Improving Curriculum Use for Better Teaching
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1. **Overview**

ICUBIT is a research and development project focused on conceptualizing and measuring pedagogical design capacity or the capacity required to use curriculum resources productively to design instruction (Brown, 2009).

**Goals**
1. To identify the teacher capabilities needed for productive use of mathematics curriculum materials;
2. To design tools to measure these capabilities.

Five elementary mathematics programs were selected as the basis for research and development activities. Three are standards-based programs, developed with NSF funding; one is commercially developed in the U.S.; on was developed in Singapore and is marketed in the U.S.

<table>
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<th>Everyday Mathematics (EM)</th>
<th>Investigations in Numbers, Data, and Space (INV)</th>
<th>Math Trailblazers (TB)</th>
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**Components**
1. **Curriculum Analysis:** We analyzed teacher’s guides of each program focusing on two questions:
   1. What demands does the curriculum place on teachers as users and enactors of the curriculum?
   2. What supports does the curriculum provide the teacher to aid in enacting the curriculum?

2. **Curriculum Embedded Mathematics Assessment (CEMA) design and pilot:** This assessment measures teachers’ knowledge of the mathematics underlying tasks, instructional designs, and representations in curriculum materials.

3. **Investigating Teacher Curriculum Use** Use tools to collect and analyze data on how 25 teachers read and use curriculum materials. Analyze data to identify the capacities needed for effective curriculum use and patterns among teachers’ mathematics knowledge, the quality of their curriculum use, and the nature of their instruction. Construct framework to identify, measure, and further develop PDC.

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2. **CEMA**

CEMA is a tool to measure teachers’ understanding of the mathematics embedded in tasks and representations in elementary curriculum resources. Our aim is to develop conceptualize this specialized form of knowledge and develop a proof of concept of a tool to measure it.

**Key Components**
- Mathematical ideas
- Surrounding knowledge
- Problem complexity
- Connections across representations

- Form:
  - Designed using excerpts selected from 5 curriculum programs; each excerpt is followed by 4-6 items that access math knowledge with respect to the dimensions.

- Field Test, IRT Analysis

CEMA was taken in online format by 150 teachers, using 2 forms.

**Form**
1. 2

**Reliability**
0.69 0.80

**Difficult**
-3.16 -1.4 -1.5 -0.008

Sample CEMA excerpt and item

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3. **Investigating Teacher Curriculum Use**

Data collection and analysis of 25 teachers (grades 3-5) using the 5 different curriculum programs.

**Data Collected**
1. **Introductory Interview:** Teacher’s background and general orientation towards the curriculum materials.
2. **Curriculum Reading Log:** Teachers highlight the teacher’s guide to indicate the parts they read (green), plan to use (blue), that influenced their thinking, but will not be used as written (orange).
3. **Table-of-Contents Implementation Record:** Teachers use copy of contents from text to indicate lessons they taught over an entire year.
4. **Observations:** Teachers are videotaped as they teach 6 lessons also included in CRL.
5. **Post-observation interview:** Asks teachers to reflect on their use of the teacher’s guide as it relates to what occurred in the classroom.
6. **Assessments:** Teachers take the CEMA as well as Mathematical Knowledge for Teaching (MKT) assessment (Hill, et al., 2011).

**Data Analysis**
Initial analysis will be within teacher and within curriculum. We will then contrast teachers using different curriculum programs.

- Curriculum reading and use to design instruction using CRLs and interviews, we will characterize and compare what and how teachers read to plan instruction.
- Enacting instruction: Classroom observations will be coded for design moments, where teachers enact instructional moves in response to classroom events. Enacted lessons will be compared to planned and written lesson in text.
- Interviews will supplement analysis by providing insight into teacher intention and decisions-making processes.
- Analysis of mathematical knowledge will involve comparing teachers’ scores on the MKT and CEMA to examine the relationship between these two constructs and both scores to quality of curriculum use.

The ultimate aim is to identify patterns among teachers’ mathematics knowledge, the quality of their curriculum use, and the nature of their instruction. These patterns will be used to develop a model of PDC and describe the role that teacher knowledge and other capacities play in curriculum use. By contrasting these findings with analysis of curriculum materials, we will consider how curriculum features influence PDC.

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**References and Acknowledgements**


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**ICUBIT**

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