

Spotlight on Assessment

Measuring Algebra Readiness:

Examining Validity Evidence for the *Iowa Algebra Aptitude Test™*



**IOWA ALGEBRA
APTITUDE TEST™**
FIFTH EDITION

Research suggests that students need a solid foundation in algebra to help maximize their success in subsequent advanced mathematics coursework. As more and more schools offer algebra courses to middle school students to allow for earlier advanced mathematics coursework, helping to ensure that students are ready to take algebra and be successful is critical.

The purpose of this study was to document the content evidence and technical characteristics of the *Iowa Algebra Aptitude Test™* (*IAAT™*) which is intended to provide educators with information about a student's readiness for success in algebra coursework. The *IAAT* is specifically designed and developed to assess skills that are necessary for success in algebra including pre-algebraic number skills and concepts, interpretation of mathematical information, representation of relationships, and appropriate use of mathematics symbols.

Consistent with the *Standards for Educational and Psychological Testing* (2014), the use of assessments such as the *IAAT* should be supported with a sound validity argument that integrates various strands of evidence. This evidence should directly support the uses and appropriate interpretations. Four primary sources of validity evidence are presented in support of the *IAAT*.

Content Evidence

Alignment of content to the foundational skills needed in algebra is an important component of the design of *IAAT*. Algebra requires students to generalize beyond arithmetic principles to solve abstract problems involving scientific notation (Ketterlin-Geller, et al., 2015). Unlike some state summative assessments that measure across content domains, standards and essential concepts that are articulated at specific grade levels, the content alignment process for *IAAT* focused on the desired outcome (success in algebra) and identified foundational skills that are necessary prerequisites. Consistent with the work of Ketterline-Geller and Chard (2011), the *IAAT* measures conceptual understanding of number systems, basic number properties, and understanding and applications of operations. Using teachers of algebra courses offered from middle school through high school in the articulation and development process, the design included the following:

- Reason quantitatively
- Use units to solve problems
- Interpret the structure of expressions
- Create equations that describe numbers or relationships
- Understand equations as a process of reasoning
- Solve equations and inequalities in one or two variables

Evidence Regarding Internal Structure

A confirmatory factor analysis (CFA) showed that a single factor explained the correlations among *IAAT* scores and measures of algebra classroom achievement. Correlations between the Algebra Performance factor and the observed variables ranged from .75 for second-semester grades to .98 for the *IAAT* composite score. A second CFA was conducted to analyze the measurement characteristics of multiple forms of the *IAAT*. The CFA model verified that the scores were comparable with respect to the contributions of the four parts across forms (Pre-Algebraic Number Skills and Concepts, Interpreting Mathematical Information, Representing Relationships, and Using Symbols).

Evidence Regarding Relationships with Algebra Grades

Grades are frequently used as an indicator of student success in algebra. The results of a research study showed a strong relationship between *IAAT* performance and algebra course grades (see Figure 1).

In 2017-2018 five school districts participated in this study with over 1375 students completing the *IAAT* and 872 of the students being admitted directly into an algebra course. Decisions for admissions in algebra were based on a combination of existing math grades, teacher recommendations and *IAAT* scores. The courses from the five districts were examined for consistency in the scope and sequence that were a part of the instruction.

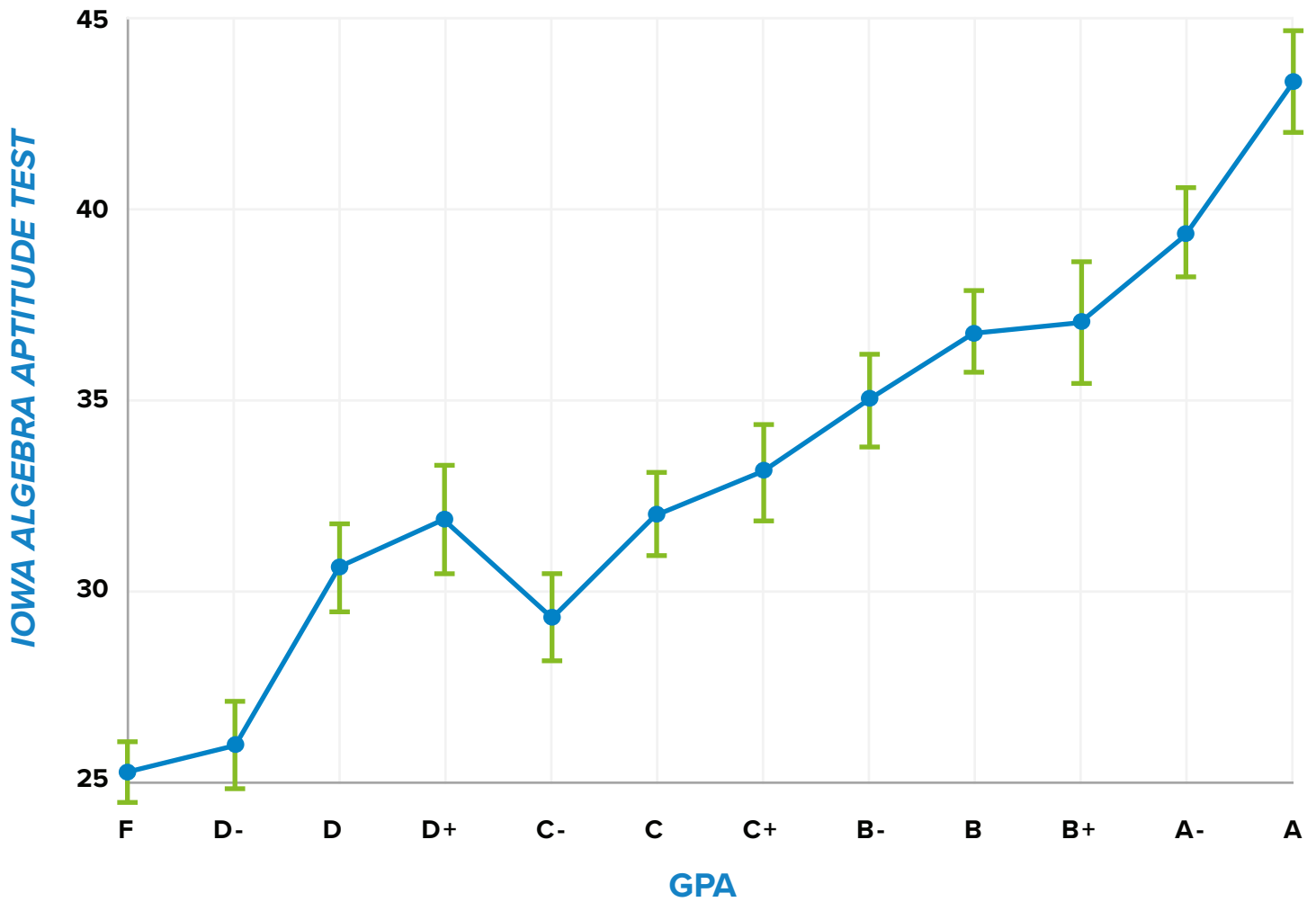
For the 872 students admitted into an algebra course, the average performance on the *IAAT* was a raw score of 32 which converts to a percentile rank (PR) of 53. The average PR for those students earning the highest grades in algebra was approximately 75.

The relationship at the content domain level was also examined and similar strong relationships existed between the individual content domains and course grades, particularly in the area of Interpreting Mathematical Information.

Evidence Related to Other Measures

In addition to algebra grades, the relationship between the *IAAT* and the *Iowa Assessments Mathematics Test* (Grade 7, Level 13) was also examined for the 872 students. The correlation between the two measures was .80 indicating a solid relationship between the two assessments. However, this correlation also suggested that the two assessments were uniquely contributing to the student's overall math ability and that the combination of the two measures may help to maximize success in algebra.

Figure 1: *Iowa Algebra Aptitude Test and GPA*



References

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Author

Catherine Welch, PhD is Co-Director of the Iowa Testing Programs (ITP) and a professor of Educational Measurement and Statistics at the University of Iowa. Dr. Welch conducts a variety of research including a focus on the design, development and validation and use of assessments. She teaches courses related to measurement and assessment issues to graduate students preparing to enter the field of educational measurement. She is a principal author of the *Iowa Assessments*.