Project Goal:
The goal of MOSAT-HS/PS is to develop rigorous assessment tools that aid in generating evidence-based measures of teacher and student understanding of high-school-level physical science concepts. The project first developed multiple-choice items based on the grades 9-12 Next Generation Science Standards (NGSS) for Physical Science, divided into the domains of chemistry and physics, using the published research on misconceptions elicited to that content. The items passed through a two-stage peer-review process and were piloted in a limited number of classrooms to ensure that students were exposed only to items successfully piloted as congruent with their peer group. The project first developing multiple-choice classroom tests in a nationwide sample of chemistry and physics courses in U.S. high schools. Instruments and research are available at no cost to teachers and researchers at the MOSART “Self-Serve” website. Research findings have been presented at meetings and through publication.

Major Accomplishments to Date:

- Test Development: misconception-based multiple-choice items for grades 9-12 NGSS physical science: 593 in chemistry and 616 in physics. Draft items reviewed by external experts. Items revised for content, clarity, and item response theory (IRT) difficulty, discrimination, guessing, item fit to IRT model.
- Pilot testing: using the Amazon Mechanical Turk (AMT) crowdsourcing platform to develop items for a prototype instrument (MOSART-PRIME) for teacher knowledge. AMT administration online, with teachers and their 6,893 students and 361 physics teachers with their 6,841 students.
- Field testing: conducted with formal classroom administration of items to 3,186 subjects in chemistry and 1,769 in physics.
- Item Construction:
  - IRT Difficulty: high (≥0.70).
  - IRT Discrimination (D): high (D>0.50).
  - Low aggregate gender bias of instrument.
  - Wide range of IRT difficulty (D) and low Standard Errors (SE) of theta across range of ability (from students to teachers).
  - High IRT discrimination (D) for half of items for large measurement of teacher knowledge of student misconceptions (KOSM or KOSP).
  - Low-aggregate gender bias of instrument.

- Data Analyses:
  - Predicted student HS physics posttest item correctness as a function of the misconception strength of the items and teachers.
  - Adjusted science knowledge and Knowledge of Student Misconceptions, controlling for student pretest correctness by item.

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