Developing Computational Thinking Through Grounded Embodied Cognition

Educator incorporates computational thinking into instruction through grounded embodied cognition.

**Key Method**

Educator coaches students to embody computational thinking concepts (such as iteration), which are taught through movement, role playing, and simulations.

**Method Components**

Examples of incorporating movement, role playing, and simulations into instruction

Incorporation of movement

- Students create their own path or maze on the floor using colored tape. Then they work in pairs or small groups to write down the instructions to navigate the path or maze to the end. See Resources section for a picture of students creating a grid or maze.

Incorporation of role playing

- One student plays the role of a robot in a maze. Classmates repeatedly give the student instructions for navigating the maze, using vocabulary such as position and orientation.

Incorporation of simulations

- Students build on their learning from the real-world movement and role-playing exercises to complete an online simulation of a robot going through a maze, using either Lightbot or Blockly. (See Resources section for links to these programs.)

Demo video

https://www.youtube.com/watch?v=FfxAgUyxndo

**Supporting Research**


Resources

Embark Labs ExploreCS courses and PD opportunities
Embark Labs is an education program that introduces elementary and middle school students to design and computational thinking in a hands-on, collaborative way.

Unit 2, Lesson 2.3: The Big Blue Grid ~ Position vs. Orientation
http://embarklabs.com/explorecsunit2free

Additional Embark Labs Resources:
http://embarklabs.com/exploreCS
embarklabs.com/schools
http://embarklabs.com/schools

Incorporation of movement (image):
http://bit.ly/1SYFDAg

Free, web-based tools that show simple versions of robots navigating mazes:
- **Lightbot**: In Lightbot, students must program a robot to solve puzzles using simple commands.
  https://lightbot.com/hocflash.html
- **Blockly**: Blockly Games is a series of educational games designed to teach programming to children who have not had prior experience with computer programming. By the end of these games, players are ready to use conventional text-based languages.
  https://blockly-games.appspot.com/

Google Computational Thinking Course
A free online course to help educators integrate computational thinking into their curricula.
https://computationalthinkingcourse.withgoogle.com/preview

Brain Rules
In Brain Rules, Dr. John Medina, a molecular biologist, shares his lifelong interest in how the brain sciences might influence how we teach children and how we work. In each chapter, he describes a brain rule—what scientists know for sure about how our brains work—and then offers transformative ideas for our daily lives based on that role.
http://www.brainrules.net/about-brain-rules

CS Unplugged
CS Unplugged is a collection of free learning activities that teach computer science through engaging games and puzzles that use cards, string, crayons, and lots of running around.
http://csunplugged.org/

Sample lesson
Algorithmic Thinking

Movement/role-playing activity demonstration video
https://www.youtube.com/watch?v=FfxAgUyxndo
Submission Guidelines & Evaluation Criteria

To earn the micro-credential, you must receive a passing evaluation for Parts 1 and 3 and a “Yes” for each component in Part 2.

Part 1. Overview questions
(150-word limit for each response)

- **Activity description:** Please provide a short, contextual description of the activity in which the use of movement, role playing, and simulation is demonstrated.
  - **Passing:** Activity description is clear with sufficient contextual detail to illustrate what the teacher did to implement this competency.

- **Activity evaluation:** How do you know your students increased their proficiency as a result of your using movement, role playing, and simulation to teach computational thinking?
  - **Passing:** Educator identifies at least one measure for determining whether students increased their proficiency in computational thinking as a result of the activity.

- Have you incorporated Computer Science/Computational Thinking into your classroom instruction before?
  - **Passing:** Description is clear and includes examples of how instructor has incorporated CS/CT activities with their students.

- (Optional) Have you attended an Embark Labs PD session before? If yes, please clarify where and when. Additionally, if you engaged with Embark’s instructional materials, please identify which resources were used.

Part 2. Evidence/artifacts

Educator must submit an artifact that highlights the inclusion of a computational thinking concept that is taught through movement, role playing, and simulations.

Evidence must include a video of the movement or role-playing activity as well as additional evidence (such as photos or screenshots) of students interacting with a simulation in the context of framing computational thinking. For simulation and activity resources, please see the resources section.

<table>
<thead>
<tr>
<th>&quot;Yes&quot;</th>
<th>&quot;Almost&quot;</th>
<th>&quot;Not Yet&quot;</th>
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<tbody>
<tr>
<td>There is conclusive evidence that movement and role playing were incorporated into the lesson or activity, and that movement is framed successfully in the context of computational thinking.</td>
<td>There is some evidence that movement and/or role playing was incorporated into the lesson or activity and/or there is little or no relationship between the movement and computational thinking. It’s not clear how the movement is tied to the lesson or content area.</td>
<td>There is little or no evidence that movement or role play was incorporated into the lesson or activity.</td>
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<tr>
<td>Evidence clearly shows multiple instances of students interacting with simulations that explicitly focus on and support computational thinking.</td>
<td>There is incomplete evidence of students interacting with simulations or the relationship between the simulation and computational thinking is ambiguous.</td>
<td>There is no evidence of students interacting with simulations and there is no substantive evidence that the simulation is related to computational thinking.</td>
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Part 3. Educator reflection
Provide a reflection on the lesson or activity, using the following questions as guidance (200-word limit):

- What was the impact of integrating movement, role-playing, and simulations with your students? Were there any relevant challenges or observations with this practice?
- How did using these methods affect your comfort level in teaching computer science/computational thinking in your classroom?
- How might you improve or differentiate this lesson in the future?

**Passing:** Reflection includes challenges and observations as well as an assessment of what (if any) impact the exercise had on the educator’s comfort level. Reflection also includes some elaboration on how the educator might improve or differentiate the lesson to make it more effective.