Student Persistence in Science: Do Science Teacher Credentials Matter?

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• Strongly connected to the country’s welfare and competitive edge in the international arena (PCAST, 2010).

• There is a serious shortage in STEM workforce endangering the nation’s security and economic power (Augustine, 2007).

• Underrepresentation of certain student populations in STEM workforce still exists (NRC, 2011).
• Student persistence in STEM areas is still unsettling despite growing efforts (Crisp, Nora, & Taggart, 2009).
• Numerous studies unpacking antecedents of student persistence (e.g., Chen, 2013; Ehrenberg, 2010; Hansen, 2014).
• Studies exploring teacher-related factors affecting persistence is scarce.
Factors of persistence

- Demographics (Ehrenberg, 2010),
- Introductory math & science success (Hanson, 2014)
- AP STEM courses in HS (Museus et al., 2010)
- Collaboration with peers (Museus et al., 2010)
- STEM projects in HS (Graham et al., 2013)
- Self-efficacy (Anderson & Ward, 2013)
- Highly qualified math & science teachers (Hanson, 2014; Museus et al., 2010).
Teacher credentials

- Professional background
- Certification in science teaching
- Graduate degree in science
- Teaching experience
  (Rice, 2003; Tschannen-Moran & Hoy, 2007; Wolters & Daugherty, 2007)
To explore the relation of science teacher-related factors to high school students’ persistence in STEM, science in particular.
Research Questions

A. To what extent do teacher level factors (i.e., academic preparation, teaching preparation, and teaching experience) predict the change in students’ motivational beliefs and interest towards science?

B. To what extent do teacher level factors (i.e., academic preparation, teaching preparation, and teaching experience) predict students’ science course enrollment and whether or not they plan to choose a future career in STEM fields?
Student Outcomes
- Science identity
- Science utility
- Science self-efficacy
- Science interest
- AP Science course-taking
- STEM career choice

Student-level
- Gender
- Race/ethnicity

Teacher-level
- Science teaching certification
- Graduate degree in science
- Experience/Novice teacher

Method

Background

Results

Conclusions
This study included more than 23,000 representative sample of 9th graders from both public and private schools across the U.S. and their teachers.

High School Longitudinal Study (HSLS:09; Ingels et al., 2011)
## Regression results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Outcome Variables (N&lt;sup&gt;1&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science identity&lt;sup&gt;a&lt;/sup&gt; (12338)</td>
</tr>
<tr>
<td></td>
<td>β</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.05</td>
</tr>
<tr>
<td>Black (non-Hispanic)</td>
<td>.06</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.02</td>
</tr>
<tr>
<td>Asian</td>
<td>.09</td>
</tr>
<tr>
<td>Other</td>
<td>-.03</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td>Science teaching cert.</td>
<td>.03</td>
</tr>
<tr>
<td>Grad degree in science</td>
<td>.06</td>
</tr>
<tr>
<td>Experienced</td>
<td>.21*</td>
</tr>
</tbody>
</table>

<sup>a</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for science identity. <sup>b</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for science utility. <sup>c</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for science efficacy. <sup>d</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for science interest. <sup>e</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for advance science course. <sup>f</sup> Reports the magnitude of the relationship between the independent variable and the outcome variable for STEM career plans.
• African American and Hispanic students tend to have lower science self-efficacy
• Hispanic students think less about STEM areas as their future career
• Asian students think more about STEM areas as their future careers
### Significant Associations

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher’s graduate degree in science</td>
<td>• Science utility&lt;br&gt;• Science self-efficacy&lt;br&gt;• Science interest&lt;br&gt;• Advance science course taking&lt;br&gt;• STEM career plan</td>
</tr>
<tr>
<td>Experienced teacher</td>
<td>• Science identity&lt;br&gt;• Science self-efficacy&lt;br&gt;• Science interest&lt;br&gt;• Advance science course taking&lt;br&gt;• STEM career plan</td>
</tr>
</tbody>
</table>
Implications

• Experienced teachers matter
  – Teacher retention
  – Induction support

• Background in the content area seems to matter for some of outcomes
  – Professional development for teachers

• Certification type did not matter (variability in and categorization of teacher certification programs [see, Zeichner & Conklin, 2008])
Limitations

• Limitations of the dataset
  – No teacher ID’s: hierarchical analyses not possible
  – Degree of teacher impact on student may vary

• Controlling variables could be extended
  – Private vs. public school
  – Socio-economic status of students
THANK YOU!

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