The Promise of Innovative Methodologies for Diverse Students in Mathematics Assessment



Abstract

ONPAR is a U.S. Department of Education funded project, developing computerized classroom assessments to support teaching and assessing students' knowledge of complex mathematics and science. These assessments use engaging multi-media content to greatly reduce accessibility barriers for students who struggle with languageheavy traditional tests, and employ sophisticated scoring algorithms to provide users with immediate and useful diagnostic feedback. ONPAR is designed to integrate into existing classroom curriculum using the latest college and career readiness standards, including the Common Core State Standards for Mathematics.



Background

- ONPAR is a methodology established to measure challenging mathematical knowledge and skills of widely diverse students, including English Learners (ELs) and those with learning disabilities.
- Drawing from linguistics and semiotic theory, ONPAR capitalizes on the affordances of different modalities to create a multi-semiotic 'grammar' of assessment design.
- ONPAR assessment items measure a variety of skills and depth of knowledge conventionally assessed through tasks requiring substantial language.
- To convey the essential components of an item, ONPAR tasks utilize representations such as simulations, animations, image rollovers, interactive sequences, and some L1 and L2 text and oral support.
- Within ONPAR tasks, students are asked to respond by building, modeling, assembling, categorizing, or producing relational or inferential explanations using screen stimuli.
- There are approximately 25 different types of response spaces currently used in ONPAR tasks.
- Underlying algorithms capture and score responses in real time. This allows for individualized student and classroom reports to be generated immediately at the end of each task.

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Methods and Materials

Participants: Large-scale tryouts of middle school mathematics and science tasks are being conducted in Wisconsin, Nevada, California, Oregon, Illinois, Colorado, Michigan, and Maryland. There are currently 8800 middle school students and 78 teachers taking part in tryouts of seven ONPAR units, two in mathematics and five in science. **Objectives:**

- Produce technically defensible, interactive diagnostic assessments in mathematics that work using typical classroom technology.
- Determine the accuracy of scoring and language algorithms when applied to a wide range of student and classroom reports.
- Investigate the effectiveness of task implementation and integration. Establish in-person and online teacher trainings, observing teachers'
- comfort with the assessments, and addressing any arising feasibility, usability, and content concerns.

Procedure:

- Development of new assessment tasks based on the latest content standards using evidence-centered design techniques.
- Prior to programming, review of storyboards by practicing classroom teachers for content and curricular alignment.
- Dissemination of completed interactive tasks, along with associated training materials and teaching guides, using the ONPAR portal.
- Facilitation of professional development for pilot teachers related to tasks they planned to implement in their classrooms.
- Teachers uploaded class rosters and administered tasks to students at appropriate times during instruction.
- Dissemination of immediate diagnostic feedback to teachers and students at the completion of each assessment.
- Collection of classroom data, including teacher surveys and interviews.
- Data analysis to confirm assumptions and inform ongoing task and unit design decisions.

Materials:



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Quality control of the technology:

- Accuracy of the task-level and language algorithms:
- names and individual reports.

- most teachers did not take the time to read or use them. Additional use of these resources.
- score report template to improve usability.

- Students liked the digital format and different response types
- sessions useful.

Summary and Next Steps





Results

• Technology was functional across major internet browsers. • Some bandwidth and firewall issues occurred and were resolved. Different iPad versions created difficulties with some response items. These issues were largely addressed through programming changes, however, some issues remain for older model tablets.

• A preliminary evaluation of the algorithms and language populating the reports showed the lines of language per task per student were generally populated correctly for student and the classroom reports. Classroom report links to particular student names at different scores and with different codes generally worked, as did linking student

Teacher efficacy in implementing and integrating the tasks: • Teachers were enthusiastic and found the tasks to be engaging. Some teachers, however, struggled with technology-related elements, such as uploading rosters and activating tasks. Despite the availability of various resources via the teacher portal,

professional development is being designed to help teachers make

• Due to state-wide testing and school calendars, some teachers did not integrate the tasks concurrently with proportional reasoning instruction. Instead, tasks were used for subsequent review. Many teachers suggested layout modifications for the classroom

Teacher and student feedback about feasibility and usability: • Teachers liked the level of challenge, content, and digital nature.

(interactivity), as well as the translator and rollovers.

Students generally found the tasks challenging.

• Teachers and administrators found professional development

• Determine validity of tasks using classification analyses on the tasks and analyzing other data generated by the classroom tryouts.

Collect ongoing teacher feedback focused on the ONPAR portal, assessment tasks, and score reports to inform modifications, particularly classroom score report design, associated classroom resources, and expanded professional development services.

• Analyze pilot data, once completed (Summer 2018).