Scratch + LEGO Spike

Total Number of Lessons: [31]
Total Estimated Time for Module: [930]

Section 1: Module Overview and Curricular Connections – Required

- **Module goal**: [At the end of this module, SWBAT…; try to make it one big goal]

The goal of this Module is for students to create a project on Scratch that shows their mastery of breaking down complex problems into smaller, manageable steps.

- **Connection to standards**: [List standards that will be addressed by the module. Should include Indiana standards; NGSS, CS Framework and CCSS are strongly recommended; CSTA could also be useful for the Computing RET.

3-5.PA.1: Collaborate with peers to implement problem-solving steps to create a variety of programming solutions.

3-5.PA.2: Design programs that incorporate sequences, events, loops, and conditionals

3-5.PA.3: Test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended.

3-5.CD.2: Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.

3-5.NI.1: Discuss real-world cybersecurity problems and how personal information can be protected.

- **RET materials/ideas to be leveraged**: [Describe what elements of your summer experience you will use as part of the module for students.]

The elements of RET that I will be using as part of the module for students is from “Coding 101”, primarily the information I learned about Scratch and its positive usage in the elementary classroom. I will also be using what I learned from working with Kevin Bowyer on biometrics to introduce cybersecurity in a way that students can understand.

Section 2: Overview of Module Framework – Required

- **Real-world context**: [Describe in 1-2 paragraphs]

Coding experiences can significantly enhance collaboration, critical thinking, and problem-solving skills for students in grades 3-5. When working on coding projects, students often need to partner up or work in small groups, fostering teamwork and communication as they share ideas and troubleshoot together. This collaborative environment encourages them to articulate their thoughts clearly and listen to others' perspectives. Coding also naturally promotes critical thinking by requiring students to break down complex problems into smaller, manageable steps– a skill that transfers to many areas of life. As they encounter bugs or unexpected outcomes, students must analyze the situation, identify the issue, and devise creative solutions. This process of testing and refining their code builds resilience and strengthens their problem-solving abilities. Through coding, young learners develop a growth mindset, learning to view challenges as opportunities for learning and improvement.

Cybersecurity is crucial in our increasingly digital world, protecting our personal information and online activities from malicious actors. For students in grades 3-5, understanding the basics of cybersecurity is essential as they begin to explore the internet and use various digital devices. One specific area of concern is facial recognition technology. While it can have beneficial applications, young students should be aware of its potential dangers. Facial recognition can compromise privacy, as images shared online may be used without consent to identify individuals. It's important for children to learn about protecting their digital identity and being cautious about sharing photos or videos of themselves online. By educating students early about these issues, we can help them develop good digital habits and become responsible digital citizens.

- **Possible Lesson Ideas**: [What are some ideas for a lesson or two focused on the real-world context and framing the project for students?]

1. Critique Groups

A small group of students who share ideas and projects-in-progress with one another in order to get feedback and suggestions for further development. Collaboration and peer review help to set up students for success in the working world.

2. Pass it on

Divide the group into pairs. Introduce students to the concept of a pass-it-on-story, a Scratch project that is started by a pair of people, and then passed on to two other pairs to extend and reimagine. This allows students to experience collaboration in a real world context– emphasising on how to navigate the successes and challenges of working with other people; specifically the importance of communication to reach an end goal.

3. My Debug it!

Give students the opportunity to create their own debugging challenge for others to solve. Bugs can focus on a specific computational concept, Scratch block, interaction, or some other programming challenge. Encourage students to take inspiration from their own experiences of getting stuck and unstuck while developing Scratch projects.

- **Background STEM content**: [Describe in 1-2 paragraphs]

With the use of both Scratch and LEGO Spike Essential, students will be exposed to a variety of STEM content; communication, collaboration, inquiry based approaches, and problem solving to name a few. LEGO SPIKE Essential, designed for grades 1-5, offers an engaging STEM (Science, Technology, Engineering, and Mathematics) learning experience. The set combines LEGO bricks with coding software, allowing students to build and program their own creations. Through hands-on projects, children learn basic programming concepts, problem-solving skills, and creative thinking while exploring subjects like simple machines,

energy transfer, and data collection. Scratch offers an excellent platform for introducing STEM concepts to students in grades 3-5 through interactive, inquiry-based learning. Students can explore fundamental coding principles while creating animations, games, and stories that integrate science, technology, engineering, and math concepts. These principles encourage students to ask questions, experiment with different solutions, and learn through trial and error. As they work, students develop critical thinking and problem-solving skills while also practicing effective communication by sharing their projects, explaining their coding choices, and collaborating with peers. This approach not only builds STEM knowledge but also fosters creativity and digital literacy skills essential for future academic success.

- **Possible Lesson Ideas**: [What are some ideas for a lesson or two focused on the background STEM content?]

Taxi! Taxi!: creating a “Taxi” to get around obstacles using the LEGO Spike tools and the coding software to move the created vehicle.

Design Sprint: Using students' project ideas, they work independently on Scratch for a set of time to work on their projects, using trial and error, critical thinking, and problem solving skills.

- **<u>Description of Main Activity/Project</u>**: [Describe in 1-3 paragraphs]

The main project that will be done at the end of the year allows students to expand upon their creative computing skills by creating an open-ended project of their own design using scratch. In this project they will have the choice of integrating story telling (making a book into a movie) or creating a video game that involves math concepts at their specific grade level. This project-based approach aims to deepen their understanding of computational concepts such as sequences, loops, events, parallelism, conditionals, operators, and data. Additionally, students

will use the important computational practices including experimentation, testing, debugging, reusing, and remixing. By developing and presenting a personally meaningful project, students will demonstrate their grasp of these fundamental concepts and practices in a hands-on, engaging way!

The learning process will be structured around a continuous cycle of planning, making, and sharing. This approach encourages students to engage in meaningful reflection throughout their project development. Collaboration will play a large role, with students working in peer teams to share skills, while participating in multiple rounds of feedback. These collaborative experiences will not only enhance their project outcomes but also develop essential teamwork and communication skills.

- **Possible Activity/Project Ideas**: [What is the goal? What will students do? What is the timeline? At what point would students work in groups or individually?]

- The goal of this project is to use coding knowledge the students have learned to create a project that reflects this knowledge.
- Students will create a computing project on scratch based on their own interests to show their understanding of computational concepts. They will have two options to choose from, recreatring a story, or creating a video game that integrates math concepts.
- Students will have a "coding project week" where a majority of math and science time will be dedicated to design sprints and project check-ins.
- Students will be working in groups during the planning and sharing portions of the learning process, and independently during the making process, as each student will have their own project.

Section 3: Module Sequencing and Assessment – Required

- **Brief description of sequenced learning objectives**: [How do learning objectives build from lesson to lesson to meet the module goal?]

Students will:

- Learn computational concepts such as sequences, loops, events, parallelism, conditionals, operators, and data.

- Learn compuative practices to identify and fix errors in a program or algorithm to ensure it runs correctly.
- Use troubleshooting strategies on peers and own projects.
- Work Collaboratively.
- Create an individual project on Scratch.

- **Brief description of formative and summative assessment approaches**: [When/what techniques will you use to assess student progress towards objectives during and at the end of the module?]

  Formative assessments: Uploading all projects to our classroom studio, so I can go in to see if students are meeting objectives stated during the introduction and explanation of the lesson for Scratch. For example, for a lesson entitled “Debug it!” Students will be given a challenge to walk through an already created code and find the spot where something went wrong. I will then go in to check if they solved the bug. I will also walk around to see if students are finishing the problem using LEGO Spike Essential. At the end of each lesson, students will answer two reflection questions based on what they created.

  Summative assessments: Grading final presentations of projects created.

- **Recommendations for implementation**: [Describe any “safety tips” or advice you have for other educators who might implement this module, including logistical considerations.]

Logistical considerations:
1. Device compatibility: Ensure all devices (computers, tablets) meet the system requirements for running Scratch and the Lego Spike Essential software.

2. Software installation: Install the necessary software on all devices in advance. For Scratch, this may mean using the online version or installing the offline editor. For Lego Spike Essential, install the dedicated app.

3. Account management: Set up individual or class accounts for Scratch if you plan to save projects online.

4. Charging: Ensure Lego Spike Essential hubs are charged before each session. Set up a charging station if possible.

5. Internet access: Ensure reliable internet connectivity for online features of both platforms.

Safety tips:
1. Proper handling: Teach students to handle Lego pieces and electronic components carefully to avoid damage.

2. Small parts awareness: Remind students not to put small Lego pieces in their mouths or leave them on the floor.

3. Battery safety: Instruct students on the proper handling and charging of the Spike Essential hub's battery.

4. Online safety: If using Scratch online, teach students about appropriate online behavior and privacy considerations.

5. Supervision: Ensure adequate supervision, especially when students are working with electronic components or connecting the Spike Essential hub to computers.

Section 4: Module Files – Optional

- **List of attached files**: [should include any lesson plans and handouts relevant to the Module, if you have them ready]
    - https://education.lego.com/en-us/products/lego-education-spike-essential-set/45345/
      Lego Spike Essential product and some premade lesson plans
    - https://scratched.gse.harvard.edu/guide/curriculum.html
      Creative Computing Curriculum for Scratch.