

## Exploring Chinese High School Students' Performance and Perceptions of Scientific Argumentation by Understanding it as a Three-Component Progression of Competencies

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**Overview:** A new conceptual framework of scientific argumentation, entailing its identification, evaluation and production, is used to understand high school students' engagement with scientific argumentation.

**AUDIENCE:** Curriculum developers; Educators; Assessment developers.

### KEY POINTS

- Scientific argumentation is an epistemic practice that enlightens students' ways of thinking and understanding and constructing knowledge.
  - By using the three-component framework, we developed an instrument in the context of Physics that is justified as valid to assess high school students' scientific argumentation competence.
  - Exploring scientific argumentation competence as learning progression(s) may lead to more consensus on its conceptual understanding, which in turn facilitates its teaching and assessment.
  - Integrating scientific argumentation into school science education meets the students' expectations, and it is important to understand and practice it in a more systematic and explicit manner, so that students are able to engage in it in a deliberate and meaningful way.
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**INTRODUCTION** Scientific argumentation, as recognized by the new Science/Physics curricula in China, is an important epistemic practice in which students construct, evaluate, and reconstruct knowledge. However, we know little about students' think/talk *about* argument when they are asked to think/talk *in* argumentation despite the variety of frameworks used to analyze or assess argumentation. Moreover, we know little about how students in China perform and perceive scientific argumentation given its different culture from Western countries. We therefore developed an instrument to assess Chinese high school students' scientific argumentation competence using a three-component and ten-element framework to explore students' experience with scientific argumentation.

**FINDINGS** The test data fits well with the Rasch model and most test items demonstrate satisfying performance. The assumption of understanding scientific argumentation competence as including three components is justified by using Confirmatory Factor Analysis. The elements within each component together are found to form a learning progression of

scientific argumentation competence. Most of the students involved in this study were at level 1 of the learning progression and providing them with the definition of argument elements does not influence their test performance. The students held a positive attitude about learning through argumentation, but students' willingness of engagement was influenced by their perception of its intrinsic and extrinsic value and the role that personality played in it.

### TAKEAWAYS

Understanding scientific argumentation competence from the three components of identification, evaluation, and production, is plausible and leads to a learning progression of it. As an epistemic practice, students need scaffolding or support and taught explicitly about scientific argumentation so that they can engage in it deliberately by thinking/talking *about* argumentation. The framework as well as the instrument in this study can be used to guide teaching and assessment, providing teachers and assessment developers with a more systematic way to approach scientific argumentation in school settings.