Digital Storyboards

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Abstract
Over $10 million in funding was allocated in 2020 by the state of Utah to support Computer Science (CS) Education and to develop the *Utah Computer Science Education Master Plan*. Despite this funding, the vast majority of elementary teachers in the state of Utah are not prepared to integrate CS principles into their classes without professional development and training. Further, although a myriad of outreach initiatives have been put into place over the past decade, the majority of students report little interest in pursuing computer science fields. The Digital Storytelling project is an ongoing design-based research project which seeks to address this immediate need by training current and future teachers in basic computer science principles, ideas, and pedagogies. Undergraduate Technology and Engineering Education students are partnering with local elementary teachers to teach a 10-week unit focused on designing, building, and programming "digital storyboards." These digital storyboards are 12" x 12" foam core pieces depicting one scene from a story of the student's choice which has been automated in alignment with the plot of the story. Digital Storyboards incorporate both electronics and programming (variables, loops, and Booleans) and are constructed across 10 weeks of guided instruction by both the undergraduate students and the classroom teachers. Student data from pre/post surveys related to their interest in, and aptitude for, computer science has been collected as well as observational notes during implementation. The preliminary results and potential applications will be shared.

Keywords: STEM Integration, Literacy, Engineering Design, Coding

Introduction

In 2019, the Utah tech industry—composed largely of companies along a central valley corridor referred to as "silicon slopes"—demanded computer science education for all students in Utah, stating that: If Governor Herbert provided $5 million, they would match it. Aaron Skonnard, founder of Silicon Slopes and CEO of Pluralsight, remarked that, (Tanner, 2019, pp. 1) "Computer science has become a form of literacy just like reading. But not everyone is learning it." The challenge was accepted, and Governor Herbert allocated over $10 million in funding to support Computer Science Education, allowing the *Utah Computer Science Education Master Plan* (UCSMP) to be created. These steps were both timely and critical for Utah. In 2019, there were more than 5,000 open computing jobs in Utah—jobs that come with an average salary of over $81,000, nearly double the state's average salary—but there were not enough qualified people to fill all the positions desperately needed (Bonilla & Paul, 2019). Further, in alignment with both these efforts and the outstanding demand, the recently developed Elementary Utah Science and Engineering Education (SEED) standards identify several computer science ideas, principles, and areas that should be considered a priority for K-12 classrooms (e.g., K.1.1, K.1.2, K.2.1, 1.2.4, etc.). However, funding and standards are only a fraction of the solution. Currently, only 16% of Utah schools offer intermediate or advanced computer science classes and such a low number of offerings represent a disparity in opportunities for students to be trained in these skills. As mentioned above, money alone cannot solve the computer science education crisis in Utah (or the nation) and, as the UCSMP states (p. 10), "Utah lacks enough teachers to teach additional computer science courses and elementary teachers need additional support to integrate the newly adopted computer science standards into their instruction." Without training, support, and curricular materials, the necessary changes are not likely to be implemented. Additionally, it is imperative that there is accountability for how the money is spent (i.e., data backing up the efficacy of efforts in place) to ensure meaningful and lasting change.

Digital Storyboards

We developed the Digital Storytelling Project (DSP) – in alignment with the UCSMP focus areas – to assist current educators and provide research mentoring experiences for teacher education students. This project is targeting both current (elementary) and future (secondary or elementary) teachers who work together to teach an engineering-design based computer science education unit in local elementary school classrooms. Each teacher-student team is engaging in the design-based research (DBR, Wang & Hannafin, 2005) under the supervision of a graduate student (with expertise in research and teaching computing and engineering education) and faculty advisors throughout the duration of the project. Further, all research data collection (pre/post questionnaires and observational notes) and intervention refinements are being conducted by these BYU education students. Supervision and mentoring by the graduate supervisor and faculty members of the research team is helping to ensure fidelity of implementation, consistency in procedures, and positive training for students and classroom teachers. Additionally, prior to any classroom implementation of the DSP, all teachers engaged in multiple sessions of professional development with the university faculty and project team to ensure preparedness with the required skills and knowledge necessary to complete the project.

In the DSP, participating elementary school students are given the opportunity to design, build, and program their own digital storyboard (see Figure 1) with guidance from their classroom teacher and a visiting undergraduate teaching major.

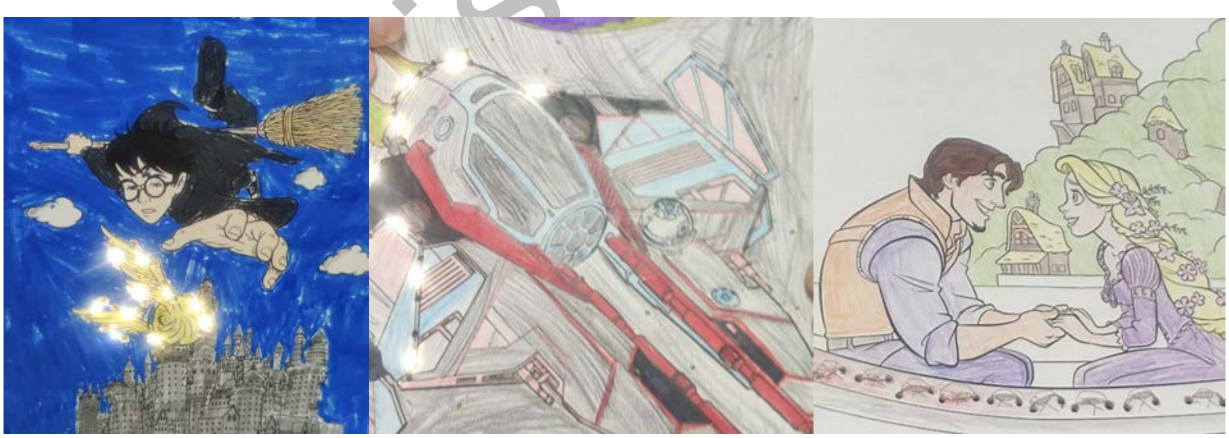

Figure 1 – *Example Digital Storyboards*

A digital storyboard is a visual representation of a scene from a story of the student's choice (e.g., The Big Bad Wolf). Students work to first design the overall appearance of the storyboard using provided art materials and supplies (e.g., drawing/coloring a wolf, Red riding Hood, and a house) and, following the design and creation of the board, students are taught several lessons around basic electronics (e.g., circuitry, breadboards, LEDs) and programming (e.g., loops, conditionals, variables). Following this instruction, students choose one aspect of their storyboard to automate/animate (e.g., a moving character) – a process being completed in tandem with daily instruction, mentoring, and assistance from both the classroom teacher and the visiting undergraduate education student. Students are also being given the opportunity to see their digital storyboards "come to life" as Luke Skywalker swings his lightsaber (e.g., automating a servo motor) or Little Red Riding Hood chases the big bad wolf (3v hobby motor and pulley system). The instruction and activities around the DSP align with both the state SEED and literacy standards for elementary students – an intentional choice given the pressures on elementary teachers for time and the large amount of necessary content to cover (Ferrero, 2018).

Elementary Students Attitudes Towards Coding

To gauge the impact, if any, of the DSP on student perceptions of coding, we used the *Elementary Student Coding Attitudes Survey* (ESCAS; see Appendix A), a 23-item instrument which assesses elementary students' coding attitudes and self-efficacy. All items are measured using a six-point Likert scale, where selecting a 'one' represents strong agreement with the statement and selecting a 'six' represents strong disagreement. The ESCAS was specifically designed to assist educators, administrators, and researchers in their attempts to better understand which factors influence students' attitudes toward coding (Mason & Rich, 2020) and a confirmatory factor analysis using data from 6000 4th-6th grade students identified five strong factors: coding confidence, coding interest, social value, perceptions of coders, and coding utility (Mason & Rich, 2020). Later a Rasch analysis showed that the ESCAS is an efficient way to measure those specific coding factors (Alasagrova, 2022). We combined the DSP with a pre/post study design using the ESCAS, coupled with qualitative observation notes, to investigate potential implications.

Research Question

In line with the stated objectives, this research effort aimed to determine the impact of the DSP on student's perceptions of coding. Our efforts were guided by the reported problems in both the disinterest and pursual of computer science degrees by both student and elementary teachers' perceptions indicating a lack of preparedness in incorporating projects with coding principles into their classrooms. Specifically, we sought to understand how participation in the DSP affected students' attitudes towards coding. The specific research question guiding our study was:

> *What is the impact, if any, of participation in the digital storytelling project on elementary students' perceptions of, and interest in coding?*

Methods

A quasi-experimental, design-based research approach was used in the DSP. In this approach, students and teachers from participating elementary classrooms engaged in the educational intervention aimed at investigating their self-efficacy, perceptions of, and skills in coding. Prior to implementation, all partnering elementary school teachers took part in a four-hour professional development aimed at providing them the opportunity to interact with the supplies, lesson plans, and content. Each participating elementary school teacher was trained by the research teacher and completed each of the DSP activities as part of this professional development. Following this, the undergraduate students worked with the elementary teachers to teach the engineering design/coding unit to their students; additionally, both quantitative and qualitative data was collected in line with IRB approval and consent/assent permission.

The Digital Storytelling Project

The 10-week classroom intervention on the following main topics: literacy and storytelling, basic circuitry, computational thinking, microcontrollers (e.g., the BBC Micro:Bit), coding, and engineering design problem solving through coding.

The undergraduate student teachers and the cooperating elementary school teachers used both a pre-developed timeline (see Appendix B) and lesson plans (see Appendix C) to ensure both the fidelity of implementation in the classroom as well as maintaining similar experiences across other classrooms. While fully still recognizing subtle differences in each classroom, the lesson plans and classroom experiences roughly follow the same prescribed timeline (see Appendix B) to provide consistency across locations, teachers, and students. Additionally, a set list of supplies (see Table 1), student challenges/experiences (see Appendix D), and technology (Mico:bit) was used.

Table 1 – DSP Supplies

Supply	Quantity	Activity
5"x7" index cards	x1 per student	Storycard
Copper wire	x1ft per student	Storycard
LED	x1 per student	Storycard, Challenge 3 (red,green,yellow)
Battery	x1 per student	Storycards
Foam Board	1 12in x 12in per student	Digital Storyboards
Fairy Lights	x10 lights per student	Digital Storyboards
Nails	x1 per student	Digital Storyboards
Micro:bit	x1 per student	Digital Storyboards, Challenges 1-10
Alligator Clips	x2 per student	Digital Storyboards, Challenges 2, 3, 5, 6, 9
Cardboard	Varies	Challenges 1, 3, 6, 7, 9
Dirt, Cup, Plant	x1 per group	Challenge 2
Catapult	x1 per group	Challenge 5
Servo	x1 per group	Challenge 5, 7
Aluminum Foil	x1 per group	Challenge 6, 9
Water pump	Optional	Challenge 2
Capasitive Sensor	Optional	Challenge 2
Light Sensor	Optional	Challenge 8

In addition to the creation of a digital storyboard (see Figures 2-10 for examples of student created digital storyboards), students worked in groups to solve one of several coding challenges. These challenges were introduced to students following the 6th day of the project and were executed to provide students with an opportunity to work on an engineering design/coding application of their knowledge. The list of possible challenges for students to choose from is included in Appendix D.

Figure 2 – *Example Wiring of the Back of the Storyboard Project*

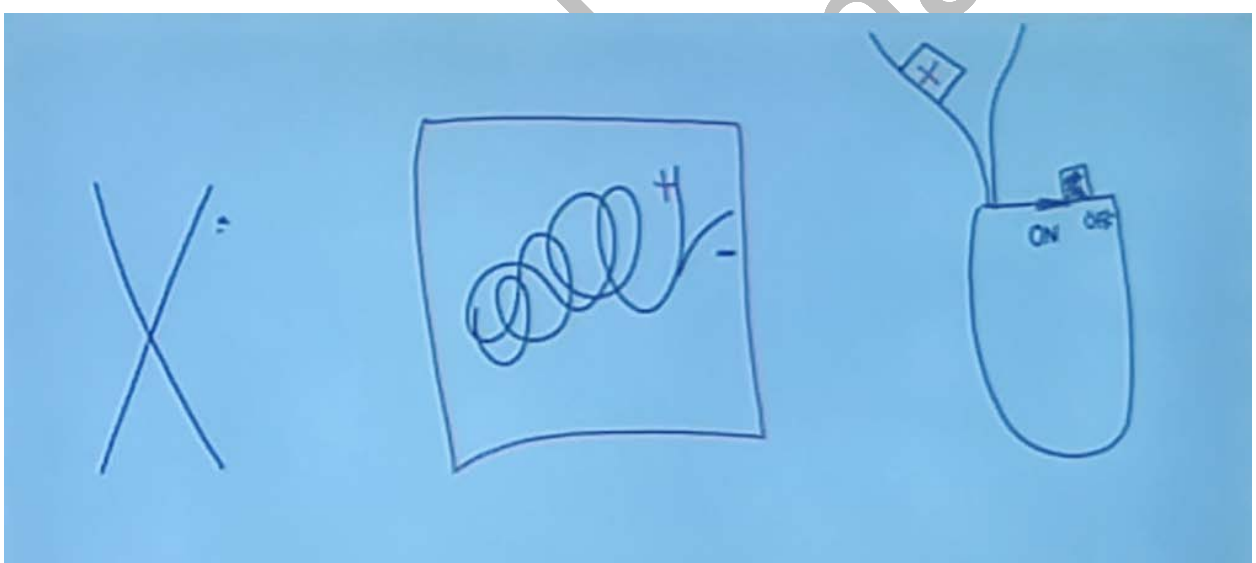

Figure 3 – *Example Diagram Illustrating Power and Ground with Wires*

Figure 4 – *Example Completed Storyboards*

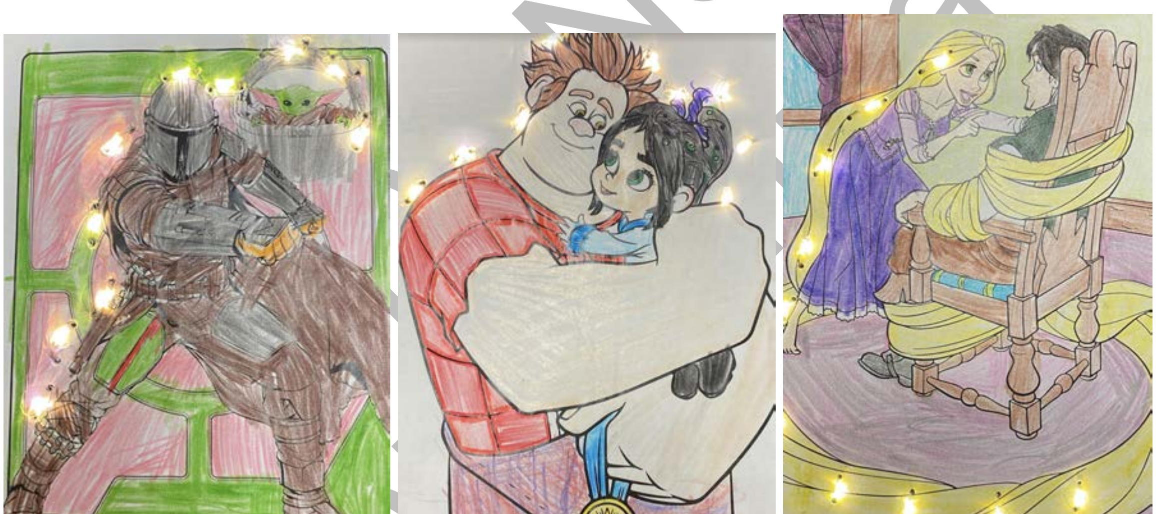

Figure 5 – *Example Completed Storyboards*

Figure 6 – *Example Completed Storyboards*

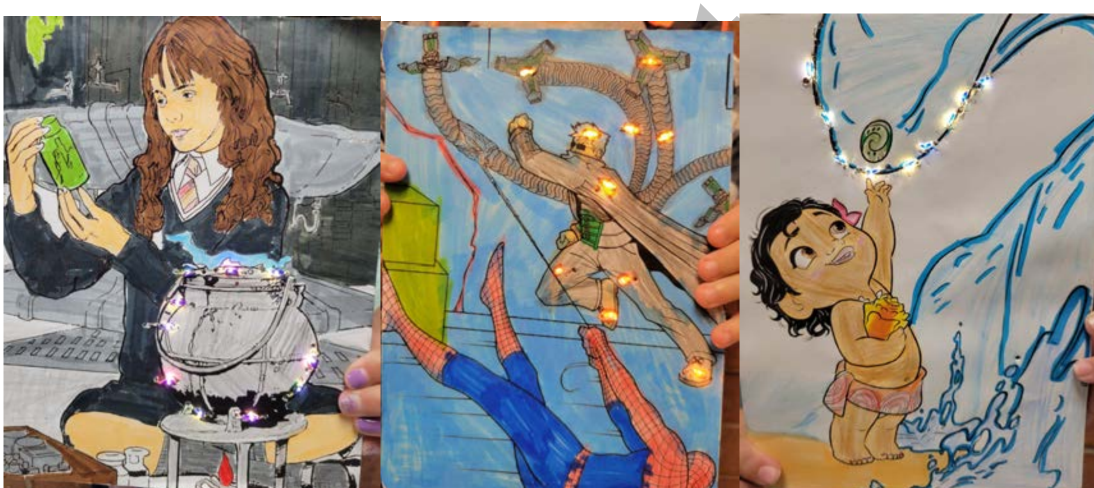

Figure 7 – *Example Completed Storyboards*

Figure 8 – *Example Completed Storyboards*

Figure 9 – *Example Completed Storyboards*

Figure 10 – *Example Completed Storyboards*

Data Collection. The quantitative data for this study was derived from the *Elementary Student Coding Attitude Survey* (ESCAS; Mason & Rich, 2020) – a self-efficacy data collection tool used as both a pre- and post-survey for this project (See Appendix A). Qualitative data was derived from researcher observations made during the implementation - this data, collected in prose form on the reflection tools, was combined with other data to investigate the "why" of the findings derived from this study.

Data analysis for the project will consist of several steps. In line with Research Question 1, following the collection of both student pre- and post-study ESCAS responses, paired-samples t-test were conducted to investigate the impact of the DSP on students' perceptions of coding. Additionally, the student researcher's observation notes from each visit were then analyzed holistically in line with Research Question 2 and the findings from Research Question 1 were used to further investigate our research questions. This comparison of both forms of data was used as an opportunity to both refute and/or support the findings from Research Question 1, as well as identify opportunities for illustrative examples of relevant findings and areas for future improvement.

Findings

Initial data analysis on this project was constrained to the first-class wide application of the DSP in one 3rd grade classroom in a western state (conducted as a pilot for the larger study) with only quantitative data collected from the ESCAS student responses (both pre- and post-). Data in this pilot was collected from 24 students including 11 students who identified as boys, 11 students who identified as girls and two students who responded with other designations. The equivalent ratio between boys and girls allowed for analyses to be completed based on gender; however, the sample size was too small for meaningful conclusions to be reached regarding other gender identities. 20 of the students identified as white, three identified as Hispanic, and one identified as both white and Native American. While this relative lack of racial diversity prevented ethnicity analysis, the findings are illustrative and representative for the classroom, school, and district.

Our research question centered on investigating the impact, if any, of participation in the digital storytelling project on elementary students' perceptions of, and interest in coding. Two-tailed paired t-tests were used to explore potential statistically significant shifts in student responses between the pre-tests and post-tests. Two students failed to complete the pre-test and two students failed to complete the post-test, so the remaining tests ($n = 22$) were evaluated.

Our first analysis was completed using all of the students' responses ($n = 22$) to the questions on the survey. Only one question had a statistically significant shift at a level of $p < .05$ and one other question showed a statistically significant shift at a level of $p < .1$ (See Table 2). The statement with the most significant difference was in response to the statement C4 "I can write clear instructions for a robot or computer to follow." Pre-test student responses averaged between "Somewhat Agree" and "Somewhat Disagree" (3.68). Post-test student responses showed a positive change as student responses averaged between "Somewhat Agree" and "Agree" (2.64). The next most significant difference was in response to the statement "I am friends with kids who code". Pre-test student responses averaged between "Somewhat Agree" and "Somewhat Disagree" (3.27). Post-test student responses averaged between "Somewhat Agree" and "Agree" (2.55).

Table 2 – Two-tailed paired t-tests with all student data where p<.1

N = 22	p-value	initial mean	final mean
C4	0.006351	3.6818	2.6364
S7	0.08807	3.2727	2.5455

Next the data was divided by gender to determine if significant shifts occurred within one gender when separated from the other. When looking exclusively at female students' responses, three questions had shifts with a p-values less than .05 and two questions had shifts with p-values less than .1 (See Table 3). The mean for female students' pre-test responses to C4 "I can write clear instructions for a robot or computer to follow" was 3.92 and the mean of the post-test responses was 2.58 (p=0.0012). Female students also showed increased agreement with the statements C1 "I can learn to code" (from 2.4167 to 1.5) and C2 "I am good at coding" (from 3.5833 to 2.0833) after completing the class: demonstrating a positive shift. The two remaining questions with significance between .05 and .1 are C6 "I've been told I am good at coding" (from 4.0833 to 2.8333) and St7 "Coders are good at math" (from 2.0833 to 2.6667).

Table 3 – Two-tailed paired t-tests with female student data where p < .1

Female	p-value	initial mean	final mean
C1	0.0047	2.42	1.5
C2	0.0055	3.58	2.08
C4	0.0012	3.92	2.58
C6	0.058	4.08	2.83
St7	0.089	2.08	2.67

The same analysis was completed by only looking at male data; however none of the questions had a significant shift with a p-value less than .05. Two questions had a significant shift with a p-value less than .1(See Table 4). Male students showed less agreement with both U3 "Knowing how to code will help me to create useful things" (from 1.6 to 2.1) and St8 "Coders are good at science" (from 1.5 to 2.2).

Table 4 – Two-tailed paired t-tests with male student data where p < .1

Male	p-value	initial mean	final mean
U3	0.052	1.6	2.1
St8	0.089	1.5	2.2

Discussion

In 18 of the 23 questions asked, the mean of all students' responses on the post-test was less than the mean of student responses on the pre-test (See Table 5) showing a positive shift in student perceptions. While only a few of those questions had differences of statistical significance this suggests that, in most ways, the DSP appeared to improve students' attitudes towards coding. The five questions where the mean of all students' attitudes trended negatively were "I am good at problem solving" (p=0.3287), "I would like to study coding in the future" (p=0.6775), "Knowing how to code will help me create useful things" (p=0.7329), "Coders are good at math" (p=0.9147), and "Coders are good at science" (p=0.7542).

All questions with statically significant shifts where $p<0.05$ portrayed positive shifts suggested an increased interest in, perception of, or attitude towards coding. All students showcased an improved attitude for the question “I can write clear instructions for a robot or computer to follow.” Furthermore, Female students also showed an improved attitude when surveyed on “I can learn to code”, and “I am good at coding.” Overall, this data suggests that the DSP may have a positive impact on student attitudes towards coding and this positive impact may be even more significant for female students.

Table 5 – Two-tailed paired t-tests with all student data

Everyone	p-value	initial mean	final mean
C1	0.18	2.04	1.73
C2	0.18	3	2.41
C3	0.33	2.05	2.27
C4	0.0064	3.68	2.64
C5	0.32	2.33	2.05
C6	0.14	3.62	2.91
I1	1	2.15	2.15
I2	0.32	2.24	1.86
I3	0.56	2.68	2.45
I4	0.30	2.4	1.95
I5	0.68	2.85	3.05
U2	0.79	2.81	2.71
U3	0.73	2	2.10
U4	0.91	2.76	2.71
U5	0.54	3.1	2.8
S3	0.42	3.14	2.77
S4	0.49	2.86	2.55
S7	0.088	3.27	2.55
St2	0.32	3.57	3.14
St5	0.77	3.29	3.19
St7	0.91	2.38	2.43
St8	0.75	2	2.10
St9	0.54	3.05	2.77

Conclusion

The Digital Storyboards Project has a unique method that aims to expose students to engineering and technology that was specifically created in alignment with state SEED and literacy standards for elementary classroom implementation. The data collected implies that DSP is a worthwhile project to pursue further to gain more data and improve the teaching process. Research is currently underway in 5th grade classrooms to collect data to draw more significant conclusions regarding the effectiveness of the project. However, evidence collected up to this point suggests that this activity not only engages all students with technology, engineering, coding, and literacy but selectively increases female students' interest in coding. Students can explore the true variety of skills necessary to be successful in STEM careers and are able to practice grit as they complete projects that include not only coding challenges but also literacy and engineering challenges.

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Appendix A: ESCAS

Factor	Item	
Coding confidence	C1	I can learn to code.
	C2	I am good at coding.
	C3	I am good at problem solving.
	C4	I can write clear instructions for a robot or computer to follow.
	C5	If my code doesn't work, I can find my mistake and fix it.
	C6	I've been told I would be good at coding.
Coding interest	I1	I like coding, or I think I would like coding.
	I2	I would like to learn more about coding.
	I3	Solving coding problems seems fun.
	I4	Coding is interesting.
	I5	I would like to study coding in the future.
Utility	U2	I can use coding skills in other school subjects.
	U3	Knowing how to code will help me to create useful things.
	U4	Knowing how to code will help me solve problems.
	U5	I think I will need to understand coding for my future job.
Social value	S3	My friends think coding is cool.
	S4	My parents think coding is important.
	S7	I am friends with kids who code
Perceptions of Coders	ST2	Kids who code are smarter than average.
	ST5	Kids who code enjoy doing sports.
	ST7	Coders are good at math.
	ST8	Coders are good at science.
	ST9	Coders are good at language arts.

Appendix B: Timeline

DAY	TIME	PLAN
Before		Pass out consent/assent forms Teacher training during PLC meetings
1	10 min 5 min 10 min 15 min 15 min	Introductions Pick up Consent/Assent forms ESCAS pre-test What is a story? (tie to 4th grade literacy standards) ● Characters ● Plots ● Themes Create 5x7 story cards ● Need characters, plot, theme, etc. ○ Need to show examples
2	5 min 15 min 30 min 5 min	Review elements of a story Circuits ● Load, power, wiring ● Can you light an LED with a battery activity? Add circuitry to your 5x7 story card Review of story elements and circuitry ● What are your favorite stories?
3	10 min 20 min 30 min	Introduce digital storyboards Review elements of a story & circuitry Students pick a scene from their favorite story Color story scenes Add lights to your digital storyboard ● Plot out pathway ● Make sure the + and - end at one location

		● Use a nail to poke the hole ● Wire fairy lights in place Test to make sure they turn on/off *If students don't finish their storyboard it is homework*
4	15 min 20 min 25 min	Introduce computational thinking & programming ● Decomposition ● Pattern recognition ● Abstraction ● Algorithm Design CT activities Introduce the Micro:Bit ● How to connect micro:bit ● Buttons ● Lights ● Sounds ● Simple Challenge: can you make your Micro:Bit show a smiley face when you press button A?
5	10 min 15 min 35 min	Micro:Bits Continued ● Inputs/Outputs [Rock, paper scissors] ● Waits/Loops, conditionals, ~~variables~~ Programming your digital storyboard ● Decide when you want the lights on/off ○ Show examples (Encanto example) ● How to turn a light on (Digital Pin) Challenge: program your Digital Storyboard to include lights!
6	5 min 10 min 35 min	Show video of Encanto video Get boards hooked up to micro: bits Finishing programming the story boards. Recording upon finishing

7	15 min 15 min 30 min	Get everyone caught up - working lights with Buttons ● Record working digital storyboards BEFORE removing micro:bits ● Opportunity to tell the story to the class/groups ● Remove Micro:Bits & help everyone get their Digital Storyboard hardwired again (Students get to take these home) Introduce Challenge Cards ● Students will work in Groups of 3 ● Each group selects a challenge to work on ○ Challenges include opportunities to work with different hardware and software techniques ● At the end, all groups will present their solutions and the class will vote ● The teacher will get to keep the top 3 challenge solutions & accompanying hardware
8-9		Challenge card workday ● Remind students that they will present their idea - they should have a story to go with their presentation (plot, characters, themes, etc.)
10		Pick up any remaining Consent/Assent forms ESCAS post-test Student presentations & voting Celebration ● Give teacher supplies ● Take pictures

Appendix C: Lesson Plans

Lesson Plan 1: Elements of a Story

Table 1

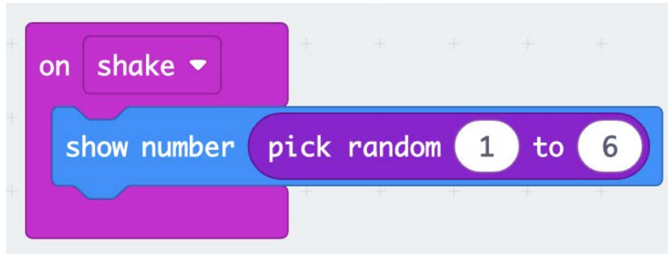
Literacy and SEED Based Lesson Overview

Elements of a Story: Lesson #1		
Time: 1 hr		
Lesson Overview/ Purpose: Students will engage in learning the elements of a story such as character, theme, plot, and setting. Students will describe in depth a character, setting, or event in a story or drama. Learning about the elements of a story will help enable them to draw on specific details in text. Recognizing the structure in their own story will require a basic understanding of what a plot is, basic plot structure, theme, characters, and the setting.		
Literacy Standards: Reading: Literature Standard 2 - Determine a theme of a story, drama, or poem from details in the text; summarize the text. https://www.uen.org/core/displayLinks.do?courseNumber=4240&standardId=70487 Reading: Literature Standard 3 - Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text (e.g., a character's thoughts, words, or actions). https://www.uen.org/core/displayLinks.do?courseNumber=4240&standardId=70488		
Global or Local Issue: Helping students recognize basic elements of a story and write an effective storyline using theme, characters, plot, and setting Students are required to read increasingly complex texts as they advance through the grades,and need exposure to arranging texts and tasks involving literature and reading. In addition, only 49 percent of Utah's third graders and 44 percent of Utah's 8th graders read proficiently at grade level (USBE,2017). With each increasing year students are less likely to catch up with their appropriate grade level of reading and literacy standards.		
Student Outcomes: Students will (1) be able to accurately describe a character, setting, or event in a story or drama, (2) distinguish and identify specific details in a text, especially the elements of a story, (3) and determine a theme of a story, drama, or poem from details in the text.		
Enduring Understandings: • A well developed storyline has multiple key elements such as theme, plot, setting, and characters. • Important lessons may be learned from drawing upon specific details in text. • When stories have all the necessary elements, they are more able to evoke emotion and are more understandable.		
Driving Question: What is a Story?		
Career Connections: • Analytical skills in drawing specific details from text • Comprehension skills in reading and understanding and writing their own story Note: Both reading, writing, comprehension, and analytical skills are necessary in any job students will obtain in the future.	• Engineer • Author	
Supplies/Sources: 35 3x5 Story Cards 4 Pack of Crayons Note: Teachers will likely have their own coloring supplies. We will bring 4 packs of crayons just in case. https://www.canva.com/design/DAFDVwOho1Y/XcQkSilkoXSTKVm4GGvW7g/edit?utm_content=DAFDVwOho1Y&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton (Presentation Link)		

Table 2

Lesson Title – Elements of a Story	
Evaluate: Allows a student to evaluate hers or his own learning and skill development in a manner that enables them to take the necessary steps to master the lesson content and concepts. TIME: 10 min	• Pass out the ESCAS pretest and allow students 10 minutes to take the test. • Re-enter the room and collect the tests and inform the students that they will be taking one more test after the 10 lessons to see what they learned.
Engage: Sets the context for what the students will be learning in the lesson, as well as gaining their interest in the topic. TIME: 15 min	***Assent/Consent forms to be given to students previously. • Introductions: Briefly tell the students who you are and why you are there ○ Explain that the digital storyboard is one of the projects we will do together and that we will get to learn the basics of programming together and do some other cool projects over the course of ten lessons ○ Play a quick 10 minute game to get to know the students' names and interests ■ Go around in a circle and every student shares their name and a word that describes them that starts with the first letter of their name. ***Collect completed consent forms and remind students who may have forgotten to complete them.
Explain: Summarizes new and prior knowledge while addressing any misconceptions the students may hold. TIME: 15 min	*** Note: Follow the Lesson #1 Power Point https://www.canva.com/design/DAFDVwOho1Y/XcQkSilkoXSTKVm4GGvW7g/edit?utm_content=DAFDVwOho1Y&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton (Presentation Link) Ask the students: What is a story? Refer to Reading: Literature Standard 3 if needed. https://www.uen.org/core/displayLinks.do?courseNumber=4240&standardId=70488 • Stories are an account of events! Stories are made up of four main elements! • Characters ○ Characters are the significant people in a story ○ We can learn about characters in a lot of ways and they can teach us a lot about the story • Plots ○ The plot is what happens in a story. There are four main parts to the plot ■ Rising Action ■ Conflict/Problem ■ Climax/Turning Point ■ Resolution • Setting ○ Time and Place a story takes place ○ There are more than one type of settings ■ Physical ■ Historical ■ Cultural ■ Note: Make sure the students understand that the setting has a big effect on the plot of the story • Theme ○ Moral or lesson learned from story ○ There can be more than one theme ○ Note: Make a point the the students that the theme is NOT a summary of the story
Explore: Enables students to build their own knowledge on the topic while making connection to their prior conceptual and procedural knowledge. TIME: 15 min	Students will now have the opportunity to apply what they learned through the brief direct instruction on the elements of a story. • Explain to students that they will have 5 minutes to draw a story that they already know (we don't want the students to take too much time coming up with their own new story) on one side of a 5x7 card that will be given to them. Students will have five minutes to identify and write the four elements of a story on the other side. • After a thorough explanation of the activity, check for understanding quickly by asking a student what the activity is. Pass out the 3x5 cards to the students and encourage them to begin. • The teacher will walk around the room clarifying any questions students may have and giving story ideas to students who may be having a hard time starting. • After the 10 minutes is up, tell the students to take 5 minutes and quickly tell their story to their neighbor. Their neighbor will then identify the 4 elements of a story to the student who shared. Each student will share their story in pairs, and each student will have the opportunity to identify the elements of a story twice: once in their own story and once in their neighbor's story. Conclude the class and thank the students for their focus and attention. Remind students who forgot consent forms to bring them next time.

Appendix D – Micro:bit Challenges

<table>
<tr><th>#</th><th>Challenge</th><th>Description</th></tr>
<tr><td>1</td><td>Digital Dice</td><td>Shake the micro:bit to display a number 1 to 6


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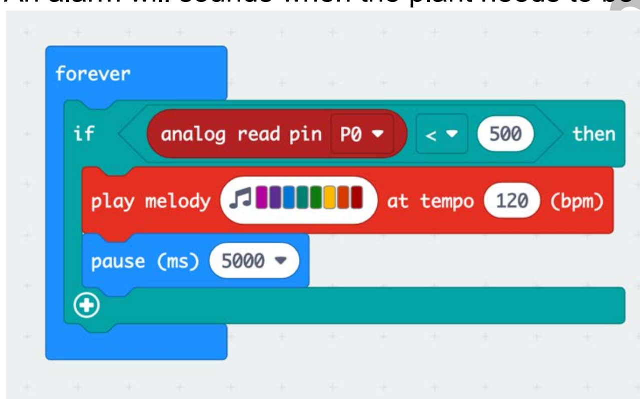
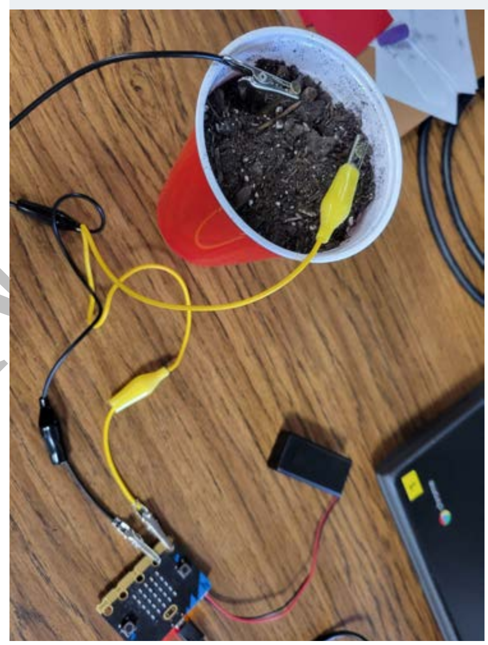
<tr><td>2</td><td>Water Reminder</td><td>An alarm will sounds when the plant needs to be watered
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<tr><td></td><td></td><td>
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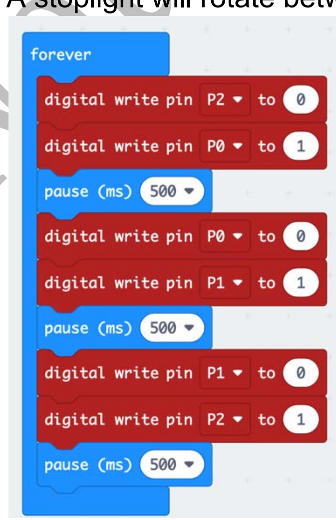
<tr><td>3</td><td>Stop Light</td><td>A stoplight will rotate between green, yellow and red

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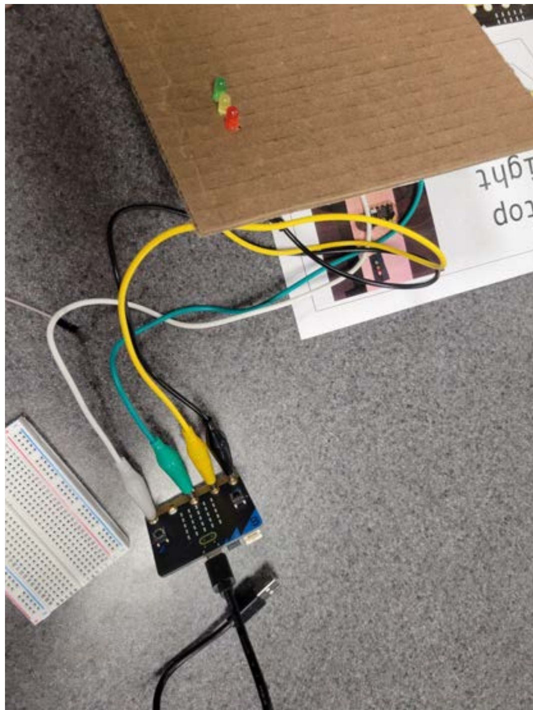
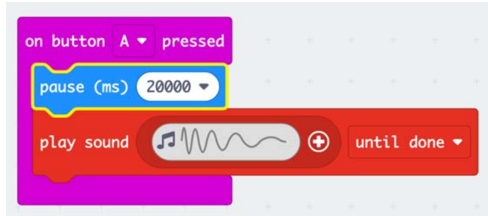
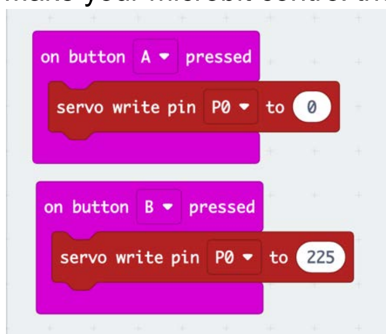
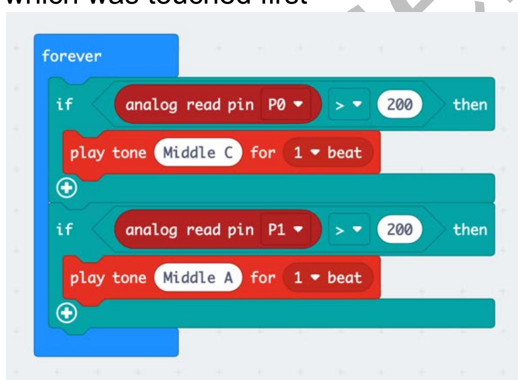
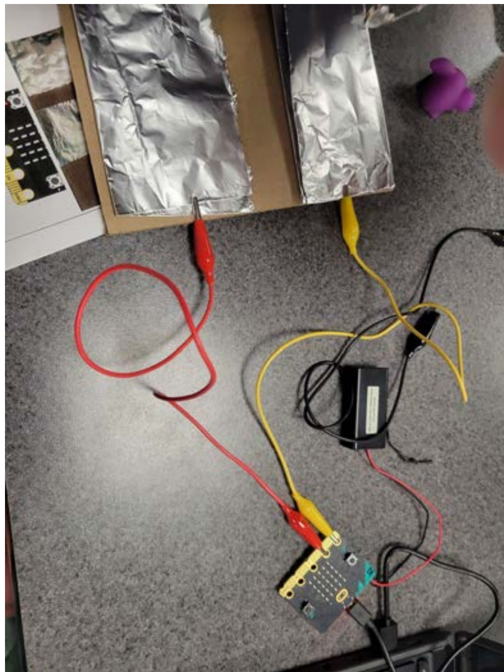
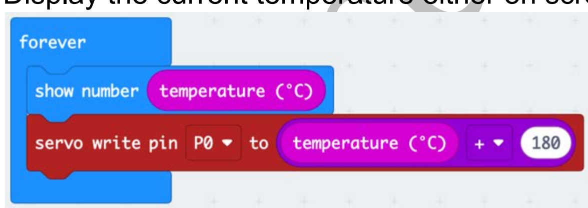
		

4	Hand Wash Timer	A timer will count down from 20 to 0 when a button is pressed 
5	Catapult	Make your microbit control the launch on a catapult 
6	Jeopardy Buzzer	Two or three buttons will be available and the microbit will display which was touched first 

		
7	Thermometer	Display the current temperature either on screen or visually 

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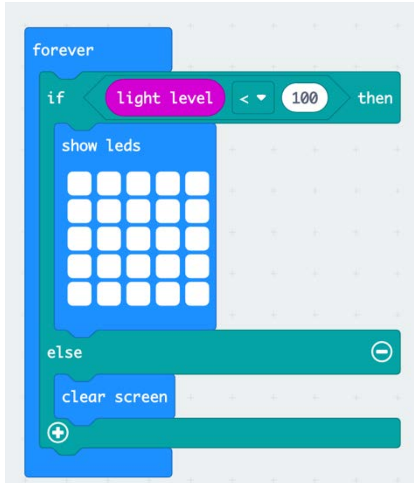
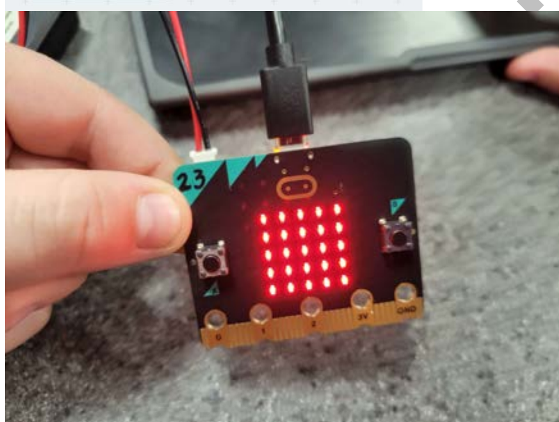
<tr><td>8</td><td>Night Light</td><td>Turn on a light if it gets dark
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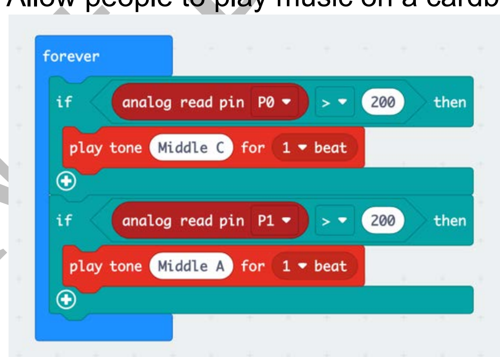
<tr><td>9</td><td>Musical Instrument</td><td>Allow people to play music on a cardboard guitar or piano

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		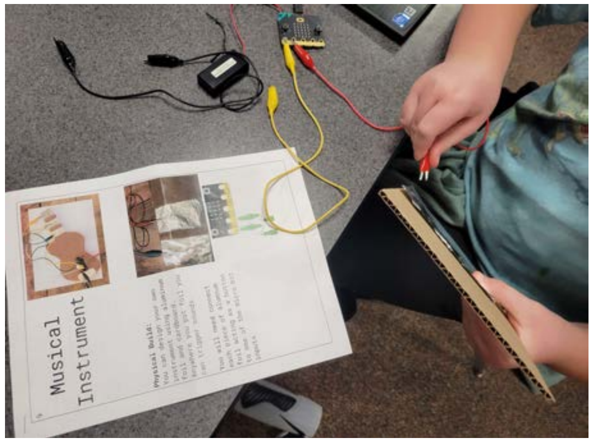
10	Step Counter	Count the number of steps a person has taken