Sp●tlight on Assessment

College and Career Readiness

Catherine Welch, PhD, Stephen Dunbar, PhD, and Anthony Fina, PhD

Amid the rising costs of college education and an increasing number of students who arrive on campus unprepared for the rigors of postsecondary coursework comes a growing need to measure—and understand—what it means to succeed in college and/or a career. Enter the ***Iowa Assessments***™. As one of the nation's premier measures of achievement, the ***Iowa Assessments*** provide users with an array of information, including measures of readiness for college and career.

> **We define college readiness as the level of achievement at which a student maximizes his or her success in credit-bearing postsecondary coursework.**

What is college and career readiness?

College readiness is the level of achievement at which a student maximizes his/her success in credit-bearing postsecondary coursework. The concept of readiness has multiple dimensions, but educators and policy makers have reached consensus on many important academic characteristics of students prepared for postsecondary opportunities. Regardless of the research base to support these targets, they are typically predicated on a criterion measure of success and an empirical relationship between prior assessment information (e.g., test score) and success in college.

Educators and policymakers have long been concerned with how to best shape teaching and learning to foster growth and enhance student success after high school. The focus on college and career readiness (CCR), and on assessments that can help, determine it is not a recent manifestation of such a universal ideal in education. E. F. Lindquist, the founder of The Iowa Tests, was a frequent writer on the nature of the problem of improving scholarship and college entrance examinations. As early as 1958, he called for a more clearly aligned assessment with what he termed "lasting outcomes" of general education in core content areas of the high school curriculum. He argued that the right test design for entrance was one that can "measure directly the student's readiness for college" (Lindquist, 1958, p. 108, emphasis in the original).

Lindquist's ideas speak to the broad nature of the CCR construct as it was understood more than half a century ago and to one idea at the core of measuring college and career readiness today: that assessments designed to support inferences about CCR must strike a delicate balance among many complementary and sometimes competing and even conflicting purposes and uses. As we know, college and career readiness have become a clarion call for assessment reform. With this call, validation evidence and arguments for the appropriate use of assessments that claim to measure CCR are urgently needed. Validity evidence presented for the ***Iowa Assessments*** as a general achievement measure strikes a balance between coverage of detailed standards and the more lasting outcomes of education. For the ***Iowa Assessments***, data and college outcome measures validate the appropriate achievement targets for readiness, connect achievement targets to actual performance in college courses, and develop a system for tracking student progress toward readiness achievement targets.

What are the targets for readiness?

In mathematics, this target reflects an emphasis on core aspects of the mathematics domain. The ***Iowa Assessments*** emphasize a developmental progression of content and skill complexity associated with the use of mathematics and quantitative thinking in postsecondary coursework such as algebra, geometry, statistics, and probability.

✳ **Iowa Assessments**™

In reading, the target acknowledges that text complexity is an important aspect of cognition in the assessment of reading. Test materials present engaging ideas that support comprehension questions with variety in terms of cognitive complexity. In addition, specific questions target vocabulary acquisition and the use of context to recognize or infer meaning. Informational and literary texts cover topics in the natural and social sciences, as well as history and government, in the processing of complex information in reading, social studies, and science.

In science, the target acknowledges that students should be able to address methods and processes used in scientific inquiry in areas most common in postsecondary coursework, to compare and interpret data, and to analyze information.

Connections to College Outcomes

The validation argument evaluates direct connections between the **Iowa Assessments** and grades in college. Course grades for the following analysis were selected based on content domain overlap with the assessment. Accordingly, Reading was paired with grades from general education courses in the social sciences, Mathematics with the first course grade recorded in mathematics or general education in quantitative/formal reasoning, and Science with the first course grade recorded in natural science, primarily biology and chemistry. First-year grade-point averages (FYGPAs) also were considered.

The relationship between course grades and the **Iowa Assessments** is depicted in Figure 1, which shows average standard scores for students who receive letter grades A through D. Higher course grades in college are associated with higher average test scores on the **Iowa Assessments**, especially in Reading and Science.

Students deemed "college ready" should perform well overall by demonstrating readiness across a variety of measures – or "indicators" – associated with mastery, not just those in a particular course associated with a subject area test. Figure 2 shows the average FYGPAs of students by the number of readiness indicators they attained in mastery across varied subject areas. As you can see, mean FYGPAs increase with the number of areas in which readiness was attained. Students demonstrating achievement in any two of the three areas averaged a B or B+ overall in their first year of college.

A third approach to examining the college outcome measure is to think of a student's probability of earning a particular course grade. As one example, Figure 3 plots the likelihood of getting either a B or above or a C or above in a college math course against scores on the **Iowa Assessments**. In general, students who performed more ably on the **Iowa Assessments** were more likely to receive a higher letter grade than those who performed less ably. For example, at the low end of performance on the **Iowa Assessments**, students are more than twice as likely to get a C in a course as they are to get a B. Meanwhile, students at the upper end of the performance distribution were generally likely to pass a course (.95 probability of earning a C or above and .80 probability of earning a B or above). Similarly shaped curves were seen across all areas, and additional probability statements can

be found in Fina, A.D., Welch, C., Dunbar, S. and Ansley, T (2015). *College Readiness with the Iowa Assessments*. Iowa City, IA: Iowa Testing Programs.
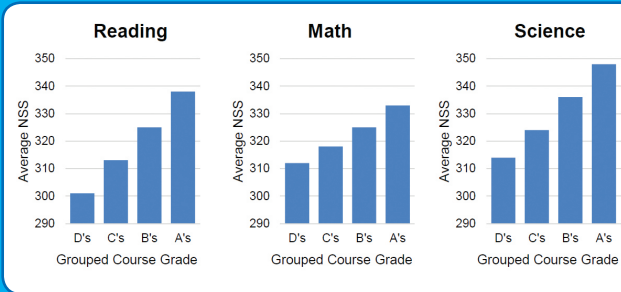

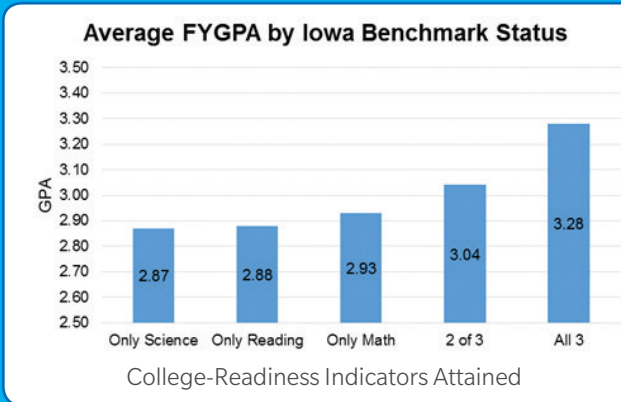**Figure 1.** Probability of Course Grades in College Math, given *Iowa Assessments* Scores

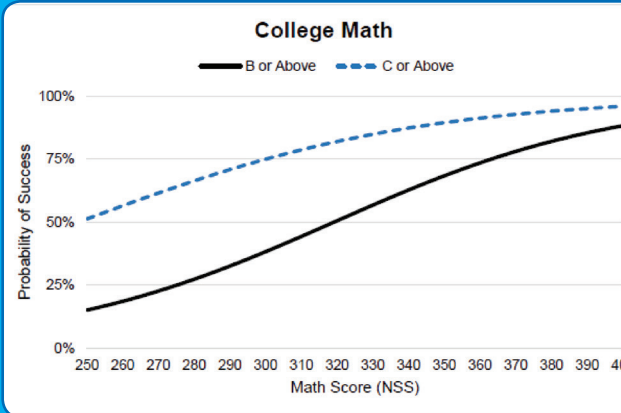**Figure 2.** Mean First-Year Grade Point Average by Readiness Attainment

Figure 3. Probability of Course Grades in College Math, given *Iowa Assessments* Scores

Tracking Student Growth toward Readiness

A universal goal of education is that every student should graduate from high school ready for success in college and/or a career or, in the language of the Every Student Succeeds Act, by achieving postsecondary and workforce readiness (ESSA, 2015). Such readiness helps provide students with meaningful choices in opportunities upon graduation from high school.

The *Iowa Assessments* monitor progress toward readiness for postsecondary education by using a growth model that integrates 1) learning as a continuum rather than a discrete set of skills; and 2) measures growth accurately using a vertical scale.

Learning is a Continuum. To argue for the measurement of growth toward readiness presumes some degree of continuous development in the achievement domain on which both growth and readiness are based. The domain and a model for growth begins with defining content standards that describe continuous learning. Sometimes the term "learning progression" may be used in this context, but this idea of a learning continuum can differ somewhat. Discrete, granular descriptions of content that are the objectives of small instructional units such as those in signed-number arithmetic, for example, may reflect a learning progression, but they may not be the best focus for an assessment of growth used to track progress over time, such as grade-to-grade growth toward readiness in science or reading. In this sense, the learning continuum constitutes a broad definition of the achievement domain and what it means to "grow" with respect to important content standards of the domain that may span three to five years of education. Measuring growth requires test design and development that retains focus on this attribute of the domain in question.

Measuring with a Vertical Scale. A vertical scale quantifies and describes student growth over time through a growth metric. One of the defining attributes of the growth metric is that the projection of subsequent performance can be made conditional on prior performance through the vertical scale. The expected vertical scale scores for each grade level and content area are derived from a large reference group and show the relative standing of a student's achievement within the score distribution of a national probability sample (Dunbar & Welch, 2015). Many tests that measure yearly growth are vertically aligned in their content and scaled across grades. This means that each successive test level builds upon the content and skills measured by the previous test level.

To bring together the ideas of growth and college readiness, the readiness benchmarks for the *Iowa Assessments* can be traced backward using the **Iowa Growth Model** to define, for grades prior to Grade 11, the comparable scale score that represents an achievement level of the same relative standing in the reference population. Everything that has been said about domain definitions of the assessments across the learning continuum is critical to valid interpretation of this backward projection of readiness benchmarks. This approach offers an empirically defined reference point for an "on-track" interpretation of achievement with respect to a long-term goal of teaching and learning. Of interest is the validation of the utility of this information for test score interpretation.

The two features of the **Iowa Growth Model** are illustrated in Figure 4 with the full performance continuum presented for each grade level. The vertical scale, reported in national standard score units, anchors the learning continuum from the early grades through Grade 12 and illustrates the growth dimension. Reviewed comprehensively across grades, the overlapping scale from level to level suggests students are growing at different rates across the learning continuum. The National Percentile Ranks (NPR) are depicted at the 40th, 50th, and 90th percentiles for each grade. Tracking the NPR from grade to grade across the scale score bands indicates expected annual growth for a student performing at that level. Within each grade, performance levels can be defined for college readiness, as shown in green. For example, Figure 4 illustrates that, in Grade 12, college readiness (CR) is identified at the national standard score of 310 and corresponding to an NPR of 70 to 80, depending on subject area and time of year. Additionally, the bars at the bottom of the graph illustrate the coverage of specific content within and between grade levels as they span the entire learning continuum.

The **Iowa Growth Model** tracks student achievement from grade to grade and supports setting goals for teaching and learning. The basic tenets of the growth model are described—and validity evidence presented—in a more comprehensive description of the model in Welch and Dunbar (2014).
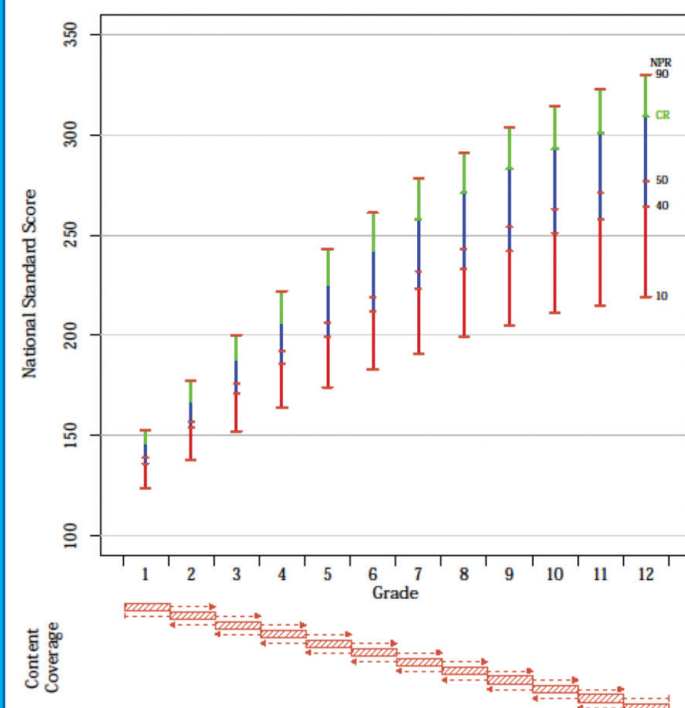

Figure 4. Iowa Growth Model Vertical Scale

Conclusions

Over the past several years, college and career readiness increasingly has become a key educational policy goal. Understanding and measuring the concept of readiness often requires more than a single assessment. One such instrument is the *Iowa Assessments*, which features a preponderance of evidence about postsecondary readiness. For example, subject-matter experts certify that a given set of content standards in each grade level of the *Iowa Assessments* can define a progression of learning that leads to readiness. In addition, test designers and developers follow a process that results in assessments with high fidelity to content standards; field tests bolster the argument for the appropriateness and accessibility of the test questions that help assess readiness.

Creation of this evidence is a critical part of best practice in test design and development and in approaches such as evidence-centered design. Such judgmental evidence is a primary focus of quality-assurance documents for college- and career-ready assessments, and serves as the correct starting point in the validation of assessments for a future generation. The *Iowa Assessments*, however, move beyond the judgmental and address a more comprehensive range of validation recommendations discussed by Kane (2006) of the 2014 Standards for Educational and Psychological Testing (AERA, APA & NCME, 2014) and provide an evidentiary basis for validation arguments. In closing, the *Iowa Assessments* illustrate the utility of a well-designed general assessment and reporting system for purposes of postsecondary readiness and student growth toward that objective.

References

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (2014). Standards for educational and psychological testing. Washington, DC: American Educational Research Association.

Camara, W. (2013). Defining and measuring college and career readiness: A validation framework. Educational Measurement: Issues and Practice, 32 (4), 16–27.

College Board. (2010). The development of a multidimensional college readiness index. College Board Research Report No. 2010-3. New York: The College Board.

Dunbar, S. & Welch, C. (2015). *Iowa Assessments Research and Development Guide Forms E and F.* Orlando, FL: Houghton Mifflin Harcourt.

Every Student Succeeds Act (2015). Pub. L. 114-95.

Fina, A.D. (2014) A third approach to examining the college outcome measure is to think of a student's probability of earning a particular course grade.

Fina, A.D. (2014). Growth and the college readiness of Iowa students: A longitudinal study linking growth to college outcomes. (Doctoral thesis). Iowa City, IA: University of Iowa.

Fina, A.D., Welch, C., Dunbar, S. & Ansley, T (2015). College Readiness with the Iowa Assessments. Iowa City, IA: Iowa Testing Programs.

Kane, M. T. (2006). Validation. In R.L. Brennan (Ed.), Educational Measurement (4th ed.). Westport, CT: American Council on Education/Praeger.

Lindquist, E.F. (1958). The nature of the problem of improving scholarship and college entrance examinations. In R.T. Lennon (Ed.), Proceedings of the 1958 Invitational Conference on Testing Problems (pp. 104–113). Princeton, NJ: Educational Testing Service.

Welch, C. & Dunbar, S. (2014). Measuring Growth with the Iowa Assessments. Iowa City, IA: Iowa Testing Programs.

Authors

Catherine Welch, PhD is a professor of Educational Measurement and Statistics at the University of Iowa. She teaches graduate-level courses in educational measurement and conducts research in the areas of test design, interpretation, and growth. Dr. Welch has responsibilities with Iowa Testing Programs, where she directs statewide testing for the *Iowa Assessments* and the Iowa End-of-Course Assessments. She is a principal author of the *Iowa Assessments*.

Stephen Dunbar, PhD is the Hieronymus-Feldt Professor of Educational Measurement in the College of Education at the University of Iowa, where he has taught since 1982, and also serves as Director of Iowa Testing Programs. His primary research interests are in the areas of test development and technical applications in large-scale assessment. He is a principal author of the *Iowa Assessments*.

Anthony Fina, PhD, is an Assistant Research Scientist for the Iowa Testing Programs.

Contact your Riverside Insights Representative or call Riverside Insights Customer Service for a presentation.

Connect with us:

riversideinsights.com • 800.323.9540

Riverside Insights