Collaboration and Computational Thinking
A Classroom Structure
Credits

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• Alexander Repenning – Scalable Game Design, University of Colorado
Introduction to AgentSheets

• What is it?

• How is it unique?
- drawn on water or disappear when attempting to cheat by walking over tunnels or top turtle makers
- game is won when on top of grass
- get squished by truck
- cursor control movement

Worksheet: level1

Stucked immediately above

Switch to worksheet level2

Then

<table>
<thead>
<tr>
<th>Key</th>
<th>Move</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key</td>
<td>Move</td>
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<td>Key</td>
<td>Move</td>
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<tr>
<td>Key</td>
<td>Move</td>
</tr>
</tbody>
</table>

While running

- I made it!
- Change
- Wait 0.5
- Erase
- Restart simulation

Test

Apply

OK
Computational Thinking Patterns

- Collision
- Generate
- Absorb
- Push/Pull
- Poll
- Script
- Hill Climbing
- Transport
CTPs, Collaboration
Computational Thinking Patterns in the Middle School Classroom

- Initial Difficulty – How do we link CTPs to independent programming?
Semester Structure

Quarter 1 – Collaborative Structure
- Frogger
- Pacman
- Sokoban
- Space Invaders
- Dungeon Adventure – Assessment

Quarter 2 – Indy Project/Showcase
- Create and Display
Collaborative Structure

- Sandbox game
- DIY Tutorial
- Application Game Product
Sandbox Game

• The “B.O.B.” game – Specific, direct instruction regarding new CTPs that will be applied to an upcoming game product

• Time to experiment, ask questions, try, and fail
DIY Tutorial

- After the Sandbox experience, students are assigned a specific set of objectives to master and then teach

Objective 1: PacMan Moves throughout the map but cannot move through walls

Explain how to achieve this objective in the space below:

Methods (list the methods that will need to be created in order to achieve this objective):

In the space below, add in any pictures (at least 1) that will help meet this objective:
Game Product

• Students utilize their DIY Tutorial to then instruct several classmates on how to achieve their objectives

• No copying, no doing it for them

• Teacher as tech support
Assessments
Two Major Summative Assessments

• Dungeon Adventure Game

• Written Assessment
Dungeon Adventure

• Application of previously implemented CTPs in new or unique ways

• Tests 21st Century Skills involving seeking answers to unique problems and collaboration

• Open resources, but limited by time
**Dungeon Adventure Rubric**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Points</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CTP MOVEMENT</strong></td>
<td>Hero moves in four directions</td>
<td>/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hero faces the direction he moves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrows move in four directions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CTP GENERATE</strong></td>
<td>Hero generates arrows in FOUR DIRECTIONS</td>
<td>/1</td>
<td></td>
<td></td>
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<tr>
<td><strong>CTP COLLISION</strong></td>
<td>Game ends when Hero steps on LAVA</td>
<td>/1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Game ends when Monster touches HERO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrow kills Monster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>/1</td>
<td></td>
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<tr>
<td><strong>CTP TRACKING/HILL CLIMBING</strong></td>
<td>Monsters track Hero by only moving towards the HERO</td>
<td>/3</td>
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<tr>
<td><strong>CTP ABSORB</strong></td>
<td>Arrow agent disappears when it hits a wall AGENT</td>
<td>/1</td>
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<tr>
<td><strong>CTP PUSHING/PULLING</strong></td>
<td>HERO PUSHES the TREASURE on the FLOOR</td>
<td>/2</td>
<td></td>
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<tr>
<td></td>
<td>TREASURE PULLS the HERO AGENT behind it</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CTP POLLING</strong></td>
<td>GAMEMASTER ends the game when all TREASURE is PUSHED onto DESTINATION</td>
<td>/1</td>
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Written Assessment

- Tests student ability to recall factual information regarding CTPs and programming minus online resources and online collaboration

SECTION 2: Look at the picture and describe what CTP is being used and HOW you know!

In the space below, identify the CTP being used

Next, explain HOW you know that is the CTP, what does this behavior remind you of?
Sample student response:

• A1 – Tracking or Hill Climbing

• A2 - I know this is tracking because it is the same behavior from PacMan. You are making the agent check for the sent [sic] being stronger up or left in order to move that way.
Other question types

- In other sections of the exam, students are asked to identify CTPs based on ‘word problem’ type questions.

- Finally, students are given a list of desired behaviors (i.e. an agent moves to a specific destination and then disappears) and are required to write appropriate programming using the AgentSheets language format.
What I learned
How did this method of instruction affect learning?

• In one semester, 38 students (43% female and 57% male) participated in the research study

• 77% of students successfully implemented 75% or more of the required objectives for the Dungeon Adventure game

• 74% of students successfully completed 75% or more of the required objectives for the written assessment

• For both assessments, 0% of students completed fewer than 50% of the objectives