Learning Progressions in Environmental Science: The Impact of a Professional Development on Teacher Practice

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• Practice as the cornerstone of the teaching profession and thus coherent and comprehensive implementation as a meaningful indicator of teachers’ professional learning (Ball & Cohen, 1999)

• A variety of factors influence teacher learning, including the school, the learning activity, and personal factors related to the teachers themselves (Opfer & Pedder, 2011; Woodbury & Gess-Newsome, 2002)
“If mastery of a core idea in a science discipline is the ultimate educational destination, then well-designed learning progressions provide a map of the routes that can be taken to reach that destination.”

-A Framework for K-12 Science Education
1) To what extent did teachers implement the Teaching Experiments (TEs) and report using the Key Pedagogies?

2) What factors are correlated with the variation in implementation of the TEs and Key Pedagogies?
   • Site? Strand? Grade level?
   • Self reported supports and constraints?
     • Personal factors – Motivation; Self-efficacy, etc.
     • PD factors – Self reported impact of PD
     • School factors – Curriculum considerations; School support, etc.
1) Teaching Experiments (TEs)
   • Water, Carbon, Biodiversity

2) Key Pedagogies (18 teaching techniques consolidated into 4 main pedagogies)
   • Focus on big ideas
   • Responding to student thinking
   • Connect to the real world issues and local contexts
   • Engage students in principle- and evidence-based reasoning

3) Supports and Constraints (15 fixed response items consolidated)
   • School factors
   • Personal factors
   • Time

4) What’s New? (Open response item)
## TE Implementation Groups

<table>
<thead>
<tr>
<th>Implementation Groups</th>
<th>Number and Amount of TE’s Taught</th>
<th>Number of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive</td>
<td>Some of 3 or all of 2</td>
<td>24</td>
</tr>
<tr>
<td>Intermediate</td>
<td>All of 1 and/or some of 2</td>
<td>41</td>
</tr>
<tr>
<td>Limited</td>
<td>None, or some of 1</td>
<td>27</td>
</tr>
</tbody>
</table>
**Constraints by TE Implementation Group**

- **Adequate time for preparation and planning**
- **The curriculum and/or state standards I am required to teach by my district**
- **Adequate time for using the practices listed**

The chart shows the percentage of respondents for each constraint.
Supports by TE Implementation Group

The training I have received from professional development

The training I received in college and the practical wisdom and skills from

My confidence that students will learn and succeed if taught using the four

My motivation to teach the subject using the four practices

My ability to differentiate instruction in response to my assessment of

My ability to teach with hands-on and outdoor approaches

My understanding of student thinking or learning in environmental science

My environmental science knowledge

Support from school administrators, principals,

[Bar chart with different levels of support: Extensive, Intermediate, Limited]
Mean influence of PD on use of practices by TE implementation group

(1=not at all; 2=somewhat; 3=moderately; 4=a great deal of influence)
## Key Pedagogy Use Groups

<table>
<thead>
<tr>
<th>Use of Key Pedagogies</th>
<th>Mean Scores (1- never; 2-very rarely; 3- occasionally; 4-frequently; 5-very frequently)</th>
<th>Number of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive</td>
<td>Mean score of 4.0 - 5.0</td>
<td>26</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Mean score of 3.7 - 3.9</td>
<td>23</td>
</tr>
<tr>
<td>Semi-Limited</td>
<td>Mean score of 3.4 – 3.6</td>
<td>24</td>
</tr>
<tr>
<td>Limited</td>
<td>Mean score of 2.4 – 3.3</td>
<td>19</td>
</tr>
</tbody>
</table>
Constraints by Key Pedagogy Groups

Adequate time for preparation and planning

adequate time for using the practices

the curriculum and/or state standards I am required to teach by my district
Supports by Key Pedagogy Group

The training I received in college or the practical wisdom and skills
The training I have received from professional development
My motivation to teach the subject using the four practices
My ability to teach with hands-on and outdoor approaches
My understanding of student thinking or learning in
My personal commitment to the environment

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Extensive
Intermediate
Semi-limited
Limited
Mean use of practices by Key Pedagogy implementation group
(1- never; 2-very rarely; 3-occasion ally; 4-frequently; 5-very frequently)
Mean influence of PD on use of practices by Key Pedagogy implementation group

(1=not at all; 2=somewhat; 3=moderately; 4=a great deal of influence)
% Teachers Mentioning Different Activities as **What's New**

- Big Ideas
- Student Thinking
- Real World
- EBR
- Reasoning Tools
- FAs/pre-post
- Use of LPs
- Nothing New/Blank

% Teachers
<table>
<thead>
<tr>
<th>TE Implementation Group</th>
<th>Limited</th>
<th>Semi-Limited</th>
<th>Intermediate</th>
<th>Extensive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>med</td>
<td>5</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>41</td>
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<tr>
<td>hi</td>
<td>9</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>24</td>
<td>23</td>
<td>26</td>
<td>92</td>
</tr>
</tbody>
</table>
1) What did the teachers do?

- There was a great deal of variety in what the teachers did with the TE and Key Pedagogies
- These two measures of teacher practice were independent, such that teachers in each TE implementation group showed similar ranges of pedagogy use
2) What factors correlated with differences in implementation?

- The factors that teachers reported as supporting their teaching were very similar across each of our measures, but there were slight differences in constraints across measures.
- Time was mentioned as a constraint more frequently by low TE implementers, but with an interesting difference for those reporting higher use of the key pedagogies.
- The teachers who used the key pedagogies most were less likely to be constrained by curriculum requirements.
• These findings are interesting because of the diversity of sites and PD providers.

• Because the trends hold up across contexts, the findings are generalizable and can provide PD providers with insights into how to best support teachers in assimilating new practices and materials into their current curriculum and thus insight into how PD efforts might be structured to more effectively support teachers in these endeavors.
Thank You!

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This work was funded by the National Science Foundation (NSF) under grant number DUE-0832173. The views expressed here are those of the authors and do not necessarily reflect those of NSF.