Results from Rice University WeTeach_CS: A Computer Science Teaching Collaborative Serving Teachers with Different Needs through Variety of Pathways

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Introduction

- 4.4 million computer and information technology jobs in the U.S. by 2024
- Underrepresentation of certain populations in CS
- Increasing demand for CS courses
- Critical shortage of teachers
- Issues with training and developing CS teachers
CS Professional Development

Three core features of effective professional development (Desimone, 2009; Loucks-Horsley et al., 2010):

1. Rigor in the subject matter
2. PD content alignment with teachers’ local/state standards
3. Active, hands-on learning opportunities for teachers
Self-efficacy

• Extent to which teachers believe they can successfully execute teaching-related tasks within a particular context (Tschannen-Moran & Hoy, 2001)

• Connection to instructional practices and students’ motivation and achievement (Clark et al., 2014; Stipek et al., 2001)
Teachers’ Technological Pedagogical Content Knowledge (TPACK)

• Teacher’s knowledge of how to coordinate the use of subject-specific activities with topic-specific representations using emerging technologies to facilitate student learning” (Cox, & Graham, 2009, p. 64)

• Complex, multi-faceted, integrative, and/or transformative (Mishra & Koehler, 2006)
TPACK (cont.)

Three technology-specific knowledge dimensions:

- Technological content knowledge
- Technological pedagogical knowledge
- Technological pedagogical content knowledge
The Rice University School Mathematics Project (RUSMP) WeTeach_CS Collaborative

Goals
1. To increase CS content and technological pedagogical content knowledge of teacher participants
2. Provide support for teacher participants as they embark on teaching the first CS course on their respective campuses
RUSMP WeTeach_CSCollaborative (cont.)

Participants:
• 18 middle school teachers
• 2 high school teachers

Required 60 hours of work
RUSMP WeTeach_CS Collaborative (cont.)

Pathways:
1. Attended face-to-face institutes
2. Attended a statewide computer science conference
3. Selected online courses and were to complete these courses at their own pace
4. Pathway 1 + Pathway 4
Methods

• Pre-survey
• Post-survey
• Post-interview
Methods

Instrument:
1. CS self-efficacy (8 items; Kolar, Carberry, & Amresh, 2013)
2. CS teaching self-efficacy (instructional strategies; 4 items; Klassen et al., 2009)
3. CS teaching self-efficacy (general; 12 items; Enochs, Smith, & Huinker, 2000)
4. Computational thinking self-efficacy (6 items; Angeli et al., 2016);
5. TPACK (14 items; Schmidt et al. (2009))
## Results

### Paired Samples $t$-Tests of Teacher Beliefs and Knowledge

<table>
<thead>
<tr>
<th>Measure</th>
<th>N</th>
<th>Mean Gain (post-pre)</th>
<th>S.D.</th>
<th>t-value</th>
<th>Cohen’s d</th>
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<tbody>
<tr>
<td>CS Self-efficacy</td>
<td>20</td>
<td>0.37</td>
<td>0.65</td>
<td>2.59*</td>
<td>0.59</td>
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<tr>
<td>Computational Thinking Self-efficacy</td>
<td>20</td>
<td>0.23</td>
<td>0.62</td>
<td>1.62</td>
<td>0.37</td>
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<tr>
<td>CS Teaching Self-efficacy (instructional strategies)</td>
<td>20</td>
<td>0.75</td>
<td>0.84</td>
<td>3.98**</td>
<td>0.91</td>
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<tr>
<td>CS Teaching Self-efficacy (general)</td>
<td>20</td>
<td>0.75</td>
<td>0.61</td>
<td>5.50***</td>
<td>1.26</td>
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<tr>
<td>Content Knowledge</td>
<td>20</td>
<td>0.62</td>
<td>0.62</td>
<td>4.42***</td>
<td>1.01</td>
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<tr>
<td>Pedagogical Content Knowledge</td>
<td>20</td>
<td>0.80</td>
<td>0.72</td>
<td>4.95***</td>
<td>1.13</td>
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<tr>
<td>TPACK</td>
<td>20</td>
<td>0.58</td>
<td>0.75</td>
<td>3.41**</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Notes. *$p < .05$. **$p < .01$. ***$p < .001$. 
Results (cont.)

• Professional, friendly, prompt, and helpful communication with teachers
• All pathways informative, well-planned, engaging, and to-the-point
• Collaboration among participants
• Deeper understanding of the subject matter (CS)
• Administrative buy-in
Results (cont.)

“The collaborative has presented a wide diversity of CS applications that are interesting and relevant. It has also provided good preparation and support for the certification test.”

“Just discovered so many resources. The sessions were very helpful. Learned lots of different methods.”
Conclusions

• The success of a CS collaborative with its key components aligned with the important features of the effective PD

• Differentiated pathways based on the needs of the teachers served their interests well

• A community of learners
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