILLS COMMAND	
Criteria	**1-10**
Collaborative Thinking	The group demonstrated flexibility in making compromises and valued the contributions of each group member
Creativity and Innovation	The group brainstormed many inventive ideas and was able to evaluate, refine and implement them effectively
Initiative and Self-Direction	The group set attainable goals, worked independently and managed their time effectively, demonstrating a disciplined commitment to the project

Essential Questions

1. What are some key computer science innovations and what is the story behind these moments in the continuing evolution of computer science?
2. How can one use technical programming skills as a means to realize a creative vision?
3. How can one design code that is reusable and generalized?
4. How can one leverage the emotional investment audiences have in characters to engage them in educational topics?
5. How is information gathered from primary sources different from information gathered from secondary sources?
6. How has immersion in the creation of original content and the production of digital media—exercising one's creativity, critical thinking and digital literacy skills—deepened the overall educational experience?
7. How has working on a team—practicing one's collaborative skills—changed the learning experience?

Student Proficiencies

1. The student will research the key facts behind a significant computer science innovation and organize this research into a coherent narrative.
2. The student will learn how a developed technical skillset can be an instrument to communicate a creative vision.
3. The student will learn how to design code in a modular way using generalized thinking in order to make more maintainable code that is easier for others to reuse.
4. The student will learn how to tell character-driven stories to make abstract and technical concepts more approachable.
5. The student will learn to use primary and secondary sources to analyze how sources close chronologically to an event differ from those more temporally removed.
6. The student will utilize key 21st century skills, with a focus on creativity, critical thinking and digital literacy, in their process of translating scientific content into a new narrative format.
7. The student will have an increased awareness of the challenges and rewards of team collaboration. Collaboration – the ability to work with others – is considered one of the most important 21st century skills to develop in students as they prepare for life after secondary school.

Curricular Correlations (CTA, NGSS and CC)

The ***More Bang for Your Byte!*** Challenge addresses a range of curricular objectives that have been articulated by three nationally recognized sources:

1. The **Computer Science Teachers' Association**;
2. The **Next Generation Science Standards**;
3. The **Common Core Curricular Standards – Mathematics;** and
4. The **Common Core Curricular Standards – English Language Arts & History/Social Studies.**

Below please find the standards that are being addressed, either wholly or in part.

Computer Science Teachers' Association	
2-AP-12	Design and iteratively develop programs that combine control structures,

	including nested loops and compound conditionals
3A-AP-13	Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.
3A-AP-14	Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.

Next Generation Science Standards	
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Common Core – Mathematics	
CCSS.MATH.Content.HSF.BF.A.1	Write a function that describes a relationship between two quantities
CCSS.MATH.CONTENT.HSF.IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

Common Core – English Language Arts & History/Social Studies	
W3 **WRITING**	Write narratives to develop real or imagined experiences or events using

Text Types and Purposes	effective technique, well-chosen details, and well-structured event sequences.
W4 **WRITING** **Production and Distribution of Writing**	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
SL1 **SPEAKING AND LISTENING** **Comprehension and Collaboration**	Initiate and participate effectively in a range of collaborative discussions (one- on-one, in groups, and teacher-led) with diverse partners on grades 8–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
SL5 **SPEAKING AND LISTENING** **Presentation of Knowledge and Ideas**	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
RH9 **HISTORY/SOCIAL STUDIES** **Integration of Knowledge and Ideas**	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.