Social Justice through SoTL: Establishing Authentic Communities of Learning

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Presenters
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Building Student Self-Awareness of Learning to Enhance Diversity in the Sciences

Erin E. Peters-Burton, Ph.D.
Giuseppina Kysar-Mattietti, Ph.D
The Need

• To remain competitive in global economy, we need more STEM professionals (National Research Council, 2011)

• Disproportionately low participation of African Americans, Native Americans, and Latino/as in STEM fields
  • 33% in population but only make up 11% of STEM professionals

• U.S. needs a more representative work force

• We must look to other ways to help students of color feel part of the STEM community
  • Particularly earlier than in undergraduate education
The Purpose

• Overview of the constructs that have provided a gateway to engaging students in meaningful science learning
  • Metacognition
  • Self-regulated learning

• Provide interventions in these areas and educational research on their outcomes
  • Suggestions to engage all students in scientific endeavors that are meaningful
## Building Self-awareness

<table>
<thead>
<tr>
<th>Metacognition</th>
<th>Self-Regulated Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ability to think about your thinking</td>
<td>• Learners are metacognitively, motivationally, and behaviorally active participants in their own learning processes</td>
</tr>
<tr>
<td>• Consider the effectiveness of those processes</td>
<td></td>
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<tr>
<td>• Act on your evaluation of the processes</td>
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### Strategies for building metacognition
- **Checklists** *(Peters & Kitsantas, 2010)*
- **Instruction on flexible control strategies** *(Son & Schwartz, 2002)*

### Key processes
- **Goal setting**
- **Self-monitoring**
- **Self-evaluation**
- **Adaptivity**
# Metacognition Interventions

<table>
<thead>
<tr>
<th>Metacognitive Prompting Intervention (MPI-Science)</th>
<th>Calibrating Self-Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention</strong></td>
<td></td>
</tr>
<tr>
<td>1. Modeling science process</td>
<td>• Diagram</td>
</tr>
<tr>
<td>2. Checklist of all skills</td>
<td>• Essay</td>
</tr>
<tr>
<td>3. Checklist that faded support</td>
<td>• Rate efficacy</td>
</tr>
<tr>
<td>4. Questions to justify monitoring and control</td>
<td></td>
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<tr>
<td><strong>Outcomes</strong></td>
<td></td>
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<tr>
<td>8\textsuperscript{th} grade students who had the intervention significantly outperformed comparison students</td>
<td></td>
</tr>
<tr>
<td>• Content knowledge</td>
<td>Undergraduate students</td>
</tr>
<tr>
<td>• Scientific thinking</td>
<td>• Answered diagrams correctly but had low self-efficacy</td>
</tr>
<tr>
<td></td>
<td>• Answered essays incorrectly but had high self-efficacy</td>
</tr>
</tbody>
</table>
Metacognitive Intervention - Visualization

Use of concept mapping to “reveal” student thinking

Undergraduate students produced 5 typologies:

- one dominant cluster
- several equivalent clusters
- chains of concepts
- trees, cycles and pyramids
- narrative maps

All types of maps were helpful for instructor to evaluate connections between ideas and foster deeper understandings
## Self-Regulated Learning Interventions

<table>
<thead>
<tr>
<th></th>
<th>SRL of the Nature of Science</th>
<th>SRL of Argumentation in Science</th>
</tr>
</thead>
</table>
| **Intervention**         | Microanalysis of SRL processes as graduate students learned about NOS and how to teach NOS  
  • Tool is instruction and assessment  | Microanalysis of SRL processes as teachers learned about argumentation in science and how to teach |
| **Outcomes**             | Graduate students improved  
  • Self-efficacy  
  • Goal setting  
  • Self-monitoring  
  Did not improve  
  • Self-reflection | In-service teachers  
  • Improved argumentation knowledge  
  • Did not improve SRL knowledge  
  Context matters! |

Context matters!
Priorities

• **Priority 1 – Help Students Be Motivated**
  • Motivation for STEM is the foundation of value and interest in the subjects

• **Priority 2 – Help Students Build Metacognition**
  • One cannot improve learning strategies to be more familiar with STEM unless they have awareness of those strategies and tactics

• **Priority 3 – Help Students Improve Self-Regulated Learning Skills**
  • The SRL cycle gives a road map for learning how to learn
Final Thoughts

When students who are not typically “STEM-minded” begin to be successful in learning STEM subjects, they:

• Have more agency and feel more in control
• Begin to build a STEM identity
• No longer feel an outsider to STEM communities

If we currently do not have enough role models in STEM for underrepresented groups, then we must do something different to support learners.

Building self-awareness of learning can create the critical mass we need to have equity in STEM.