Towards The National Assessment of Educational Progress (NAEP) as an **Indicator of Academic Preparedness** for College and Job Training

Ray Fields
National Assessment Governing Board
May 2014

National Assessment Governing Board

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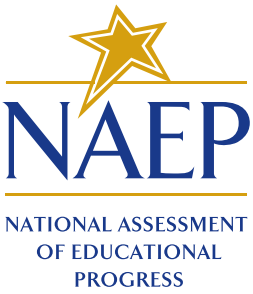

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Introduction

For more than a decade, the National Assessment Governing Board has been conducting research to determine the potential of the National Assessment of Educational Progress (NAEP) at grade 12 to serve as an indicator of academic preparedness for college and job training. This report provides the rationale for pursuing this goal, the Phase I research results from more than 30 studies conducted in connection with the 2009 administration of 12th grade NAEP, and the implications for reporting the 2013 NAEP 12th grade results.

Indicators of many kinds are used to monitor critical aspects of national life and inform public policy. These include economic indicators (e.g., gross domestic product), health indicators (e.g., cancer rates), and demographic indicators (e.g., population trends by race/ethnicity and gender).

NAEP serves the public as a national and state indicator of education achievement at the elementary and secondary levels. NAEP reports achievement results for the nation, states, and demographic subgroups. NAEP does not report or provide individual student results.

NAEP monitors student achievement at key points in the elementary/secondary progression: grades 4, 8, and 12. According to a policy statement of the National Assessment Governing Board (National Assessment Governing Board, 2013b):

- The 4th grade is the point at which the foundations for further learning are expected to be in place (e.g., when "learning to read" becomes "reading to learn")
- The 8th grade is the typical transition point to high school
- The 12th grade is the end of the K-12 education experience, the transition point for most students to postsecondary education, training, the military, and the work force.

NAEP is the only source of nationally representative 12th grade student achievement results. State tests of academic achievement are usually administered before 12th grade and are quite different across the country. Likewise, college admission tests like the ACT and SAT are generally taken before 12th grade by a self-selected sample and, therefore, are not representative of all 12th graders.

Consequently, NAEP is uniquely positioned to serve as an indicator of academic preparedness for college and job training at grade 12—the point that represents the end of mandatory schooling for most students and the start of postsecondary education and training for adult pursuits.

A wide array of state and national leaders has embraced the goal that 12th grade students graduate "college and career ready." These include the leadership and members of the National Governors Association (NGA), the Council of Chief State School Officers (CCSSO), the Business Roundtable (BRT), the U.S. Chamber of Commerce (the Chamber), a task force on education reform of the Council on Foreign Relations, and state and national political leaders (Fields and Parsad, 2012, pp. 3-4).

NAEP and Academic Preparedness

The Governing Board believes that NAEP reporting on the academic preparedness of 12th grade students would afford an invaluable public service: providing an indicator of the human capital potential of today's and future generations of the nation's population.

The Board began this initiative in 2004, after receiving recommendations from a distinguished blue-ribbon panel that had examined whether NAEP should continue assessing at the 12th grade.

The panel stated that "America needs to know how well prepared its high school seniors are… [only NAEP] can provide this information…and it is necessary for our nation's continued well being that it be provided." The panel recommended that NAEP continue to assess at grade 12 and that the 12th grade assessment be transformed to measure readiness for college, job training, and the military[1] (National Commission on NAEP 12th Grade Assessment and Reporting, 2004, p. 2).

In acting on the panel's recommendations, the Governing Board changed the term "readiness" to "academic preparedness." This is because "readiness" is broadly understood to include both academic preparedness and other characteristics needed for success in postsecondary education and training, such as habits of mind, time management, and persistence (Conley, 2007). NAEP does not measure such characteristics. Rather, NAEP is designed to measure academic knowledge and skills.

To transform 12th grade NAEP into an indicator of academic preparedness, the Governing Board took several significant steps.

1. The Board determined that measuring academic preparedness for college and job training should be an intended purpose of 12th grade NAEP (see http://www.nagb.org/content/nagb/assets/documents/policies/resolution-on-preparedness.pdf).

2. The Board contracted with Achieve, Inc. in 2005 to review the NAEP 12th grade reading and mathematics assessment frameworks and identify where changes, if any, would be needed. Modest changes were recommended (Achieve, 2005; Achieve, 2006).

3. Accordingly, the Board made changes to the frameworks to be used for the administration of the 12th grade assessments, scheduled for 2009 and 2013 (National Assessment Governing Board, 2008a; 2008b).

4. In 2007, the Board assembled a team of noted psychometricians, industrial/organizational psychologists, and K-12 and postsecondary researchers to serve as a technical panel, advising on validity research to conduct.

5. In 2008, the technical panel recommended a comprehensive program of research (National Assessment Governing Board, 2009a). The validity of statements about academic preparedness in NAEP reports would be affected by the degree to which the results were mutually confirming.

[1] Prepared for the military was later subsumed under "prepared for job training" by Board action.

Figure 1 presents a model of the research program, with five types of research displayed, the interrelationships that would be examined, and the potential meaning of the research results in terms of the NAEP score scale.

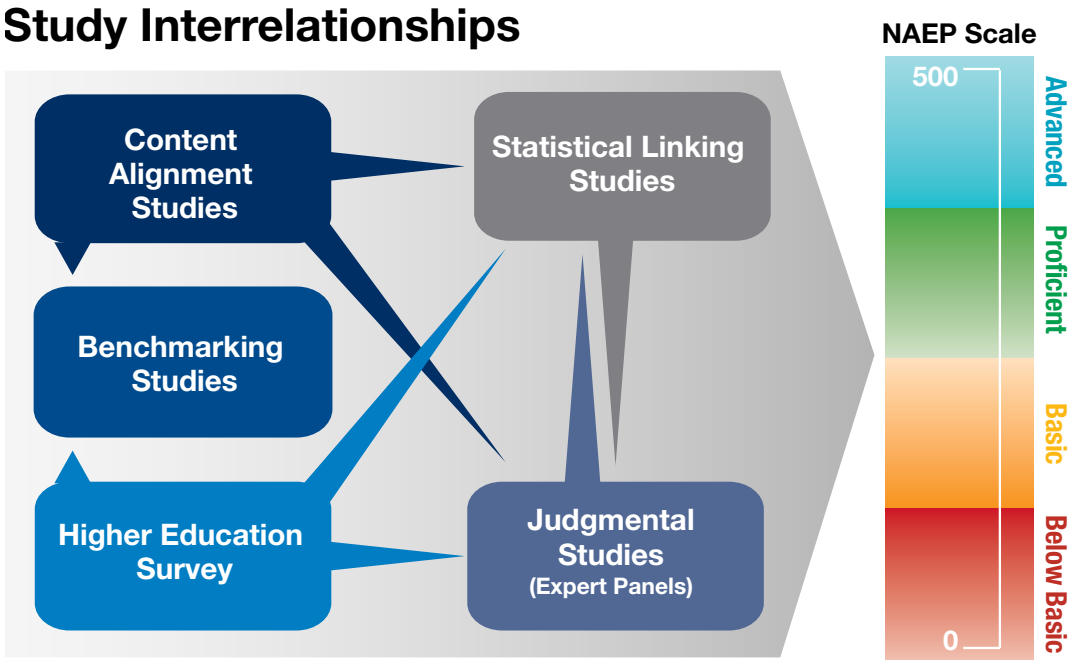
6. The Board began contracting for the research studies in 2008, in connection with the 2009 administration of the 12th grade reading and mathematics assessments. More than 30 research studies were completed during the period 2009-2012 (see technical report at http://www.nagb.org/what-we-do/preparedness-research.html).

   The research studies were of five types: (1) content alignment studies to compare the content of NAEP with the content of other relevant tests, (2) statistical linking studies to compare performance on NAEP and other relevant tests by the same sample of students, (3) judgmental studies in which experts identify the point on the NAEP scale that represents "just academically prepared", (4) a survey of postsecondary education institutions' use of tests and cut scores for placement into first-year courses, and (5) benchmarking studies in which target groups of interest take NAEP (e.g., military recruits, freshmen college students, trainees in selected technical/career programs, etc.).

The Research Findings

The research findings were generally consistent across studies. Brief examples of the research results follow, which include data from different years (e.g., see Figures 2 and 3).

Figure 1: Model of the Preparedness Research Program



The content of the 12th grade NAEP reading and mathematics assessments was found to be similar to widely recognized tests used for college admission and placement (see http://www.nagb.org/what-we-do/preparedness-research/types-of-research/content-alignment.html).

Performance by the same sample of students on NAEP and the SAT mathematics and reading tests was correlated at 0.91 and 0.74, respectively (see http://www.nagb.org/content/nagb/assets/documents/what-we-do/preparedness-research/statistical-relationships/SAT-NAEP_Linking_Study.pdf).

Statistical linking studies examined performance on NAEP in relation to the college readiness benchmarks adopted by the College Board for the SAT reading and mathematics tests. The average NAEP score of students scoring at the SAT college readiness benchmarks was 163 in mathematics and 301 in reading.[2] These results were confirmed by other studies that examined performance on NAEP in relation to the college readiness benchmarks adopted for the ACT (see Figures 2 and 3).[3]

A longitudinal study followed a representative sample of Florida 12th grade NAEP test-takers into the state's public colleges. The longitudinal study permitted an analysis of performance on NAEP and actual student outcomes. In the first year of this study, an analysis was conducted of performance on NAEP and (1) enrollment in regular versus remedial courses, and (2) first-year overall college grade point average (GPA). The average NAEP score of the students who were not placed into remedial courses or who had a first-year college GPA of B- or better was similar to, and thus confirmed, the NAEP to SAT linking studies cited previously (see Figures 2 and 3).

Results from the more than 30 studies were used to develop a validity argument to support proposed inferences (claims) about academic preparedness for college in relation to performance on 12th grade NAEP. The validity argument was reviewed by two independent technical reviewers. The technical reviewers concluded that the validity argument supports the proposed inferences.

The complete research reports and the validity argument can be found at http://www.nagb.org/what-we-do/preparedness-research.html. The two independent reviews can be found in Appendix A and Appendix B of the validity argument at http://www.nagb.org/content/nagb/assets/documents/what-we-do/preparedness-research/nagb-validity-report.pdf.

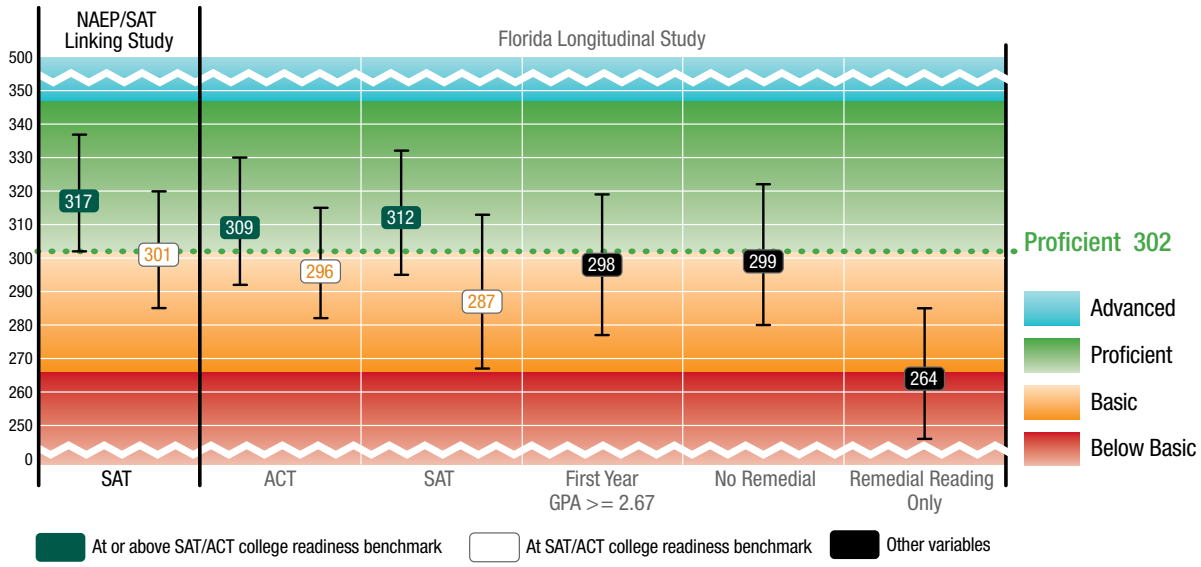
The research results support inferences about NAEP performance and academic preparedness for college at the national level. The research results do not support inferences about NAEP performance and academic preparedness for job training. A second phase of NAEP preparedness research was begun using NAEP data collected in 2013. The results from the second phase of research will be examined to determine the extent to which they confirm existing results. They also will be examined to determine their support for (1) inferences about academic preparedness for college at the state level, (2) reporting by demographic subgroups, and (3) inferences about academic preparedness for job training.

[2] The average score of 301 in reading is not statistically different than the cut score for the Proficient achievement level on NAEP, which is 302. Consequently, the Governing Board developed the inference for reading in relation to the score of 302.

[3] The respective SAT and ACT college readiness benchmarks in effect in 2009 were used for the analyses in the studies displayed in Figures 2 and 3.

Figure 2: NAEP 12th Grade Academic Preparedness Research: Reading

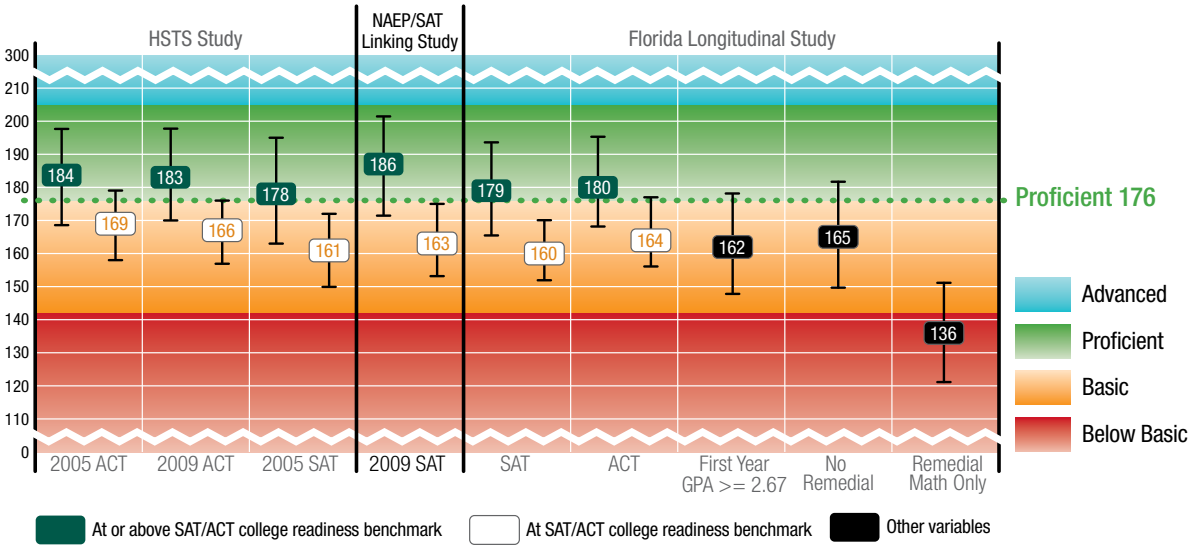
Average Scores and Interquartile Ranges on NAEP for Selected Variables and SAT/ACT College Readiness Benchmarks, from the 2009 NAEP SAT Linking Study and 2009 Florida Longitudinal Study



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, previously unpublished analyses, March 2013; National Assessment Governing Board, Statistical Linking of National Results from NAEP and SAT (2009), previously unpublished analyses, March 2013; National Assessment Governing Board, *Longitudinal Statistical Relationships for Florida NAEP Examinees: First-Year College Performance Outcomes (2009–2010),* previously unpublished analyses, March 2013.

Figure 3: NAEP 12th Grade Academic Preparedness Research: Mathematics

Average Scores and Interquartile Ranges on NAEP for Selected Variables and SAT/ACT College Readiness Benchmarks, from the 2009 NAEP/SAT Linking Study, 2005 High School Transcript Study, 2009 High School Transcript Study, and 2009 Florida Longitudinal Study



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, NAEP High School Transcript Study (2005, 2009), previously unpublished analyses, March 2013; National Assessment Governing Board, Statistical Linking of National Results from NAEP and SAT (2009), previously unpublished analyses, March 2013; National Assessment Governing Board, *Longitudinal Statistical Relationships for Florida NAEP Examinees: First-Year College Performance Outcomes (2009–2010),* previously unpublished analyses, March 2013.

A Transition to Reporting on Academic Preparedness

The reporting of the 12th grade results for 2013 represents a transition point for NAEP.

The interpretations of the 2013 NAEP 12th grade reading and mathematics results related to academic preparedness for college set forth in this report are foundational, a first step, and subject to adjustment in the future. **Accordingly, the percentages of students at or above the NAEP scores described in the inferences for reading and mathematics below should be considered provisional estimates.**

The technical reviewers concluded that these interpretations are supportable. They are included in this report to promote public discussion about their meaningfulness and utility.

The Context for Academic Preparedness for College

In the United States in 2014, there is no single, agreed upon definition of "academic preparedness for college." Postsecondary education in the U.S. is a complex mix of institutions, public and private, that have different admission requirements and different procedures and criteria for placing individual students into education programs.

In this complex mix are 2-year institutions, 4-year public and private institutions with a wide range of selectivity, and proprietary schools. Institutions range from highly selective (i.e., with admission criteria including very high grade point averages, successful completion of rigorous high school coursework, and very high SAT and/or ACT scores) to open admission (i.e., all applicants are admitted).

Even within institutions, requirements may vary across majors or programs of study. For example, the mathematics and science high school coursework and academic achievement needed for acceptance into an engineering program in a postsecondary institution may be more rigorous than the general requirements for admission to the institution or for a degree in elementary education in that institution.

The need for clarity and coherence in describing to students, parents, and educators what constitutes academic preparedness for college is widely recognized. State education agencies responsible for K-12 and postsecondary education have been working for several years—collectively as a part of consortia collaborating with national organizations or individually for their own state—on standards and tests to define and measure academic preparedness for college. This work is expected to continue for the next several years.

In addition, the SAT and the ACT college admission testing programs continue to be refined, in terms of test content and research on indicators of college readiness.

An Evolving Definition of Academic Preparedness for College for NAEP

Given the diversity of postsecondary education institutions, it is essential to provide a reasonable definition of academic preparedness for NAEP reporting. The definition should be relevant to NAEP's purpose of providing group estimates of achievement. (It is important to note that NAEP does not provide individual student results.)

The definition should be meaningful to NAEP's primary audiences: the general public and national and state policymakers.

In order to design the NAEP 12th grade preparedness research, a working definition of preparedness was needed. As a working definition, it would change and evolve based on the research results. The working definition was intended to apply to the typical degree-seeking entry-level student at the typical college. For the working definition, "academically prepared for college" refers to the reading and mathematics knowledge and skills needed for placement into entry-level, credit-bearing, non-remedial courses in broad access 4-year institutions and, for 2-year institutions, the general policies for entry-level placement, without remediation, into degree-bearing programs designed to transfer to 4-year institutions.

It is important to note the focus on "placement" rather than "admission." This distinction was made because students who need remedial courses in reading, mathematics, or writing may be admitted to college, but not placed into regular, credit-bearing courses. The criterion of importance is qualifying for regular credit-bearing courses, not admission.

The working definition was not intended to reflect

- academic requirements for highly selective postsecondary institutions;
- the additional academic requirements for specific majors or pre-professional programs, such as mathematics, engineering, or medicine; or
- academic requirements applicable to entry into certificate or diploma programs for job training or professional development in postsecondary institutions.

The working definition was focused on the first year of college; it did not address college persistence beyond the first year or completion of a degree. The definition was intended to apply in general across a broad range of programs and majors, but not specifically to any particular program or major.

Inferences for NAEP Reporting

The NAEP preparedness research does not affect the 2013 NAEP 12th grade results in any way. The distribution of student achievement is unchanged. That is, the average scores, the percentiles, and the achievement level results are not impacted by the NAEP preparedness research.

The independent technical reviewers confirmed that the research findings support inferences about performance on NAEP 12th grade results in reading and mathematics in relation to academic preparedness for college. The research findings had an impact on the working definition of academic preparedness for college that was used for the purpose of designing the preparedness research. In contrast to the working definition's focus on being just "minimally academically prepared" (i.e., not needing remedial reading or mathematic courses in college), the research findings point more to a level of academic achievement consistent with attainment of a first-year overall college grade-point average of B- or better and a low probability of placement into remedial courses in college.

Inference for Reading

In the NAEP/SAT linking study for reading (Figure 2), the average NAEP score for 12th grade students scoring at the SAT college readiness benchmark for critical reading was 301, not significantly different statistically from the Proficient cut score of 302. The results from the Florida longitudinal study were confirmatory.

These data, together with the content analyses that found NAEP reading content to be similar to college admission and placement tests, support the inference for reading that

> Given the design, content, and characteristics of the NAEP 12th grade reading assessment, and the strength of relationships between NAEP scores and NAEP content to other relevant measures of college academic preparedness:
>
> > *the percentage of students scoring at or above a score of 302 on the Grade 12 NAEP scale in reading is a plausible estimate of the percentage of students who possess the knowledge, skills, and abilities in reading that would make them academically prepared for college.*
>
> A score of 302 corresponds to the cut score for the Proficient achievement level in 12th grade reading.
>
> In 2013, 38% of 12th graders nationally scored at or above 302 in reading.

Inference for Mathematics

In the NAEP/SAT linking study for mathematics (Figure 3), the average NAEP score for 12th grade students scoring at the SAT college readiness benchmark for mathematics was 163, lower than and significantly different from the Proficient cut score of 176. The results from the High School Transcript Study and the Florida longitudinal study are confirmatory.

These data, together with the content analyses that found NAEP mathematics content to be similar to college admission and placement tests, support the inference for mathematics that

> Given the design, content, and characteristics of the NAEP 12th grade mathematics assessment, and the strength of relationships between NAEP scores and NAEP content to other relevant measures of college academic preparedness,
>
> > *the percentage of students scoring at or above a score of 163 on the Grade 12 NAEP scale in mathematics is a plausible estimate of the percentage of students who possess the knowledge, skills, and abilities in mathematics that would make them academically prepared for college.*
>
> A score of 163 in mathematics is between the cut scores for the Basic and Proficient achievement levels in 12th grade mathematics.
>
> In 2013, 39% of 12th graders nationally scored at or above 163 in mathematics.

The research results for mathematics support a related inference—that students in the distribution at or above the NAEP Proficient level in mathematics are likely to be academically prepared for college. However, the percentage of such students would be substantially less than the percentage in the distribution at or above 163, and thus, would underestimate the percentage of 12th grade students in the U.S. who are academically prepared for college.

To consider the plausibility of these estimates, comparisons can be made with the percentages of students who met the ACT or SAT college readiness benchmarks. These data, displayed in Table 1, are from reports published by ACT and the College Board, respectively.

The table presents information about students who were seniors in 2009 (ACT) and in 2010 (SAT). Thus, the ACT data are for the same student cohort as the NAEP research data, but the SAT data are for a cohort that followed one year later.

It also must be noted that, unlike the NAEP results, neither the ACT nor the SAT results represent all 12th graders. Further, there is overlap among ACT and SAT test-takers, with about 20% estimated to take both tests.

Assuming that a substantial portion of students who do not take either test are not academically prepared for college, it is not inconsistent that the NAEP percentages displayed in the table are lower than those for the respective college readiness benchmarks.

Table 1

Percentages* scoring at/above 302 in Reading on NAEP and at/above 163 in Mathematics on NAEP, and at/above ACT and SAT College Readiness Benchmarks

	Reading	Mathematics
ACT (2009)	53	42
SAT (2010)	50	54
NAEP (2009)	38	40

* About 48% of 12th graders took the ACT or SAT. NAEP is intended to represent 100% of 12th graders.

Source: ACT (http://www.act.org/newsroom/data/2009/benchmarks.html); SAT (Wyatt et. al. (2011); National Center for Education Statistics.)

Limitations on Interpretation and Other Caveats

False Negatives and False Positives

Some proportion of 12th grade students scoring below 302 on the 12th grade NAEP Reading or below 163 on the Mathematics Assessment are

- likely to be academically prepared for college
- not likely to need remedial/developmental courses in reading or mathematics in college,

but with a lower probability than those at or above 302 in reading or 163 in mathematics.

In addition, some proportion of 12th grade students scoring at or above 302 on the 12th grade NAEP Reading or 163 on the Mathematics Assessment may

- not be academically prepared for college
- need remedial/developmental courses in reading or mathematics in college.

Academic Preparedness Indicators and Inferences

The NAEP reading and mathematics scores identified in this report are intended to serve as preliminary indicators of the academic preparedness of the U.S. students. They are not intended to represent or be used as standards for minimal academic preparedness for college. The use of these indicators is intended solely to add meaning to interpretations of the 12th grade NAEP reading and mathematics results in NAEP reports. It is important to note that the measures and outcomes used in the validity argument to support the inferences in this report are at a level that is somewhat beyond a "minimally acceptable"

or "just qualified" level for placement into entry-level, credit-bearing courses. **Thus, the average NAEP scores associated with these indicators are based on measures and outcomes that point more to solid academic achievement than to a "minimal" level of academic preparedness.**

GPA of B- or Better

The variable "first-year GPA of B- or better" was selected because of its use as a research-based criterion in defining college readiness benchmarks developed by an acknowledged leader in college testing programs—the College Board. The College Board had agreed to partner with the Governing Board in the study linking performance on 12th grade NAEP with the SAT. Another leader in college testing programs, ACT, Inc., has developed similar benchmarks for its college admission assessments using a similar criterion and similar methodology. Because they are based on research related to college outcomes, and because performance on the respective tests could be linked to performance on NAEP, the college readiness benchmarks used by these testing programs were relevant, useful points of reference for the NAEP preparedness research.

The College Board set a score of 500 on the SAT Mathematics and Critical Reading tests as its college readiness benchmarks in those areas. Based on its research, the College Board determined that the score of 500 predicts, with a probability of .65, attainment of a first-year overall GPA of B- or higher. Similarly, the ACT college readiness benchmarks are based on research indicating a .50 probability of attaining first-year grades in relevant courses (e.g., college algebra and courses requiring college-level reading) of B or better and .75 probability of C or better.

The inferences are not intended to convey that a B- or any particular grade should be deemed a standard or goal for postsecondary student outcomes. This criterion was selected to foster comparability across the preparedness research studies, where applicable. However, it does seem self-evident that achieving a first-year GPA of B- or better, without enrollment in remedial/developmental courses, lends support to the likelihood of having possessed academic preparedness for first-year college courses upon entry to college.

Data Limitations

The NAEP preparedness research studies are comprehensive and the results consistent and mutually confirming. However, for reading, the statistical studies are limited to one year for data at the national level and to one state-based longitudinal study. For mathematics, there are two separate years of data at the national level and one state-based longitudinal study (see Figure 3). Therefore, more evidence exists to support the plausibility of inferences related to mathematics than to reading. Further, at this time, inferences will be made at the national level only. Research completed to date does not support inferences at the state level or for student subgroups.

Preparedness for Job Training

The research to date with respect to academic preparedness for job training does not support conclusions relative to the NAEP scale. Options for additional research on this topic will continue to be reviewed and discussed by the Governing Board.

Conclusion

The independent technical reviewers found the Governing Board's preparedness research to be methodical, rigorous, and comprehensive. They concluded that the research findings support the use of inferences in NAEP reports about 12th graders' academic preparedness for college.

The interpretations of NAEP results in relation to academic preparedness for college are being reported on a preliminary basis. They are provided to help foster public understanding and policy discussions about defining, measuring, validating and reporting on academic preparedness for college, both for NAEP and for related initiatives more broadly.

Including these inferences in NAEP 12th grade reports is intended to add meaning to the interpretation of the NAEP 12th grade results. However, the potential for misinterpretation exists. For these reasons, the section above on limitations on interpretation and other caveats is included in this report.

The Governing Board will monitor the use of these inferences, as well as unintended consequences arising from their use, as a part of the next phase of the preparedness research. The Board will take appropriate steps to clarify any misconceptions that may be discovered through this monitoring.

The next phase of the preparedness research is being conducted in connection with the NAEP reading and mathematics assessments administered in 2013. The research will be used to refine and possibly expand reporting on 12th grade academic preparedness.

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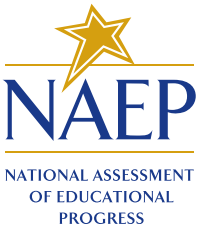

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