Integrating Curricular Resources into CS Classrooms

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U.S. Department of Education, Education Innovation & Research Award

Extending the Computer Science Pipeline

Enhancing Rigor and Relevance in Middle School Computer Science

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"Extending the Computer Science Pipeline" is a research grant from the USDOE. Rutgers University will work alongside middle schools in New Jersey towards authentic, rigorous, and engaging CS education programs. The Rutgers EIR project provides technical assistance (TA) to middle school teachers and administrators to define educational goals and initiatives, co-create implementation plans, and carry out meaningful changes to CSE. The project both creates a blueprint for school partnerships and supports and works to broaden participation of underserved student populations.

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Setting the Scene

Finding Resources

Integrating Curricular Resources into CS Classrooms

Resource Functions

Replacing, Adding, Changing

A piece of a lesson

An entire lesson

A sequence of lessons

An entire course!

Providing Supplemental Resources

A modified version of a lesson

An extension activity

An assignment option

...to meet an identified need!

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Many Resource Types

- Lesson plans
- Worksheets
- Short activities
- Slides
- Projects
- Units
- Course Curricula
- Videos
- Examples
- Guest Speakers

Where do you find resources?

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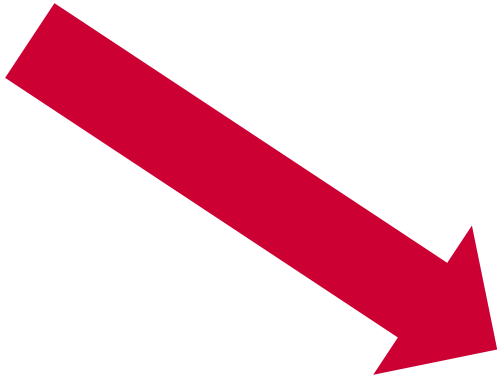
Other Sources to Consider

Rutgers EIR Resource Library	New Jersey Computer Science Hubs	Computer Science Teachers Association (CSTA/NJ)
Curriculum Providers	Colleagues! (Social Media, Cafeteria, Hallways)	CS Unplugged
State Resources & Webinars	CS4NJ Coalition & Google Group	Conferences, Summits, Meetings

Selecting Resources

Integrating Curricular Resources into CS Classrooms

Resources are abundant!



You can be picky!

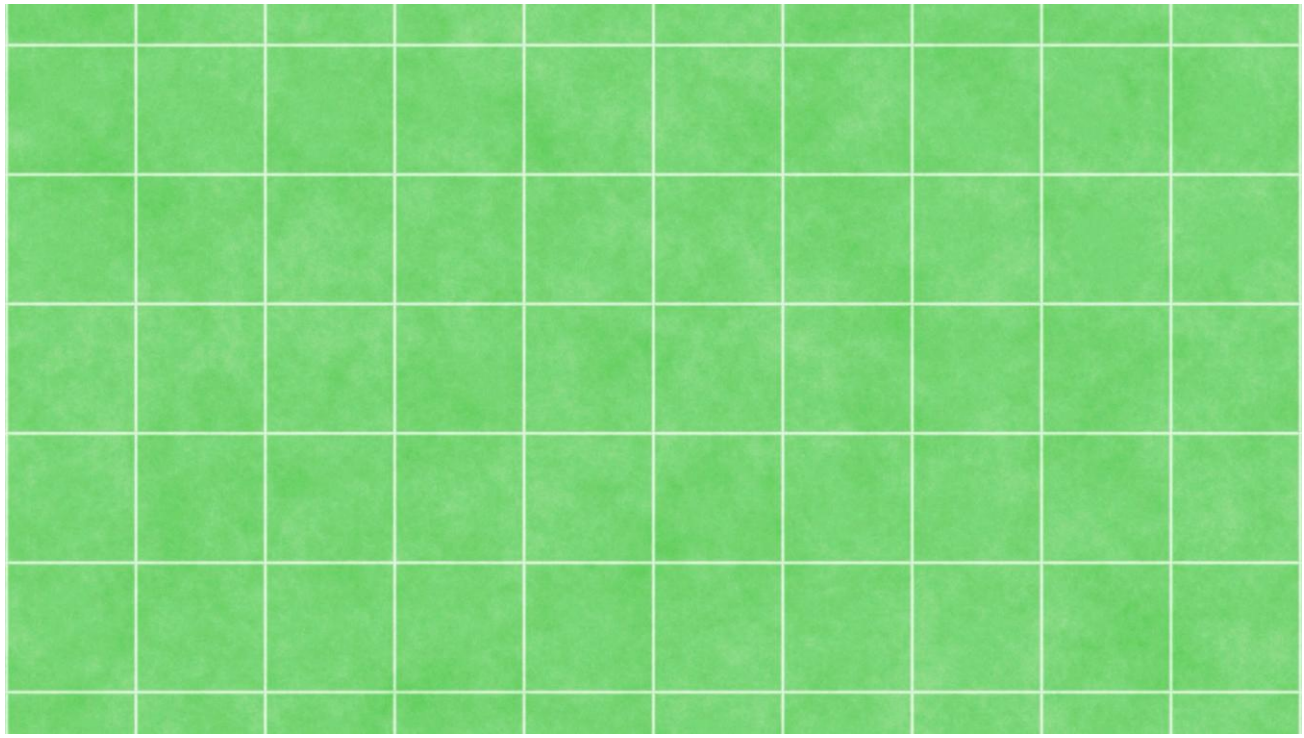
Selection Factors

Logistic	Content	Context
• Materials and equipment • Device compatibility • Lesson & class duration • Prep time • **Grades/assessments** • Cost	• Difficulty of content • Familiarity with content • Alignment with learning goals/standards • **Enduring understandings**	• Backward and forward connections • **Examples used** • Instructional methods used • Compatibility of activities

What did we miss?

VIGNETTE

Selecting the right VEX Solution



HIGHLIGHT

Selecting (some of) Code.org Curriculum

The situation:

- Middle school technology & CS course
- Tight course schedule (every other day, one marking period, 37 minutes per class)
- Small space; no room for equipment
- Several curriculum changes over the past 5 years
- Many multi-lingual learners; many struggle with reading directions

Educator goals:

- Provide 8th graders with something exciting before moving to HS
- Include everyone, knowing incoming 8th graders have gotten different combinations of content recently

Decision:

- Two chapters of Code.org AI & ML Unit; typically 1150 minutes, only have 900
- Modify most lessons, extend activities, remove others

Full-Year Implementation

If teaching the course as a full year, we recommend teaching the units in the order they appear in the curriculum, which is also presented below. The following pacing guide gives a rough recommendation for unit length, assuming the class meets five days a week for at least 45 minutes per session.

Semester 1	Problem Solving & Computing	
	Chapter 1 — 180 minutes (~1 week)	Chapter 2 — 405 minutes (~2 weeks)
Semester 2	The Design Process	
	Chapter 1 — 405 minutes (~2 weeks)	Chapter 2 — 720 minutes (~3-4 weeks)

Focus on Creativity

Problem Solving & Computing		Web Development		Interactive Animations and Games		Creating Apps with Devices	
Chapter 1 — 180 minutes (~1 week)		Chapter 1 — 765 minutes (~3-4 weeks)	Chapter 2 — 540 minutes (~3 weeks)	Chapter 1 — 945 minutes (~4 weeks)	Chapter 2 — 630 minutes (~3 weeks)	Chapter 1 — 640 minutes (~3 weeks)	Chapter 2 — 675 minutes (~3 weeks)

Focus on Hardware

Problem Solving & Computing		Data and Society	Creating Apps with Devices	
Chapter 1 — 180 minutes (~1 week)	Chapter 2 — 405 minutes (~2 weeks)	Chapter 1 — 360 minutes (~2 weeks)	Chapter 1 — 640 minutes (~3 weeks)	Chapter 2 — 675 minutes (~3 weeks)

Focus on Data

Problem Solving & Computing	Data and Society		AI and Machine Learning	
Chapter 1 — 180 minutes (~1 week)	Chapter 1 — 360 minutes (~2 weeks)	Chapter 2 — 540 minutes (~2-3 weeks)	Chapter 1 — 675 minutes (~3 weeks)	Chapter 2 — 450 minutes (~2 weeks)

Focus on Design with Purpose

Problem Solving & Computing		Web Development		The Design Process		Creating Apps with Devices	
Chapter 1 — 180 minutes (~1 week)		Chapter 1 — 765 minutes (~3-4 weeks)	Chapter 2 — 540 minutes (~3 weeks)	Chapter 1 — 405 minutes (~2 weeks)	Chapter 2 — 720 minutes (~3-4 weeks)	Chapter 1 — 640 minutes (~3 weeks)	Chapter 2 — 675 minutes (~3 weeks)

Focus on Coding

Problem Solving & Computing		Web Development		Interactive Animations and Games		Creating Apps with Devices	
Chapter 1 — 180 minutes (~1 week)		Chapter 1 — 765 minutes (~3-4 weeks)	Chapter 2 — 540 minutes (~3 weeks)	Chapter 1 — 945 minutes (~4 weeks)	Chapter 2 — 630 minutes (~3 weeks)	Chapter 1 — 640 minutes (~3 weeks)	Chapter 2 — 675 minutes (~3 weeks)

Focus on Impact in Society

Problem Solving & Computing		The Design Process		Data and Society	AI and Machine Learning	
Chapter 1 — 180 minutes (~1 week)		Chapter 1 — 405 minutes (~2 weeks)	Chapter 2 — 720 minutes (~3-4 weeks)	Chapter 2 — 540 minutes (~2-3 weeks)	Chapter 1 — 675 minutes (~3 weeks)	Chapter 2 — 450 minutes (~2 weeks)

Using Resources

Integrating Curricular Resources into CS Classrooms

Adapt, adapt, adapt!

Adjust the structure

- Combine multiple resources into one
- Re-order the concepts/activities in a lesson
- **Change the timing (within a lesson, across multiple classes)**

Adjust the content

- **Swap out examples with more relevant ones**
- Add a throwback/highlight to a previous concept
- Highlight a concept that will be explored later

Adjust the pedagogy

- Add a class demonstration
- Add scaffolding mechanisms (partial solutions, hints)
- Change how an activity is run (make collaborative, pair programming)
- **Infuse cooperative learning, opportunities to debrief, reflections**

What did we miss?

VIGNETTE

Creating an AI Lesson 0

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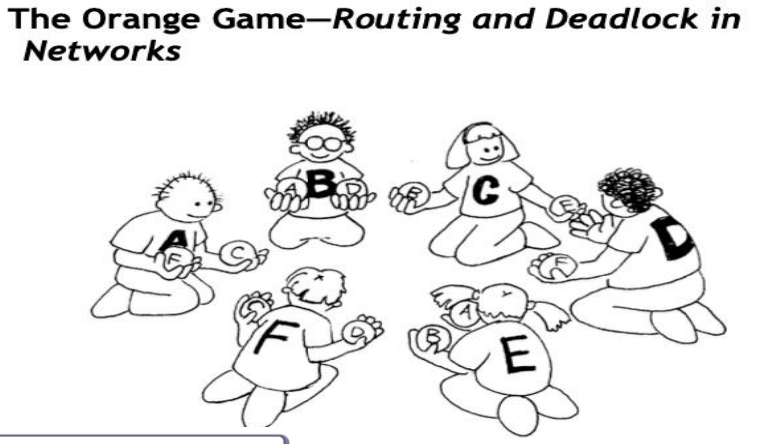
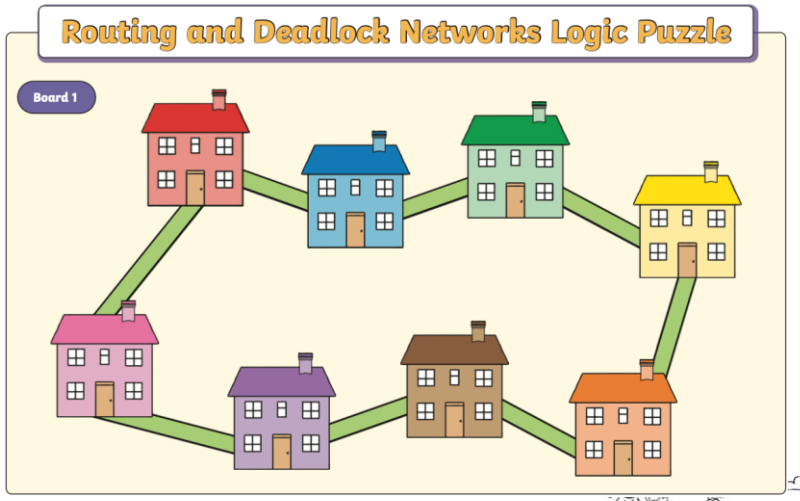
HIGHLIGHT

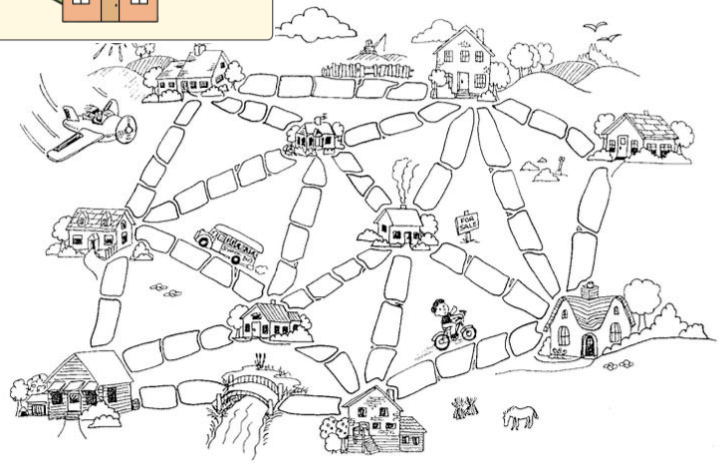
Assembling a Routing Lesson

- Hands-on way to introduce routing and deadlock (networking concepts)
- Adapted several activities:
  - The Orange Game, CS Unplugged
  - Mail Game, TPT
  - Muddy City, CS Unplugged
- Needed “glue”
  - Debrief discussions and reflections
  - Explicit connections to the CS concepts and real-world applications
  - Used cooperative learning structures to keep all students engaged

Product: introduces CS concepts in a hands-on way, ensures students understand relevance of activity to topic, and connects to lessons around it!







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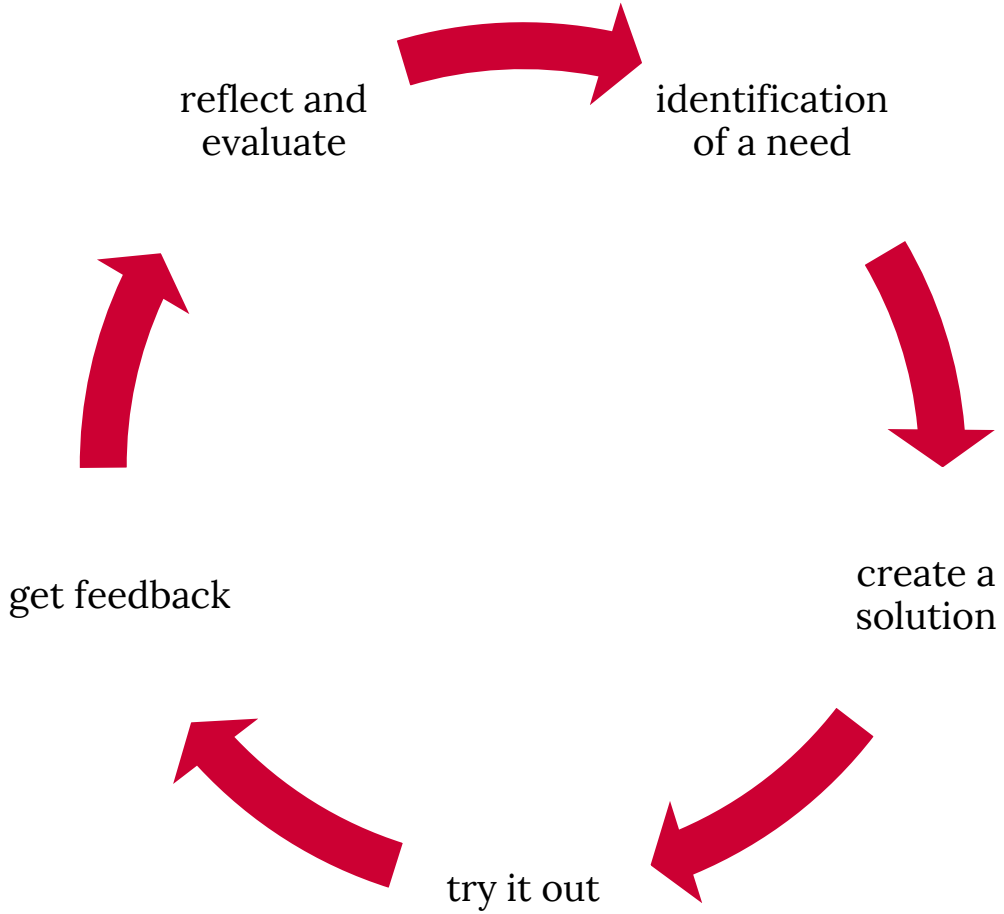
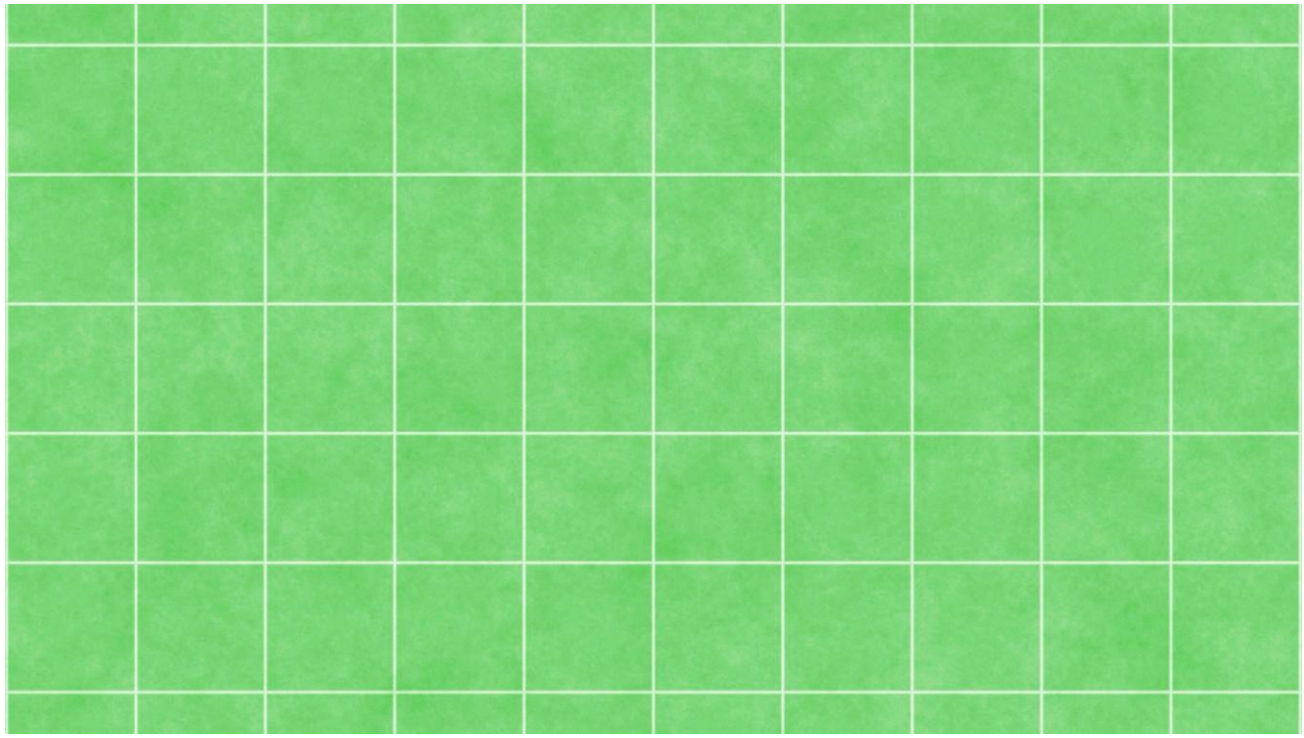
An iterative process!



HIGHLIGHT

Re-adapting Tablets of Stone



HIGHLIGHT

Exchanging Resource Features

Computing Systems

In this WebQuest, you will work in pairs to use the internet and explore computing systems. Use search engines to locate credible resources to answer the below questions. You will turn in this worksheet with your answers filled in.

1. What is a computing device?

   →

2. Give an example of a computing system that consists of more than one computing device.

   →

3. What are the benefits of having multiple computers working together in a system?

   →

4. What are the different ways that computers can work together in a system? How do the computers in a system communicate with one another?

   →

Smart Cafeteria

Imagine you are getting lunch in a new Smart Cafeteria. In this cafeteria, you start by scanning your ID card when you enter the cafeteria. Throughout the cafeteria, there are many food options available to you (some main entrees, some sides, snacks, and beverages), and each time you take an item, you scan your student ID card. When you are finished eating, you scan your ID card on your way out.

1. Does the technology that powers the Smart Cafeteria make up a computing system?

   →

2. What are some of the devices in that system?

   →

3. How do the devices communicate with one another?

   →

4. Which of the following questions can be answered using the data collected by the system?

   - How many students ordered French fries today?
   - How many students ate lunch?
   - What is a student's favorite food?
   - How many students are in the cafeteria at a specific time?
   - Do the hamburgers have ketchup on them?

Selecting Resources

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Sharing Finding Resources

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Wrapping Up

Finding Resources

- Identify a need
- Select resource types
- Use varied sources

Selecting Resources

- Logistic
- Content
- Context

Using Resources

- Adapt!
  - Structure
  - Content
  - Pedagogy
- Evaluate & Repeat

Sharing Resources

- Share your goals, process, sources, and experience!
- Make it easy to find!

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And you!
Again, what did we miss?

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