



Imagination Station (Istation):

Universal Screener Instrument Development for Grade 4

Technical Report 11-01

**Imagination Station (Istation):
Universal Screener Instrument Development for Grade 4**

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Abstract

In this technical report, we describe the development of the Grade 4 Formative Assessment Item Bank for the Imagination Station (Istation). The formative assessment item bank will be used to deliver a computerized adaptive universal screening assessment to support teachers' instructional decisions. The construct underlying the items is mathematics skills and knowledge in Grade 4 as defined by state and national content standards. We include a description of the process used to identify and sample the content and levels of cognitive complexity assessed in the item bank. Next, we describe the item writing procedures. Finally, we describe the process and outcomes of an external item review to document content related evidence for validity.

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Imagination Station (Istation) Universal Screener

being able to logically organize one's knowledge to integrate and understand concepts as part of a coherent whole.

2. Procedural fluency pertains to students' ability to accurately and appropriately carry out skills, including being able to select efficient and flexible approaches.
- 3.

standards. Her interest with assessments led her to writing mathematics assessment items.

Item Writer 4. Item Writer 4 has a Masters of Arts in Teaching from Oregon State University and a Bachelors of Arts in Mathematics from California State University at Fresno. Her thirteen years of teaching high school math have included courses at a variety of levels. The courses have varied in difficulty from foundational math to help transition students into high school through Advanced Placement (AP) and International Baccalaureate (IB) courses that offer students the option of earning college credit during high school. While teaching half-time, she is also currently a half-time math coach helping to coordinate and develop math instructional materials at all grade levels within the district. Over the last five years she has served on several state math panels that have worked to update our state math standards and review/align test items to our state standards.

Item Writer 5. Item Writer 5 is a school psychologist with expertise in mathematics education. She earned a Ph.D. in Educational Leadership with a focus on assessment and measurement. She has been the lead author on a district-wide mathematics formative assessment given to all first through eighth grade

Item Writing Process

After completing the training and attending a project conference call, item writers were provided with the item writing template for creating items. Items were submitted and reviewed by the researchers and project staff. At least two internal reviewers provided feedback for each item. Dimensions of the review included the mathematical accuracy of the item, alignment with the content standards, appropriateness of language and graphics for students in Grade 4, and compliance with the principles of universal design. Comments were returned to the item writers; revisions were made and resubmitted for approval.

Once items were accepted, item level information was entered into an Item Database. Graphics were created by the Istation graphic design team. The finalized items were copy edited and reviewed by SMU researchers and Istation staff.

Content-Related Evidence for Validity

To evaluate the accuracy and appropriateness of the content of the Formative Assessment Item Bank for students in Grade 4, all items were reviewed by mathematicians and teachers.

Mathematician Review

Three mathematicians reviewed all items in Grade 4. Two reviewers were professors of mathematics at a university in Texas. One reviewer was a post-doctoral fellow in mathematics at a university in California working on a project funded through the National Science Foundation. All reviewers had undergraduate and graduate degrees in mathematics. The years teaching and researching in mathematics ranged from 5-17 years. All reviewers were female. Two reviewers were Caucasian and one reviewer was Filipino and Caucasian.

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Items and distractors were evaluated on a 4-point scale for each criterion. A rating of 1 indicated that the item was not accurate, precise, or the distractors were not effective; a rating of 2 indicated that the item was somewhat accurate, precise, or the distractors were somewhat effective; rating of 3 indicated that the item was somewhat accurate, precise, or the distractors were mostly effective; and a rating of 4 indicated the item was somewhat accurate, precise, or the distractors were extremely effective. In instances where the reviewer assigned a score of 1 or 2 on a category, recommendations were solicited that would aid in revision.

Overall, the mathematicians rated the items as mostly to always accurate, precise, and effective. For 57 items, the mathematicians recommended revisions. The primary consideration for revision was the mathematical precision of the language and graphics. For some items, the mathematicians identified multiple plausible answer choices. We revised all items in response to the recommendations. In instances where the mathematician did not provide a suitable suggestion, we revised the item and requested an additional review from an independent mathematician.

Teacher Review

Two teachers with experience teaching Grade 4 mathematics reviewed the items. One reviewer had been teaching in the state of Texas for more than 20 years. The other reviewer was from the state of Oregon and had 4 years of teaching experience. Both reviewers had Master's degrees in education and had experience working with students with disabilities. Both teachers were Caucasian females.

Teachers analyzed each item for grade-level appropriateness in terms of understandability of language and vocabulary, content or concepts, graphics, potential bias in language and/or content, clarity of directions and answers, and effectiveness of distractors. The criteria were further described as follows:

- Appropriateness of language: Is the language used in the item appropriate for students in your grade level? Are the question and response options written so that students in your grade level can understand the meaning of the problem?

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- Bias in language or content: Does the item require background knowledge unrelated to the concept being tested that would differ for students with different backgrounds? Is the language sensitive to students from diverse backgrounds, students with limited English proficiency and students with special needs?
Example: “What _____ may be unfair for students in certain geographic regions and students with diverse background who are unfamiliar with the terms “sub or hoagie.”
- Effectiveness of the distractors: Some students use an eliminating process to narrow their options in the context of multiple-choice questions. The purpose of selecting appropriate distractors is to reduce the likelihood of students with misconceptions choosing a correct answer in the elimination process. Are the distractors appropriate for the item? Do the distractors discriminate between students with specific misconceptions?

The items and distractors were rated on a scale of 1 to 4 for each criterion. A rating of 1 indicated that the item/distractors were not at all appropriate based on the criterion (or very biased); a rating of 2 indicated that the item/distractors were somewhat appropriate based on the criterion (or somewhat biased); rating of 3 indicated that the item/distractors were appropriate based on the criterion (or not biased); and a rating of 4 indicated that the item/distractors were extremely appropriate based on the criterion (or not biased _____ has multi-cultural components to it). In instances where the teachers provided a rating of 2 or lower, they were asked to provide additional suggestions and comments to improve the item.

Overall, the teachers rated the items as mostly appropriate in regards to language, vocabulary content, visual representation, bias, and effectiveness of distractors. The teachers recommended revising 33 items, primarily due to language. Most of the comments suggested using common language for students in Grade 4, such as using the term “garden” as opposed to the term “flower bed.” Several comments referenced the clarity of the visual/graphics. The research team reviewed all suggestions and made revisions based on teacher feedback.

Conclusions

The purpose of this technical report was to describe the development of the formative assessment item bank. We described the construct underlying the items in reference to the content standards and levels of cognitive complexity and described the process for sampling the content assessed in the item bank. Next, we described the item writing procedures and provided the qualifications for the item writers. Finally, we documented the process and outcomes of an external item review by mathematicians and teachers to document content related evidence for validity.

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Appendix A - State Content Standards Referent Sources

National Council of Teachers of Mathematics (NCTM) Curricular Focal Points

The National Council of Teachers of Mathematics (NCTM) Curricular Focal Points were retrieved from http://www.nctmmedia.org/cfp/front_matter.pdf on 4/20/2010. Additional information was also retrieved on 4/20/2010 from: www.nctm.org/focalpoints . The coding system for the NCTM Critical Focal Points can be found under Part II.

Florida

Florida's Next Generation Sunshine State Math Standards (adopted 2007) were retrieved on 4/20/2010 from <http://www.floridastandards.org/Standards/FLStandardSearch.aspx>. Verification of accuracy and currency of the standards was obtained on 5/5/2010 from Florida Department of

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