ARGUMENTATION & TEACHER BELIEFS

- Argumentation is a key NGSS science practice (NGSS Lead States, 2013) that has been shown to have a multitude of benefits for students (Jimenez-Aleixandre & Erduran, 2008).
- Argumentation necessitates that students use higher-order cognitive processes to debate, critique, and defend ideas and engage in the collective production of knowledge (NRC, 2012).
- Teacher beliefs about students’ abilities to engage in challenging work have been shown to impact opportunities in the science classroom (Prime & Miranda, 2006; Zohar, Degani, & Vaarvink, 2001; Calabrese Barton, 2003).
- There is a limited amount of empirical research exploring teachers’ beliefs of argumentation (e.g., Katsh-Singer, et al., 2014; Sampson & Blanchard, 2012).
- We define argumentation as both a dialogic process in which students debate, critique, and defend ideas and engage in the collective production of knowledge (NRC, 2012).
- Argumentation necessitates that students use higher-order cognitive processes to debate, critique, and defend ideas and engage in the collective production of knowledge (NRC, 2012).

RESEARCH QUESTIONS

1. What are teachers’ beliefs about students’ capabilities to engage in argumentation?
2. What are the characteristics of items that are easier and more difficult for teachers?

METHODS

Initial Phase of Item Development

- Four vignettes about fictional students with specific backgrounds or abilities.
- Piloted with 42 middle school science teachers enacting a curriculum focused on scientific argumentation.
- Teachers were asked whether they believe each fictional student is “not capable,” “somewhat capable,” “capable,” or “very capable” to engage in argumentation.

Table 1: Sample Items (Phase 1)

<table>
<thead>
<tr>
<th>Item</th>
<th>Vignette</th>
<th>Student Focus</th>
<th>Positive Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-2</td>
<td>Diego's family is new to this country from Mexico, and he lives in a local Spanish-speaking neighborhood. His parents have repeatedly told you that they are against school and learning as much as possible. He receives support to learn English during one period of school each day.</td>
<td>ELL Student</td>
<td>Parent interest in student success, in-school language support</td>
</tr>
<tr>
<td>19-4</td>
<td>Abby has attended multiple schools in the past few years, as her family has had to move into different living situations. Abby says she participated a lot in science classes in her previous schools. She receives free breakfast and lunch at school every day.</td>
<td>Low SES Student</td>
<td>Frequent participation in science class</td>
</tr>
</tbody>
</table>

Second Phase of Item Development

- Four more vignettes written.
- Eight vignettes piloted with 103 middle school science teachers solicited through e-mail listservs.

Table 2: Sample Item (Phase 2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Vignette</th>
<th>Student Focus</th>
<th>Positive Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-1</td>
<td>Casey is part of the after school science club and says she wants to be a marine biologist when she grows up. She is reading two years below her grade level and receives remedial instruction from the school's reading specialist three times a week.</td>
<td>Struggling reader</td>
<td>Interested in science, receives reading support</td>
</tr>
</tbody>
</table>

RESULTS

- The belief items (left side) only correspond to the lower part of the teachers’ distribution (right side). This means the items describe students that most teachers believe are capable to engage in argumentation.
- The items are all easy suggesting we need to develop more difficult items.

DATA ANALYSIS

- Factor analysis was first performed to check the assumption of unidimensionality.
- Average factor loadings: 0.65
- No items had loadings lower than 0.3
- A Rasch (1960) measurement model was used to determine whether teachers are more or less likely to believe the student described in each item is capable to engage in argumentation.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-2</td>
<td>Teacher believes a student developing proficiency in English is capable to engage in argumentation.</td>
</tr>
<tr>
<td>19-3</td>
<td>Teacher believes a student who struggles to comprehend written text is capable to engage in argumentation.</td>
</tr>
<tr>
<td>19-4</td>
<td>Teacher believes a student who comes from an economically disadvantaged background is capable to engage in argumentation.</td>
</tr>
</tbody>
</table>

DISCUSSION

- Similar to Stevens and her colleagues (2009) we used empirical results to develop a hypothetical construct map (see Figure 2).

IMPLICATIONS

- Teacher beliefs of student capability (Research Question 1)
  - The items that were more difficult for teachers focused on ELLs and struggling readers; teachers were more likely to believe that these types of students are less capable to engage in argumentation.
  - The items that were easier for teachers focused on low SES students; teachers were more likely to believe that these types of students are capable to engage in argumentation.
  - Whole teachers will likely need continued support to meet the needs of diverse learners.

This research is funded by National Science Foundation grant DRL-1119584.
Contact Information

Rebecca Katsh-Singer: katsh@bc.edu
Amanda M. Knight: knightam@bc.edu
Maria Gonzalez-Howard: mariajorgelina418@gmail.com
Katherine L. McNeill: kmneill@bc.edu