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Research Questions
1. How and why do teachers implement the inquiry- and collaboration-based instructional strategies (IBIS, CBIS) supported in the ECS program?
2. How, why, and to what extent do teachers adapt the ECS curriculum materials?
3. How does implementation relate to student outcomes? What factors enhance or impede the successful implementation of ECS?

Research Plan
The CS3 project involves two broad strands of work.

• Assessing student learning outcomes requires the team to develop validated measures of students’ proficiency with computational thinking practices.

• Characterizing the relationship between curriculum implementation and student learning outcomes requires an analysis integrating teacher and learning context attributes, teaching approaches, and curriculum adaptation.

Core Constructs
• Teaching Quality
• Curriculum Enactment
• Teacher and Learning Context Attributes

Analysis
Our analysis will link indicators of TQ and CE along with key attributes of the ECS teachers and learning contexts. We explore the impact of these key indicators and attributes on student computational thinking outcomes, as measured by assessments for ECS Units 1 to 4, as well as a pretest and a cumulative posttest.

Samples
We operationalized IBIS and CBIS as combinations of a teacher’s instructional practices with the perceived success of CT promotion strategies related to those practices. We have included examples of survey questions in each area below.

Relating Instructional Strategies, Curriculum Adaptations and Student Success

Instructional Strategies
Below are some examples of how the CS3 team measured inquiry- and collaboration-based instructional strategies (IBIS, CBIS). We measured these constructs by asking teachers about their typical experiences in a background survey, and then asking them about their specific implementation experiences in a series of unit surveys.

Inquiry-Based Instructional Strategies (IBIS)

Inquiry-Based Practices + Perceived Success of CT Promotion Strategies Related to Inquiry

When teaching Unit XX, how often did you engage students in the following practice?

• Students identify questions to answer or problems to solve
• Students develop their own solutions to problems

Which of the following were successful in promoting computational thinking in your ECS classroom during Unit XX?

• Opportunities for students to solve challenging problems
• Opportunities for students to create computational artifacts or products

Collaboration-Based Instructional Strategies (CBIS)

Collaboration-Based Practices + Perceived Success of CT Promotion Strategies Related to Collaboration

When teaching Unit XX, how often did you engage students in the following practice?

• Students present or communicate their ideas to peers
• Students engage in reflection and discussion

Which of the following were successful in promoting computational thinking in your ECS classroom during Unit XX?

• Opportunities for students to share their computational thinking with peers

Levels

<table>
<thead>
<tr>
<th>Levels</th>
<th>N of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1: No practice regardless of Success</td>
<td>0</td>
</tr>
<tr>
<td>L2: Low frequencies of practice + Few success</td>
<td>3</td>
</tr>
<tr>
<td>L3: Low frequencies of practice + More success</td>
<td>5</td>
</tr>
<tr>
<td>L4: High frequencies of practice + Few success</td>
<td>12</td>
</tr>
<tr>
<td>L5: High frequencies of practice + More success</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

Interpretation

• High IBIS levels across all ECS units, with units 3 and 4 having the highest levels.

• Some teachers transitioned from lower IBIS levels to higher IBIS levels as they progressed from unit 1 to unit 4, likely due to the nature of the different unit topics and activities.

Levels

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<td>L1: No practice regardless of Success</td>
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</tr>
<tr>
<td>L2: Low frequencies of practice + Few success</td>
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<td>L3: Low frequencies of practice + More success</td>
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<td>L4: High frequencies of practice + Few success</td>
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</table>

Interpretation

• High CBIS levels across all ECS units, but less so than IBIS levels. ECS units 1 and 2 had the highest CBIS levels.

• Some teachers transitioned from higher CBIS levels to lower CBIS levels as they progressed from unit 1 to unit 4, likely due to the nature of the different unit topics and activities.

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