Rising Waters: Engineering Solutions for the Real World

Approximately 10 45-minute class periods

Authors

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SUBJECT/GRADE LEVEL

Subject Area:

- Computer Science
- Science
- Engineering
- Mathematics
- Language Arts

Grade Level:

- Middle School
- High School

Materials

- Flood Detection with Flood Alarms
  - Climate Action Kit
    - https://forwardedu.com/pages/climate-action-kit
  - micro:bit V2
    - https://forwardedu.com/collections/micro-bits#Shop-microbits
  - Computer with access to Microsoft MakeCode
  - Watertight container
  - Water
- Flood Detection with Sump Pumps
  - Climate Action Kit
    - https://forwardedu.com/pages/climate-action-kit
  - micro:bit V2
    - https://forwardedu.com/collections/micro-bits#Shop-microbits
  - Computer with access to Microsoft MakeCode
  - Watertight container
  - Water
- Computer with Internet capability to access:
  - Wayground (formerly Quizizz) interactive videos and assessments
  - Online worksheets (Google Docs)
  - Concord Consortium

STANDARDS

Next Generation Science Standards

- 3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
- 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.
- 4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- 5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- 3-5 ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5 ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.
- HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Mathematics Standards | Common Core State Standards

- CCSS.MATH.MP.2: Reason abstractly and quantitatively
- CCSS.MATH.MP.4: Model with mathematics

English Language Arts Standards | Common Core State

- CCSS.ELA.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph,

or table).
- CCSS.ELA.RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g. in an equation) into words.
- CCSS.ELA.WHST.6-8/9-10/11-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes
- CCSS.ELA.SL.6-8.4: Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- CCSS.ELA.SL.9-10.4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- CCSS.ELA.SL.11-12.4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
- CCSS.ELA.SL.6-8.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and
- CCSS.ELA.SL.9-10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA.SL.11-12.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA.W.6-12.10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

CSTA Standards

- 1B-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-12 Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 2-CS-02: Design projects that combine hardware and software components to collect and exchange data.
- 2-AP-12: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
- 2-AP-17: Systematically test and refine programs using a range of test cases.
- 2-AP-18: Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.

- 2-AP-19: Document programs to make them easier to follow, test, and debug.
- 2-CS-01: Recommend improvements to the design of computing devices, based on analysis of how users interact with the devices.
- 2-IC-20: Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.

LESSON OBJECTIVE(S)

Students will be able to:

- identify potential natural and human causes of flooding based on prior knowledge and lived experiences.
- describe the general impact of flooding on people and communities.
- make personal connections to the risks and severity of flooding through a math-based reflection.
- collaborate with peers to brainstorm flood causes, effects, and prevention strategies.
- respond to multimedia prompts that introduce key flood-related vocabulary and concepts.
- identify and describe the key environmental and human factors that influence flood risk.
- analyze how environmental and human factors influence flood risks in different regions using a simulation model.
- interpret data from digital simulations and real-world case studies to identify trends in flood frequency, intensity, and impact over time.
- evaluate the effectiveness of flood mitigation in reducing damage to people, infrastructure, and the environment.
- construct an evidence-based explanation that predicts how flood risks and impacts may change over the next 100 years due to urbanization and climate change.

CAREER CONNECTION(S)

Mentor Background:

Joshua Church is the Acting Chief of the Software Engineering and Informatics Division at the U.S. Army Engineer Research and Development Center, Information Technology Laboratory (ERDC ITL), leading a team of 165. He holds degrees in Computer Science and Software Engineering from Mississippi State University. An award-winning specialist in scientific software development and computational analysis, with expertise in data science and machine learning, Mr. Church drives innovation and excellence. His leadership roles have included Chief of the ITL Scientific Software Branch and Acting Chief of the ITL Computational Analysis Branch, focusing on strategic initiatives, personnel management, and fostering team growth. He has also held leadership positions in professional organizations like ACM, dedicated to fostering camaraderie and professional development. Prior to ERDC, he researched virtual reality, human-computer interaction, and wireless sensor networks at MSU.

STEM Careers:

Career	Connection to Unit
Environmental Scientist	Understanding air and water quality systems
Data Analyst	Collecting, visualizing, and interpreting sensor data
IoT Systems Engineer	Designing smart devices with sensors and microcontrollers
Cybersecurity Analyst	Protecting networks and connected devices like Arduinos
Urban Planner	Monitoring infrastructure for flood risks and environmental health
Meteorologist	Using data from air sensors to model and predict atmospheric changes
Embedded Systems Engineer	Programming and building with Arduino or microcontrollers
Civil/Environmental Engineer	Applying sensor data to inform design decisions about drainage, air flow, and public safety
Computer Science Educator	Integrating technology into environmental topics for K–12 students

ENGAGEMENT

Brief Description:

Flooding is the most common global natural hazard, causing significant loss of life and property each year (Kuang & Liao, 2020). To launch this STEM-based unit, students will view and respond to two interactive videos hosted on Wayground. The first video presents recent news footage from summer 2025, highlighting the devastating floods in Kerr County, Texas. The second video is an introductory explainer for kids, covering what floods are, types and causes, and potential prevention strategies. The video concludes by encouraging students to think about how they could help manage floods, leading naturally into the Explore phase.

Procedures:

Teacher Actions

1. Anticipatory Prompt (1–2 minutes) Ask:
   "Imagine a river near your town suddenly rises and floods nearby areas. What natural and human factors might cause this? How could people prepare or prevent damage?"
2. Cause and Effect Brainstorm (5 minutes)
   - Distribute the Brainstorming Worksheet.
   - Have students list possible causes of floods (e.g., heavy rainfall, dam failure, deforestation, urban development).
   - In small groups, students connect causes to likely effects and possible prevention strategies.

- Ask groups to briefly share 1–2 examples with the class.

3. Interactive Videos (15–20 minutes total)
    - Share and display the links for the following interactive Quizizz videos:
        - Heavy Rain Returns to Texas After Recent Flooding (Summer 2025)
        - Understanding Floods and Their Causes (Intro Video)
    - Instruct students to complete each video independently, answering the embedded questions.
4. Administer Quiz
    - Use a Wayground quiz or separate assessment to check understanding.
5. Provide Reflection Worksheet
    - Share the Flood Reflection Worksheet and guide students through the multi-step activity.
6. Monitor & Support
    - Circulate or monitor virtually to assist students.
    - Provide feedback, clarify misunderstandings, and encourage deeper thinking.
7. Wrap-Up
    - Lead a short class discussion: "What's one thing that surprised you or stood out to you in the videos?"
    - Introduce the Explore phase, where students will investigate causes, impacts, and solutions in more depth.

Student Actions

1. Respond to the anticipatory question independently.
2. Complete the Cause-Effect-Prevention (Brainstorming Worksheet) in small groups.
3. Watch and interact with the following Wayground videos:
    - Heavy Rain Returns to Texas
    - Understanding Floods and Their Causes
4. Complete the Flood Reflection Worksheet
5. Take a short quiz.

Opportunities for Formative Assessment

- Observation of group collaboration and diagrams during brainstorming
- Student responses in Quizizz videos
- Flood Reflection Worksheet (written reflection)
- Quiz performance (formative)

Adaptations for Individual Learners

- Use Quizizz's "Read Aloud" or text-to-speech features
- Allow solo work for students who find group work challenging
- Provide visual vocabulary aids (e.g., images for rain, levee, floodplain)

- Offer extended time as needed
- Enable closed captions for all video content
- Accept oral responses or drawings for written tasks (especially with IEPs or ELLs)

Virtual Learning Options

- Share all Quizizz and worksheet links through Google Classroom, Microsoft Teams, or your LMS
- Use breakout rooms for group brainstorming
- Provide editable Google Docs versions of all worksheets
- Use Padlet or Figma for class-wide sharing and reflection
- Track student progress through Quizizz reports and follow up individually by chat or email

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EXPLORATION

Brief Description:

The Flood Module is designed to help students develop a deep understanding of the key factors that contribute to flood risk and impact. Through interactive simulations using the Flood Explorer model and real-world case studies, students examine how floods affect people and communities, explore the increasing dangers of frequent and severe flooding, and consider mitigation strategies.

The module centers on four core scientific factors: Precipitation, Topography, Permeability, and Water Table level, presented as the Flood Diamond. It also addresses human influences such as urban development, population growth in river cities, and mitigation efforts like dams and levees.

Using the Flood Explorer, students simulate rainstorms in a fictional Midwest river region in the past, present, and future. They adjust variables like storm duration and rainfall to observe river overflow, guided by terrain maps and cross-section stream gauges. These tools help students identify flood-prone areas and understand how urbanization affects flood risk. Real-world case studies complement the model, highlighting how floods impact people, infrastructure, and the environment.

Procedures:

Teacher Actions

Preparation:

1. Create a teacher account and class on the Concord Consortium (see associated guide).
2. Assign the Flood Risks and Impacts module to your class.
    - Pre-test: https://learn.concord.org/eresources/2338.run_resource_html?logging=true
    - Module: https://learn.concord.org/eresources/2517.run_resource_html?logging=true
    - Post-test: https://learn.concord.org/eresources/2337.run_resource_html?logging=true

Launching the Explore Phase:

1. Tell students they will begin the module independently: navigating five sequential units (45 minutes each).
2. Demonstrate how to login, access the module, and use the “Tap to Listen” audio feature.

3. Administer a pre-test to gauge baseline understanding.
4. Emphasize: work is individual but discussion in pairs/small groups is encouraged.
5. Monitor student progress, answer questions, and provide feedback throughout.

Reflection & Assessment:

1. Post a reflection question at the start and end of each unit (see below).
2. After completing all five units, administer the floods post-test to assess understanding.

Student Actions

1. Take the pre-test: Pre-Test
2. Complete all five units of the Flood Risks and Impacts module in order: Module
3. Respond to reflection questions before and after each unit (see attached document):
4. Take the post-test to demonstrate learning: Post-Test

Adaptations for Individual Learners

- Audio Support: Use the built-in "Tap to Listen" feature to assist students with reading difficulties or language barriers.
- Chunking Tasks: Allow students to complete one module per day or in shorter chunks, as needed.
- Guided Notes or Visual Aids: Provide a structured notes organizer or vocabulary organizer.
- Flexible Grouping: Pair ELLs or struggling students with peers for peer-supported navigation.
- Assistive Tech: Allow use of screen readers or browser extensions like Immersive Reader.
- Additional Time: Allow extended time for students who process content more slowly.
- All Concord Consortium content and documents are digital and accessible online, making it easy to implement in a virtual learning environment.

EXPLANATION

Brief Description: This activity introduces students to the BBC micro:bit and Microsoft MakeCode, focusing on basic coding principles and hands-on interaction with connected hardware. Students will explore how to program and control an LED ring, read data from a soil moisture sensor, and simulate controlling a sump pump based on sensor input. The activity emphasizes problem-solving, creativity, and real-world applications of microcontrollers in environmental monitoring and automation.

Procedures:

Background Information

The BBC micro:bit is a pocket-sized microcontroller designed for education. Using Microsoft MakeCode, a block-based programming platform, students can quickly create interactive programs without needing prior coding experience.

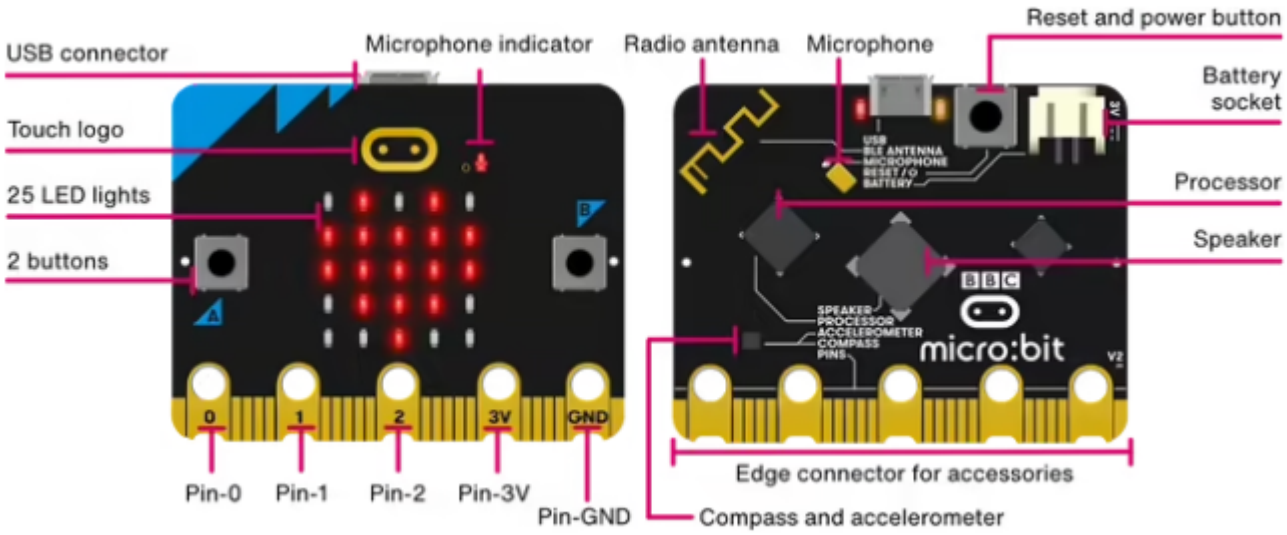
- **LED Ring:** A circular array of addressable LEDs that can display colors and patterns, often used for visual indicators.
- **Moisture Sensor:** Measures the water content in soil, providing real-time data that can be used for smart gardening or automation.

- **Sump Pump:** A real-world device used to remove water buildup—students will simulate controlling one with the micro:bit based on moisture levels.

Microbit Features:

The microbit is capable of a wide range of applications and is accessible with an easy approach to programming, both text and block methods for various age groups.

Here is a picture of the features with labels and a more detailed description listed below.



Front:

- **25 LED Lights Matrix** – Displays images, text, and patterns based on program logic and sensors
- **2 buttons (A & B)** – For user inputs like clicks or combinations.
- **Microphone & LED Indicator** – Detects sound levels; indicator shows when it's active.
- **Touch logo** – Can be used as a touch button along with the A and B buttons.
- **Pins (Edge Connector)** – Exposed gold contacts for connecting to circuits and accessories which many suppliers provide various sensors and components that will use the edge pins or it can be used individually with alligator clips.

Back:

- **Processor & Accelerometer** – Handles programs and senses movement/tilt.
- **Compass (Magnetometer)** – Detects magnetic direction and fields.
- **Reset Button** – Quickly restarts the program.
- **USB Port** – Used for power and uploading code.
- **Battery Connector** – Powers the micro:bit when not plugged into USB.
- **Radio & Bluetooth** – Enables wireless communication between micro:bits and other devices.

- **Speaker** – Plays tones, sound effects, and music.

For a more detailed description of the micro:bit components follow this link: https://microbit.org/get-started/features/overview/ (The image above was taken from the same URL)

Teacher Actions:

1. **Introduction (10–15 minutes):**
    - Briefly explain what a microcontroller is and show the micro:bit.
    - Introduce Microsoft MakeCode (https://makecode.microbit.org) and demonstrate how to write a simple program (e.g., displaying text on the micro:bit screen).
    - Discuss real-world applications of sensors and automation (e.g., smart gardens, flood prevention).
2. **Hardware Overview (10 minutes):**
    - Show the LED ring, moisture sensor, and a mock sump pump setup.
    - Use the LED Ring tutorial and Moisture Sensor tutorial to demonstrate connections and functions.
3. **Guided Coding Activity (20–30 minutes):**
    - Walk students through building a MakeCode program that:
        - Displays a visual pattern on the LED ring.
        - Reads and displays moisture levels on the micro:bit screen.
        - Triggers a "sump pump" action (simulated with a servo or simple output signal) when moisture levels exceed a set threshold.
4. **Student Work Time (15–30 minutes):**
    - Students modify their code to create different LED patterns, set their own thresholds for moisture levels, and customize how the sump pump is triggered.
    - Encourage them to explore extensions (e.g., using the LED ring as a dynamic moisture indicator).
5. **Discussion & Reflection (10 minutes):**
    - Have students share their projects and discuss how these technologies could be used in environmental or agricultural applications.

Student Actions:

- Engage in hands-on coding with MakeCode.
- Connect the micro:bit to the LED ring and moisture sensor.
- Test and troubleshoot their programs.
- Reflect on how the setup can be adapted for real-world problem-solving.

Formative Assessment Opportunities:

- **Check for Understanding:** Ask students to explain what each block in their program does.
- **Quick Demos:** Have students run their code and describe how the micro:bit responds to changing moisture levels.
- **Reflection Questions:** "How could this setup be used in a community garden?" "What would you change to make it more reliable?"

Adaptations:

- **Individual Learners:** Provide pre-built code snippets for students who need extra support.
- **Advanced Learners:** Challenge students to add data logging.
- **Virtual Options:** Use the MakeCode simulator for students without hardware access; provide recorded demos of sensor readings and outputs.

Links to the are some resources to get you started:

https://learn.forwardedu.com/led-ring/

https://learn.forwardedu.com/moisture-sensor/

https://learn.forwardedu.com/course/sump-pump/

ELABORATE

Students will explore how technology can mitigate the impacts of flooding through two hands-on design challenges.

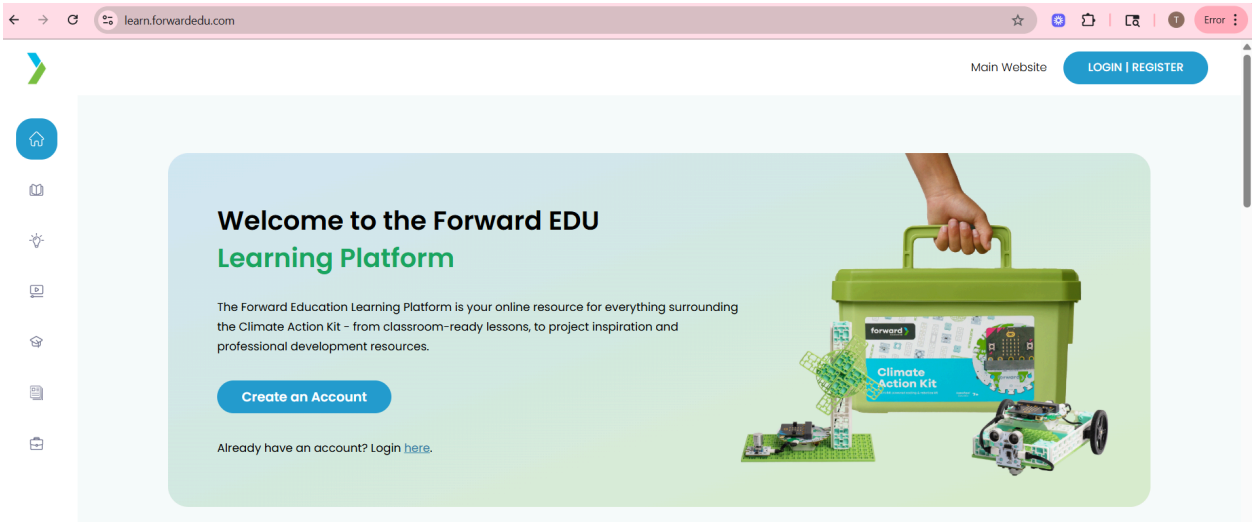
- **Flood Detection with Flood Alarms:** Students examine how climate change increases flood risk for communities near bodies of water. They identify benefits of flood alarm systems and build a working model using moisture sensors to detect rising water levels and trigger community alerts for safe evacuation.

- **Flood Protection with Sump Pumps:** Students investigate flooding caused by extreme weather and learn how sump pump systems function. Using the Climate Action Kit, they design and build an automated sump pump prototype that uses sensors and code to respond to rising water. Students test the effectiveness of their designs and propose improvements.

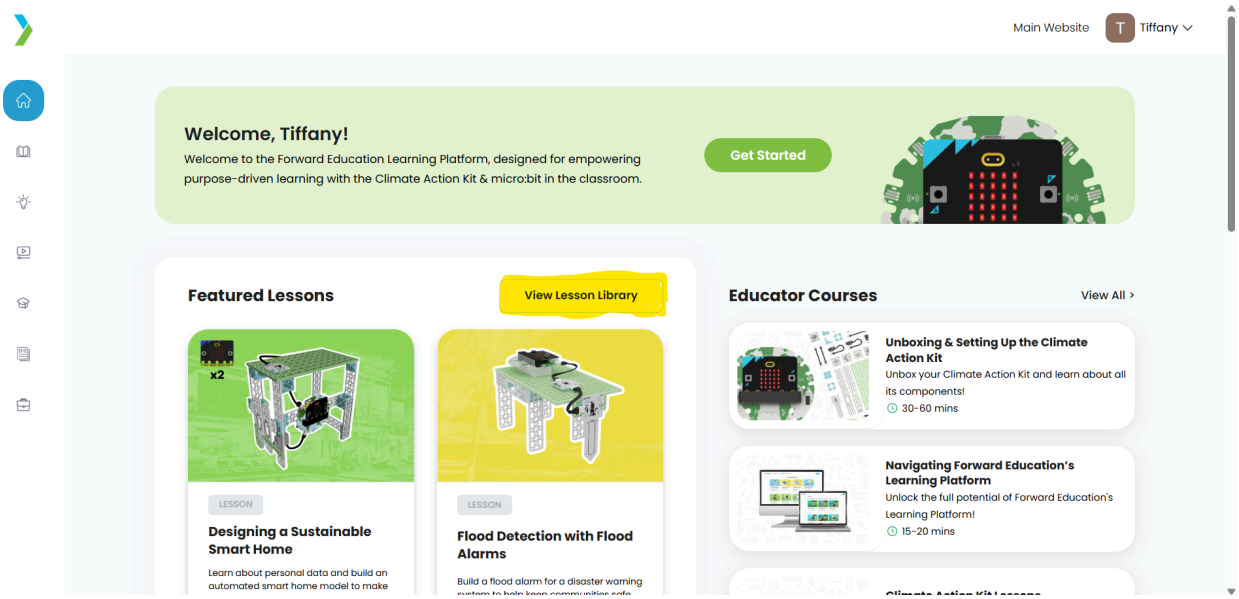
Together, these projects highlight the intersection of environmental science, engineering, and coding in developing solutions for real-world climate resilience.

Forward Education

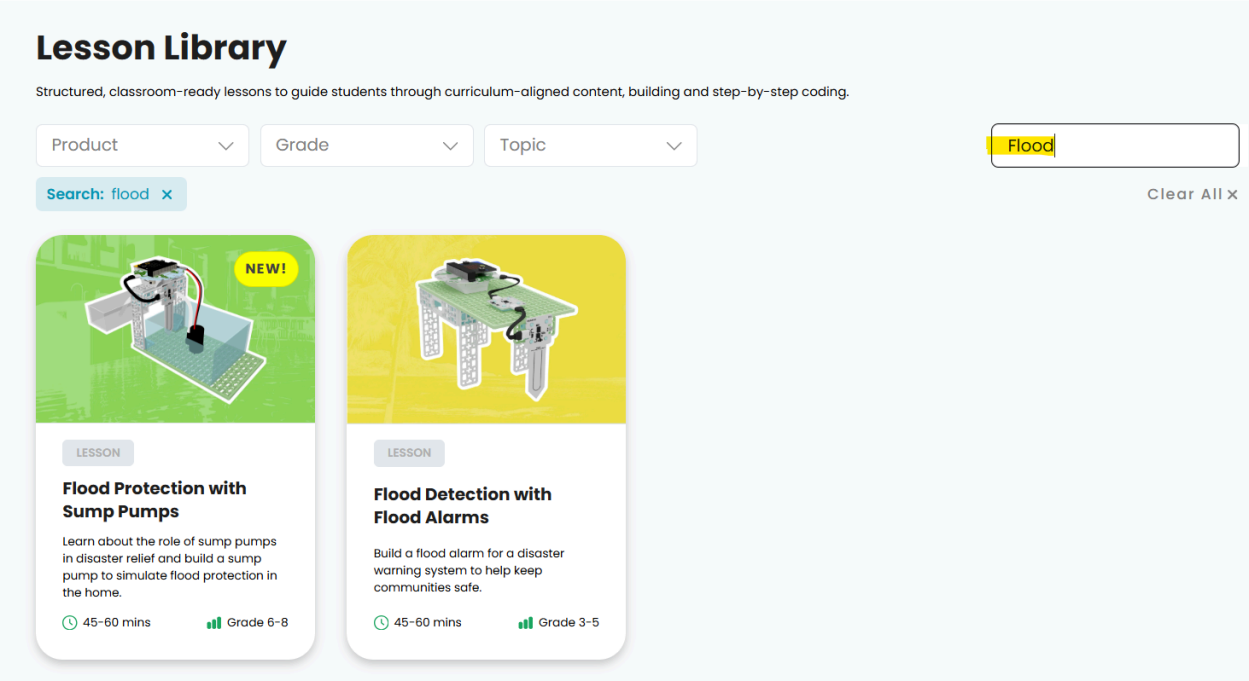
1. Go to the following website: https://learn.forwardedu.com/
2. Create a free educator account
    a. If you already have an educator account Login.



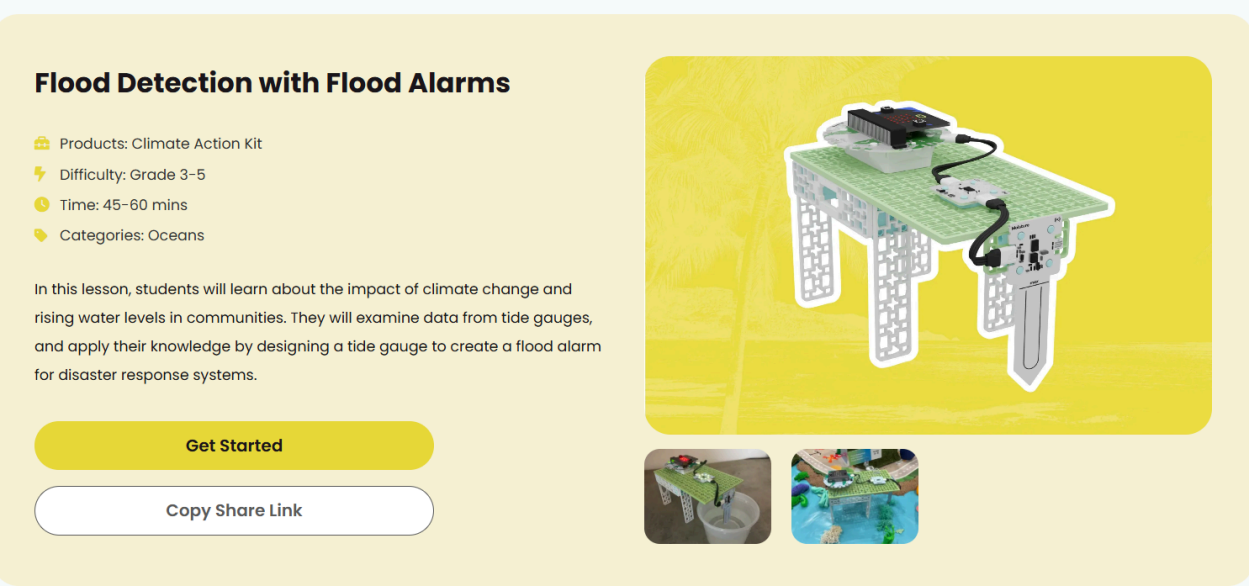
3. Click on View Lesson Library.



4. In the search bar of the Lesson Library type “Flood”



5. This will narrow down the search to lessons pertaining to floods.
6. We will focus on the Flood Detection with Flood Alarms lesson first.



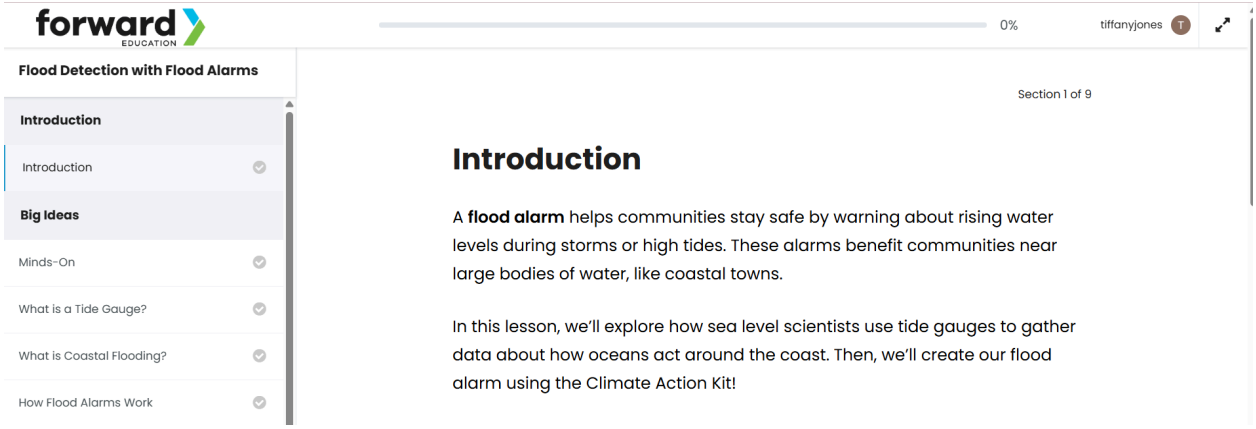
Flood Detection with Flood Alarms

Learning Goals

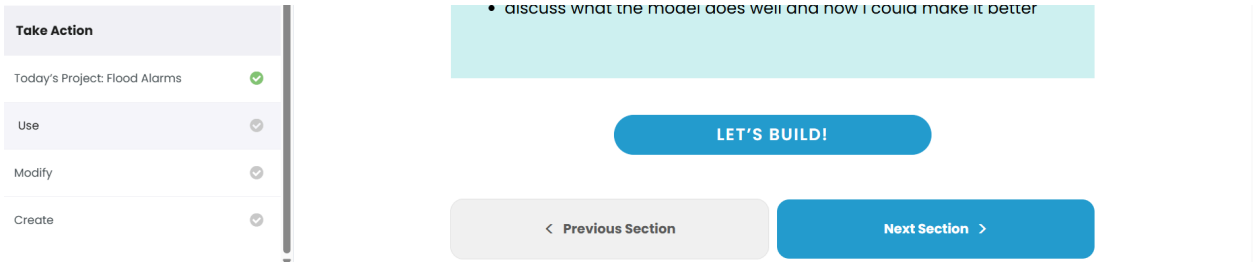
- Describe the influence of climate change on communities near bodies of water
- Identify at least three benefits of flood alarm systems
- Build a flood alarm model that:
    - uses a moisture sensor to detect the water level of a tide

- triggers an alert to communities when excessive water is detected, so people can evacuate safely

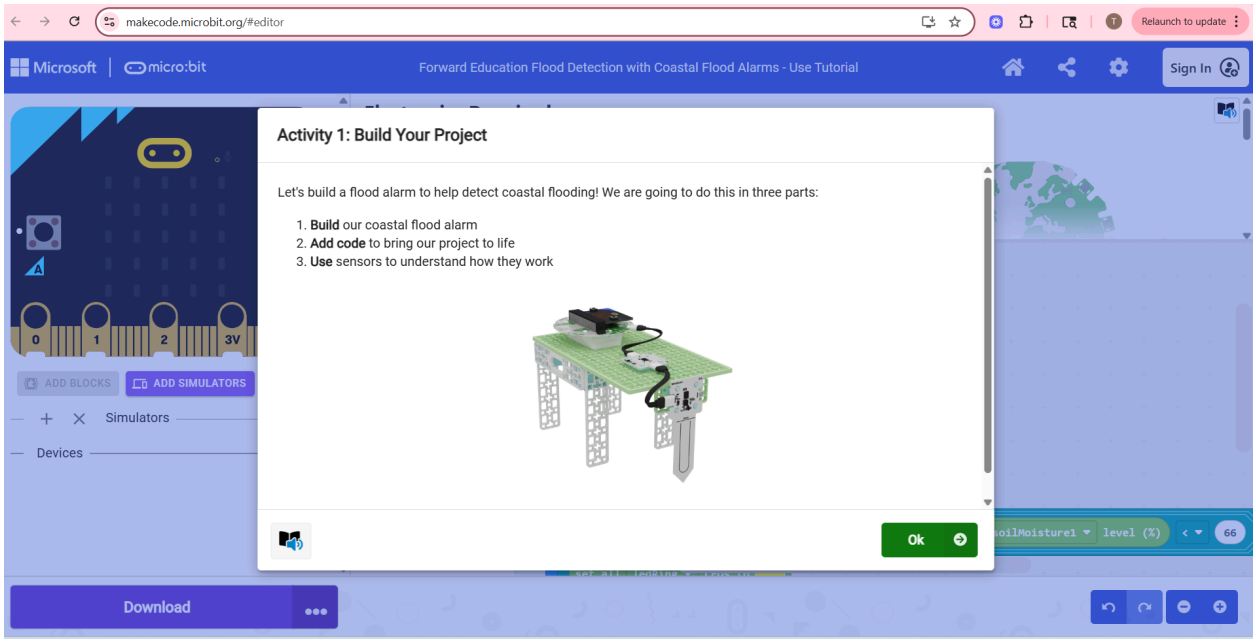
1. You can access the activity from the Forward Education Lesson Library or directly using this link: https://learn.forwardedu.com/student_view/YO4NHKL9/
2. Click on the Get Started button. This will take you to the lesson that introduces the topic and concept.



3. Familiarize yourself with lesson
4. You will build the Flood Alarm project when you get to the Take Action section of the lesson:

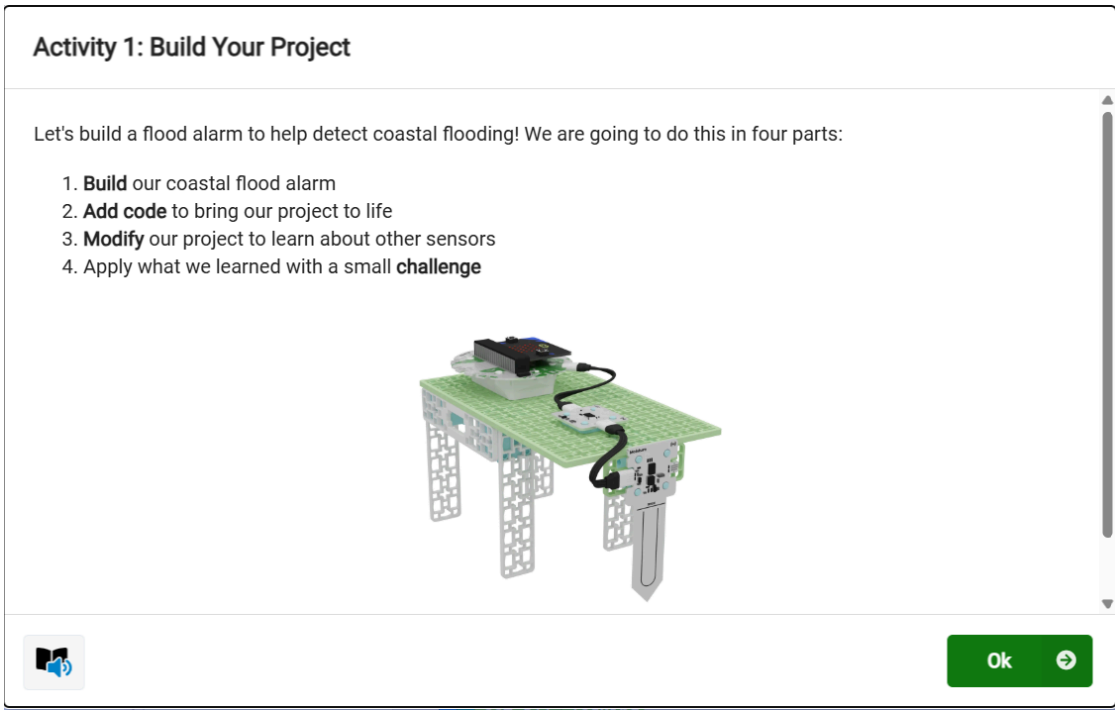


In the section titled USE click on the LET'S BUILD button to open the project in Microsoft Makecode.



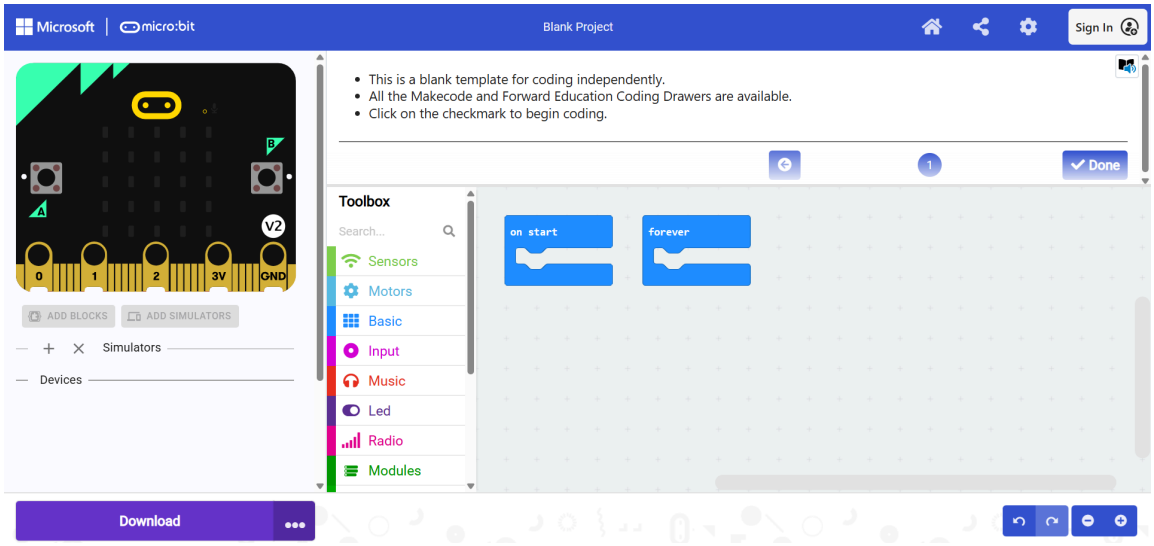
This screen will open in a new window.

5. Students will follow a tutorial to build and test a flood alarm model that detects tide levels on a dock.
    a. Learning Goals:
        i. I can:
            1. Build a flood alarm model using the Climate Action Kit
            2. Name and describe the main parts of my model
            3. Explain how the model senses the tide level
            4. Discuss what the model does well and how I could make it better
6. Next students will move to the MODIFY phase.
7. In the section titled MODIFY click on the LET'S BUILD button to open the project in Microsoft Makecode.



8. Students follow a tutorial to add two new alerting features to their flood alarm.
    a. Learning Goals:
        i. I can:
            1. Build a flood alarm model using the Climate Action Kit
            2. Change the code to add new features, like sound or light signals that tell communities when a flood is coming
9. Next students will move to the CREATE phase.
10. In the section titled CREATE click on the LET'S BUILD button to open the project in Microsoft Makecode.

    Note: This will open a blank Makecode environment without any starter code. Students are expected to use what they have learned in the USE and MODIFY phases of the activity to create their own flood alarm.



11. Students work in small groups to design, build, and code their own flood alarm model.
    a. Learning Goals:
        i. I can build a flood alarm model with the Climate Action Kit that is physically sturdy and keeps electronic components dry.
        ii. and uses:
            1. sensors to detect the tide level at a dock
            2. sounds, lights, or graphs to send alerts
            3. comparisons (\<, \=, \>) to make decisions

Use the following criteria to assess student learning.

Conversations

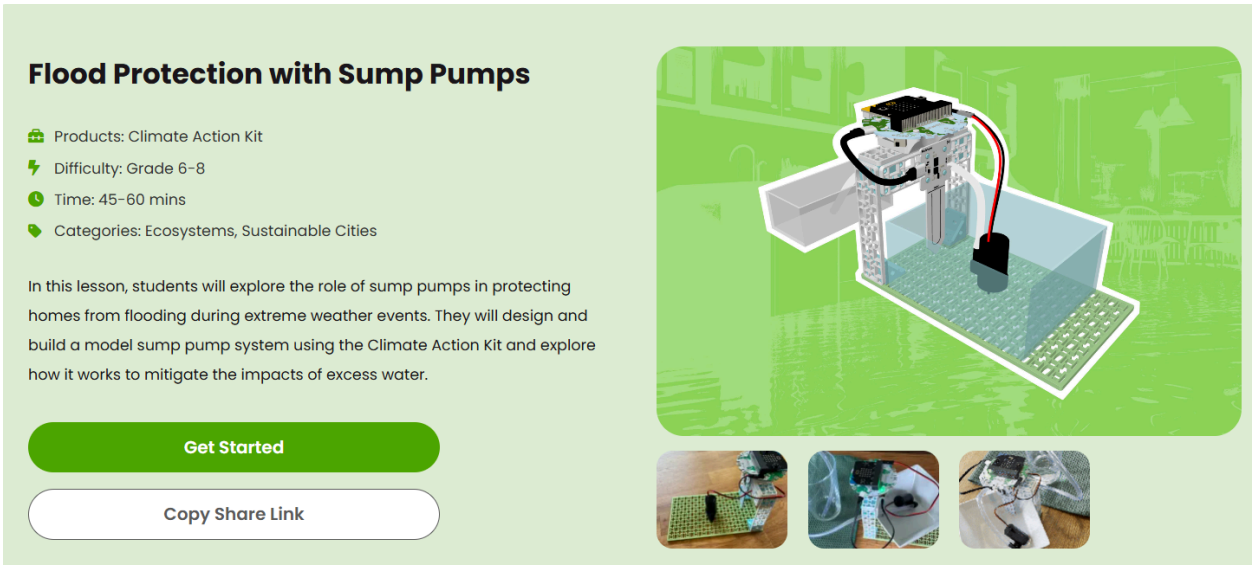
1. Can students explain the features of a tide gauge or flood alarm?
2. Can students explain the sea level scientist's role in tide data collection?
3. Can students communicate the flooding risks for communities and explain how technology can help solve these problems?
4. Can students explain how the sensors and alerts work in their model? (Use, Modify, Create)
5. Can students explain how fractions (⅓) and comparisons (<,=,>) help make their flood alarm function?

Observations

1. Do students methodically test and debug their model? (Modify, Create)
2. Do students make predictions about what certain segments of the code are responsible for and test those predictions? (Use, Modify)

Products

1. Students annotate their code to explain how it works (Use, Modify, Create)
2. Students add their events to trigger output (Modify, Create)
3. Students break down problems into smaller subproblems (Modify, Create)
4. Student-created models meet the design criteria outlined in the lesson (Create)

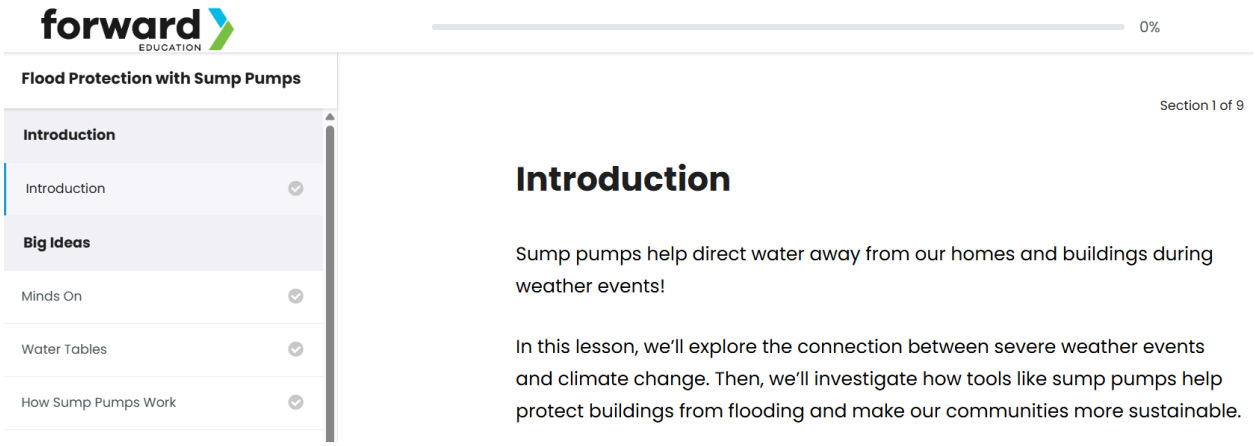


Flood Protection with Sump Pumps

Learning Goals:

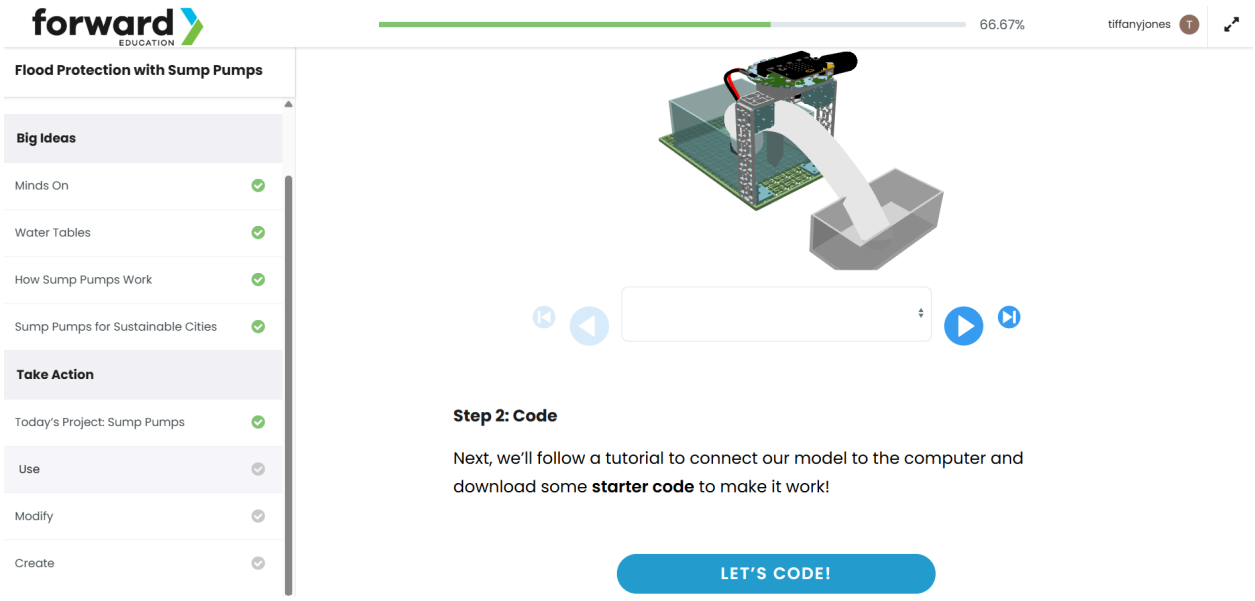
- Explain the causes and impacts of flooding during extreme weather events.
- Describe the function and components of a sump pump system.
- Design and build a model sump pump system using the Climate Action Kit.
- Use sensors and code to automate the activation of the sump pump in response to rising water levels.
- Analyze the effectiveness of their design and propose improvements.

1. You can access the activity from the Forward Education Lesson Library or directly using this link: https://learn.forwardedu.com/student_view/MF2MEE45/
2. Click on the Get Started button. This will take you to the lesson that introduces the topic and concept.

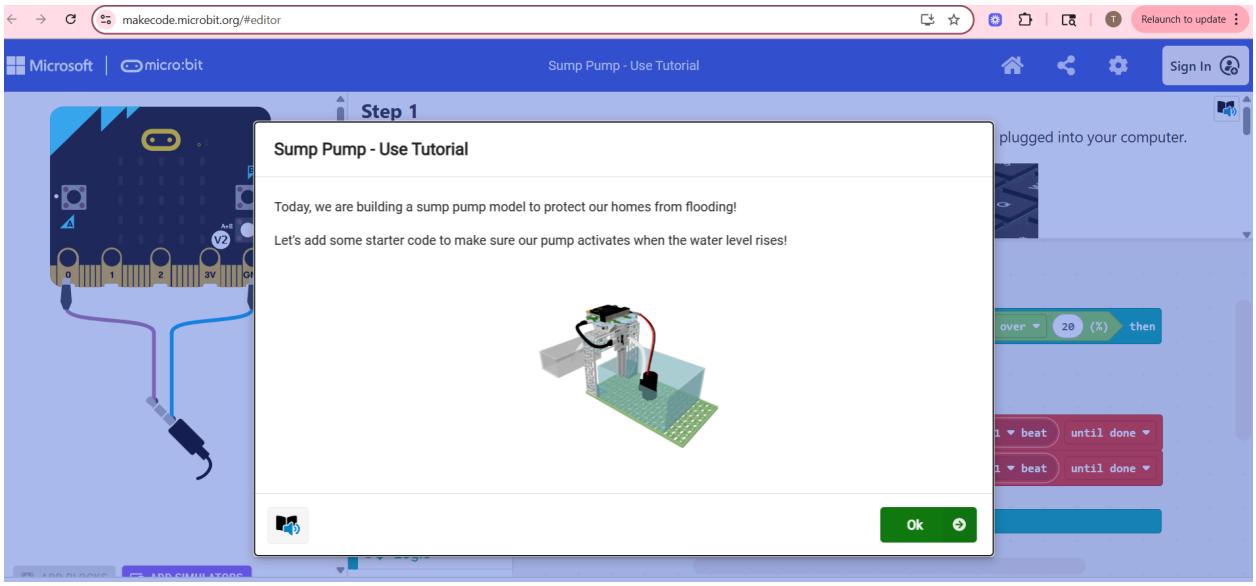


3. Familiarize yourself with lesson

4. You will build the Flood Protection with Sump Pumps project when you get to the Take Action section of the lesson:



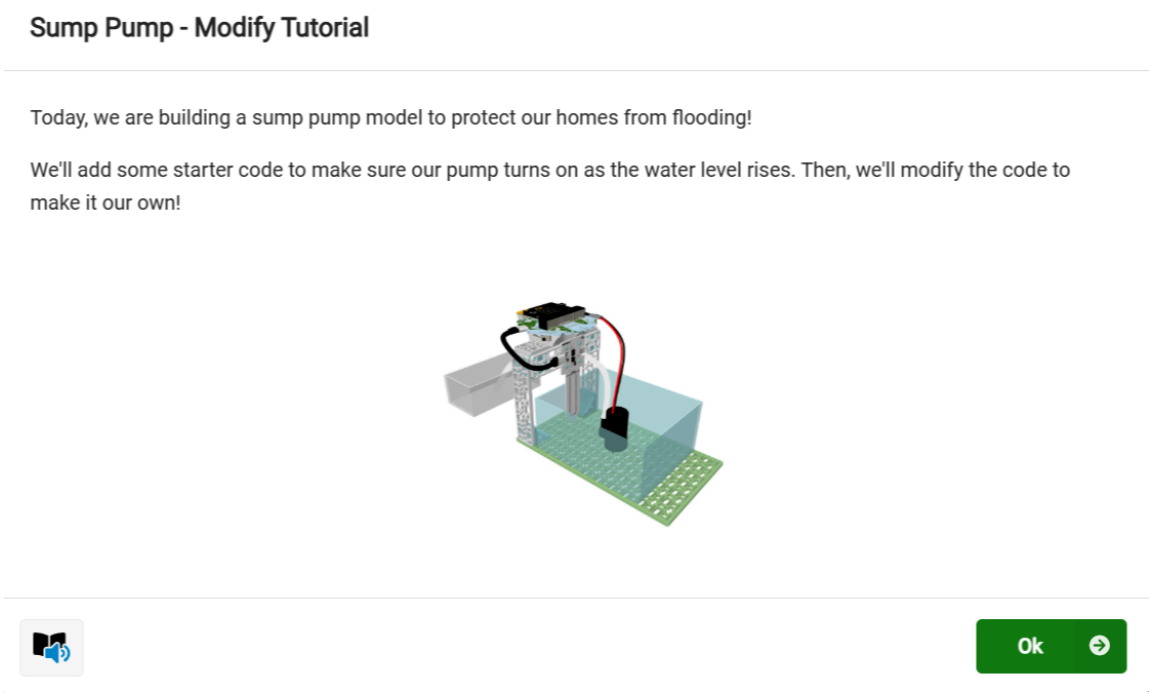
5. In the section titled USE click on the LET'S CODE button to open the project in Microsoft Makecode.



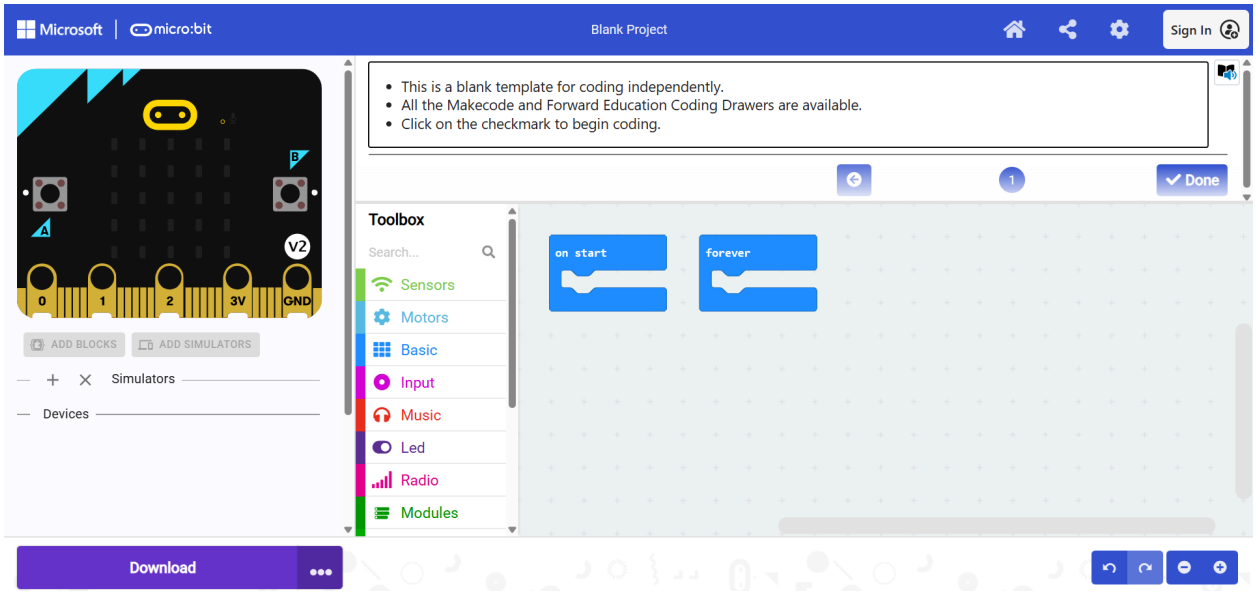
This screen will open in a new window.

6. Students follow a tutorial to build and test a sump pump model to detect rising water levels in a home.
    a. Learning Goals:
        i. I can:
            1. Build a model to represent the parts of a sump pump in a home
            2. Activate the pump by changing the water level.
            3. Explain why the pump turns on when the water level is high
7. Next students will move to the MODIFY phase.

8. In the section titled MODIFY click on the LET'S CODE button to open the project in Microsoft Makecode.



9. Students will follow a tutorial to build their sump pump model and enhance its behaviour with more advanced programming concepts.
    a. Learning Goals:
        i. I can:
            1. Build a model to represent the parts of a sump pump in a home
            2. Modify how long my pump runs when it is triggered
            3. Change the water level threshold that triggers the pump
            4. Add visual or audio indicators that play while the pump is running
10. Next students will move to the CREATE phase.
11. In the section titled CREATE click on the LET'S BUILD button to open the project in Microsoft Makecode.



Note: This will open a blank Makecode environment without any starter code. Students are expected to use what they have learned in the USE and MODIFY phases of the activity to create their own flood alarm

12. Students will create a sump pump that removes water from the basement and relocates it to the yard.
    a. Learning Goals:
        i. I can build a sump pump model using the Climate Action Kit that is: :
            1. portable
            2. uses at least one sensor to detect water levels
            3. uses the water pump to relocate water from one container to another
            4. includes visual cues to improve usability

Use the following criteria to assess student learning.

Conversations

1. Can students describe the relationship between extreme weather events and climate change?
2. Can students describe the parts that make up a sump pump?
3. Can students explain a plumber's role in disaster management within a city or urban environment?
4. Can students explain how the sensors work in their model? (Use, Modify, Create)

Observations

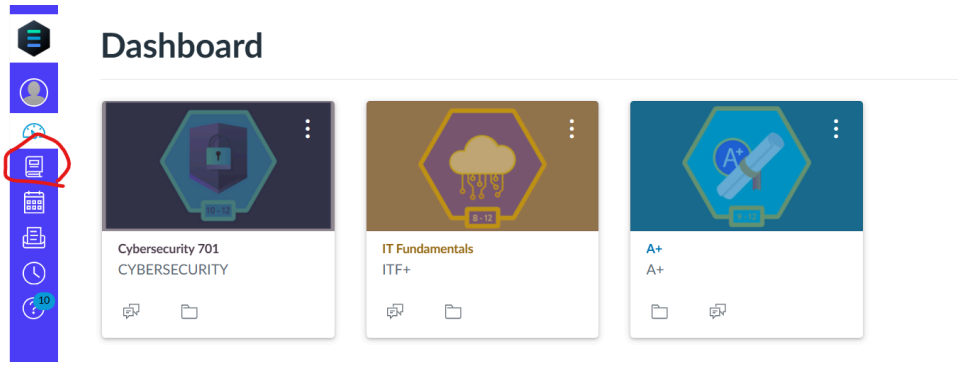
1. Do students methodically test and debug their model? (Modify, Create)
2. Do students make predictions about what certain segments of the code are responsible for and test those predictions (Use, Modify)

Products

1. Students annotate their code to explain how it works (Use, Modify, Create)
2. Add to the model to improve the functionality of the sump pump model (Modify)
3. Student-created models meet the design criteria outlined in the lesson (Create)

Malpasset Dam Activity (Cyber.org)

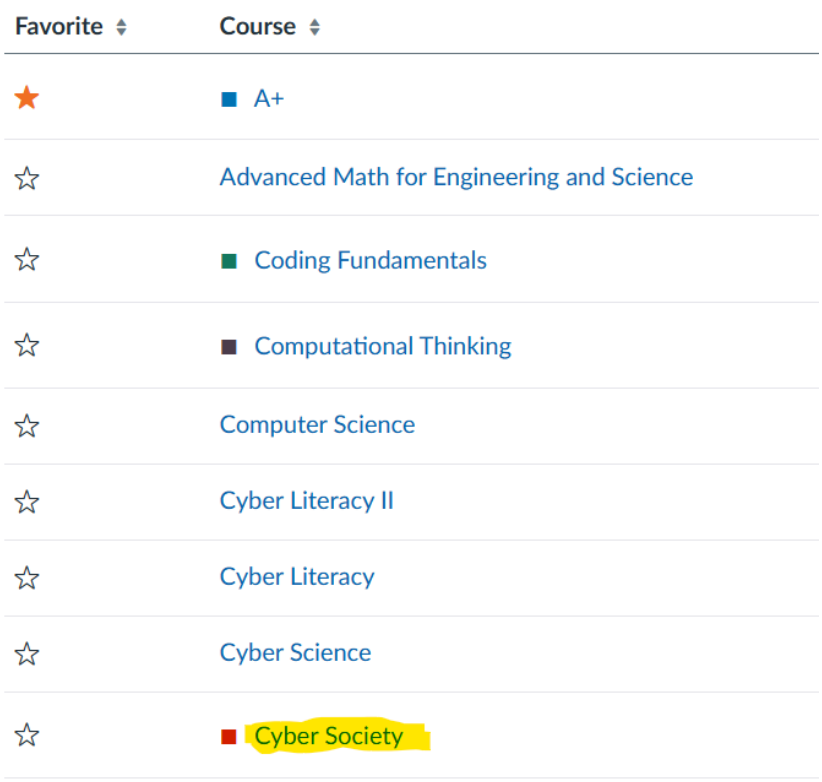
1. Create a free educator account on the cyber.org website.
2. On your dashboard click on the Icon labeled “Courses”



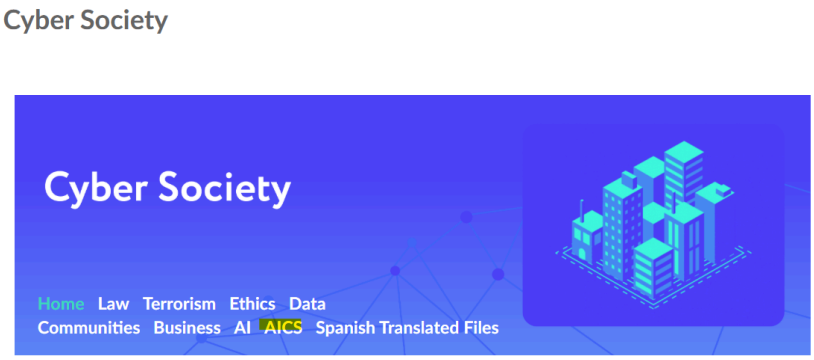
3. Click on All Courses



4. Click on Cyber Society
    a. If you click on the star icon and Favorite the Course it will be visible on your Dashboard.



5. Click on AICS



6. Navigate to Module 5: Malpasset Dam

Module 5

Malpasset Dam

A mechanical failure causes a large hydroelectric dam in France to open and flood the region.

Lesson 0

Teacher Notes

Lesson 1

Teacher Notes
News video
Briefing One Folder

Lesson 2

Teacher Notes
Briefing Two Folder

Lesson 3

Teacher Notes
Briefing Three Folder

Lesson 4

Teacher Notes
Presentation Rubric

a. All Resources and activities for this activity will be found here.

EVALUATION

The Flood Engineering Unit includes multiple opportunities to check for understanding across all phases. Each phase integrates formative assessments through reflection questions that encourage critical thinking and provide insight into student comprehension:

- In the Engage phase, reflection questions appear at both the beginning and end to prompt discussion and assess students' initial and developing understanding.
- The Explore phase includes open-ended reflection questions at the end of each module within the Concord Consortium activities. These questions promote critical thinking and allow instructors to monitor individual student progress.
- Both the Engage and Explore phases also conclude with summative assessments to gauge overall understanding of the content.
- The Explain phase features additional formative assessments through reflection questions and includes a summative quiz and a mini-project to evaluate learning.
- In the Elaborate phase, students engage in the Malpasset Dam activity from Cyber.org, which includes built-in assessment components. Additionally, students will complete a final project where they apply their knowledge to solve a real-world problem. This culminating task will be

assessed using a rubric to evaluate students' depth of understanding, application of content, and overall synthesis of what they have learned throughout the unit.

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