



Imagination Station (Istation):

Universal Screener Instrument Development for Grade 5

RESEARCH IN
MATHEMATICS
EDUCATION

Technical Report 11-02

**Imagination Station (Istation):
Universal Screener Instrument Development for Grade 5**

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Abstract

In this technical report, we describe the development of the Grade 5 Formative Assessment Item Bank for the Imagination Station (Istation). The formative assessment item bank will be used to

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Imagination Station (Istation) Universal Screener

Items are written following the principles of universal design for assessment (c.f., Ketterlin-Geller, 2005; 2008), and are amendable to accommodations. Items are scored dichotomously.

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

Item Writing Training

All item writers were trained to write items that aligned with the content expectations and met the item specifications. The training included review of the Item Writing Training Manual, as well as participating in a training conference call with the researchers and project staff. The Item Writing Training Manual provides a detailed description of the principles of universal design for assessment. In addition, information was provided on the elements of high quality test design.

The mathematicians were asked to review each item and evaluate the accuracy of the content, precision of the vocabulary, and effectiveness of distractors. The criteria were further described as follows:

- **Mathematical accuracy of content:** Each item was written to reflect an integration of knowledge and skills identified by the NCTM Curriculum Focal Points. Is the item mathematically accurate?
- **Precision of mathematical vocabulary:** Is the mathematical vocabulary used accurately? Is the mathematical vocabulary precise?
- **Appropriateness of the distractors:** Most 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 from choosing a correct answer in the elimination process. Are the distractors appropriate for the item? Are the distractors mathematically plausible misconceptions?

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 31 items, the mathematicians recommended revisions. One reviewer noted the following issues on 12 items: presence of typographical errors in the distractors, the possibility of multiple plausible answer choices, items in which the correct answer was missing, corrections to the stem to improve the precision of the language, and formatting for distractors that include variables. The other reviewer noted the following issues on 19 items: items in which the correct answer was missing, the possibility of multiple plausible answer choices, and distractors that are missing units of measurement. The reviewer also suggested wording of the stem of several items to improve communication of mathematical concepts, as well as creating alternate distractors that aligned with common misconceptions.

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 5 mathematics reviewed the items. One reviewer was a female African American who had been teaching in the state of Texas for more than seven years, with three years experience teaching grade 5. The other reviewer was from the state of

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 to always appropriate in regards to language, vocabulary content, visual representation, bias, and effectiveness of distractors. The teachers recommended revising 23 items, primarily due to language. One reviewer noted the following issues on eight items: the graphics were too small, confusing language for grade 5 students, and numbers with more than four digits should have use a comma. The other reviewer noted the following issues on 15 items: the presence of multiple plausible answers, confusing language for grade 5 students, small or unclear graphics, and possible confusion between the division symbol and the addition symbol. The research team reviewed all suggestions and made revisions based on teacher feedback. Moreover, the item developers changed all division and addition symbols to larger font to aid in discrimination.

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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Figure 1

Content Sampling Matrix

1	10	10	10	10	10	10						
2	10	10	10	10	10	10						
3	10	10	10	10	10	10						
4	10	10	10	10	10	10						
	40	40	40	40	40	40	2	24	2	2	24	2

Appendix A - State Content Standards Referent Sources

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'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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