

Development of a questionnaire on teachers' knowledge of language as an epistemic tool

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Tweet. *A new instrument developed for measuring elementary school teachers' knowledge of language as an epistemic tool in science classes*

AUDIENCE. Teacher educators; District Science Coordinators; Formal educators

KEY POINTS

- Language helps students create and evaluate knowledge for themselves rather than relying solely on others
- We created a questionnaire that was used to see how teachers understood using language as a tool for creating and evaluating knowledge in science classrooms.
- After studying the performance of individual items, we were able to create 15 question instruments that effectively and reliably can be used to assess teacher understandings of language use for knowledge creation.
- This instrument can be used to improve teacher learning, explore how teacher knowledge develops, and ultimately help enhance the ways in which language is used in science classrooms.

INTRODUCTION. A key emphasis in new science standards is for students not to receive knowledge but to generate and validate scientific knowledge by applying practices like designing investigations, analyzing data, and arguing from evidence. These scientific practices serve as epistemic tools: they help support the creation of knowledge. The most basic epistemic tool is language, which includes spoken word, written text, equations, figures, and so on. Language is used to share ideas as well as to help build and revise ideas, both publicly and privately. As teacher educators, we want to support teachers in using language as an epistemic tool in science classes, but until now had no way of measuring their knowledge of language's use as an epistemic tool.

To help study how teachers understand the ways language can be used as a tool in science, we developed a questionnaire that reveals how teachers think of language in the creation and evaluation of knowledge in science classrooms. We employed a systematic approach that involved reviewing theory and research about the epistemic role of language, multiple rounds of item writing, expert teacher review, pilot testing, and analyses involving Rasch measurement modeling. We tested the items with 158 in-service and pre-service teachers. We then used these results as a basis for selecting the most effective items for measuring teachers' knowledge of language as an epistemic tool in science classes.

FINDINGS. Based on our review of theory and research, we focused on four aspects of language in the questionnaire: (1) Language is Essential—doing science requires language; (2) Language is Constitutive—thinking about science requires language; (3) Language is needed as both Process & Product to generate and report knowledge; and (4) Language involves Multiple Modes of Representation. Results showed that the questionnaire, with items from all four aspects, was a reliable way of assessing teachers' knowledge of language as an epistemic tool. The instrument's .83 reliability index indicates that we can effectively distinguish between teachers of higher and lower level of knowledge using this questionnaire. We then chose the 15 most effective questions to be included in a shorter, more practical version that is available for free public use at [URL].

TAKEAWAYS. Language is the fundamental epistemic tool for learning. Teachers vary in how much they understand the role of language use as a process to create and validate knowledge. This instrument allows researchers, teacher educators, district personnel, and others to gauge teachers' knowledge of language, and to track possible changes in this knowledge over time. This, in turn, makes it possible to test the efficacy of interventions designed to support teachers' knowledge of language, explore how teacher knowledge develops, and ultimately help to improve that ways that language is used in science classrooms.