

Improving the Contextual Questionnaires for the National
Assessment of Educational Progress:

PLANS FOR NAEP CORE CONTEXTUAL MODULES

A WHITE PAPER TO THE NATIONAL ASSESSMENT
GOVERNING BOARD

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NOTE

This white paper is in draft form.

1 Introduction

This memo describes the plans to develop core contextual questionnaire modules for the 2017 National Assessment of Educational Progress (NAEP) technology-based survey questionnaires.

Two main goals for this memo are, first to describe a proposed revised general questionnaire approach that focuses on questionnaire modules and indices in addition to stand-alone questions and, second, to describe five potential modules capturing opportunity to learn and noncognitive student factors relevant to student achievement that are proposed for future NAEP Core survey questionnaires. Evidence from the research literature on selection of these modules will be provided.

We thereby directly address the National Assessment Governing Board's policy principles laid out in their 2012 policy statement, particularly the principles that "NAEP reporting should be enriched by greater use of contextual data derived from background or non-cognitive questions asked of students, teachers, and schools" (National Assessment Governing Board, 2012, p. 2). Proposed Revision of General Questionnaire Approach

Historically, NAEP has designed its contextual questionnaires around single questions and questionnaire results were therefore reported as single questions as well. A revised approach is presented that is a more balanced, one that provides a mixture of both breadth and depth of coverage. That is, in addition to single questions that are important to providing context for student achievement, indices that are based on aggregation of data and several questions that will add more robust policy-relevant reporting elements to the NAEP survey questionnaires. Indices can be clustered into a number of distinct modules that each focus on a specific area of contextual variables (e.g., socio-economic status). This approach is not entirely new – the existing core questionnaires already contain several questions on multiple topics. In the existing approach, however, no aggregate indices were created for reporting. While additional questions will be needed to capture all modules proposed here, the main difference between the existing and newly proposed approach is aggregating questions into indices that build several modules. This approach directly addresses the National Assessment Governing Board's call for making better use of the NAEP contextual variables, specifically the first implementation guideline that, "clusters of questions will be developed on important topics of continued interest" (National Assessment Governing Board, 2012, p. 2). Table 1 summarizes the differences between the current and proposed approaches in terms of both questionnaire design and reporting.

Table 1 - Proposed revision of general questionnaire approach

	Current Approach	Proposed Approach
Design	Single questions	Modules of questions and select single questions
Reporting	Single questions	Indices based on multiple questions and select single questions

The proposed modules will comprise multiple questions on the same topic. While this marks a shift to the approach to questionnaire design in NAEP, the central interest remains the same, that is assessing topics related to student achievement. The NAEP subject area assessments focus on measuring what students know and can do. The NAEP survey questionnaires capture relevant contextual data for evaluating the achievement results that can help educators and policy makers better understand the circumstances under which learning and instruction take place. In addition, the proposed modules can add value to the NAEP survey questionnaires by capturing student, teacher, and school factors that might not only be interpreted as important achievement predictors, but that may also represent goals of education, and related outcomes, by themselves (see e.g., “Defining and Selecting Key Competencies”, Rychen & Salganik, 2003; “Key Education Indicators”, Smith & Ginsburg, 2013). Enhanced questionnaire designs with questions being spiraled across multiple forms will be considered for future technology-based assessments, in line with the National Assessment Governing Board’s implementation guideline that, “whenever feasible, assessment samples should be divided (spiral sampling) (...) in order to cover more topics without increasing respondent burden” (National Assessment Governing Board, 2012, p. 3). Spiraling approaches are the standard practice for the cognitive (subject area) tests in educational large-scale assessments (Comber & Keeves, 1973; OECD, 2013). Recent research findings suggest that questionnaire spiraling can substantially increase content coverage of survey questionnaires with very small to negligible impact on the overall measurement model, including conditioning and estimation of plausible values (see e.g., Adams, Bereznier, & Lietz, 2013; Kaplan & Wu, 2014; Monseur & Bertling, 2014; Almonte et al., 2014). Different possible spiraling designs for the 2017 NAEP questionnaires are currently being explored.

The idea of questionnaire indices (or modules) is not new. It is the current practice for other large-scale assessments and surveys to aggregate multiple questions into scale indices, and analyze relationships with achievement results and group differences based on these questionnaire indices, in addition to analyzing responses to single questions.

Since the year 2000, the Organization for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA; e.g., OECD, 2013) has been providing various questionnaire indices based on a 30 minute student questionnaire, plus additional indices from a school principal questionnaire, as well as a number of optional questionnaires (e.g., Information and Communications Technology (ICT) Familiarity questionnaire) that are administered in selected countries only. Example indices from PISA 2012 are Attitudes towards school (4 items), Sense of Belonging (8 items), Perseverance (4 items), Openness for Problem Solving (4 items), or Mathematics Self-Efficacy (8 items). PISA also entails an index of economic, social, and cultural status that is based on several questionnaire components. With PISA 2012 OECD introduced several new item formats for increased cross-cultural validity of the derived questionnaire indices, among them Anchoring Vignettes to adjust Likert type responses (Bertling & Kyllonen, 2013), Topic Familiarity items with overclaiming correction (Kyllonen & Bertling, 2013), and Situational Judgment Tests to measure students' problem solving approaches (Bertling, 2012; see Kyllonen & Bertling, 2013, for an overview). The International Association for the Evaluation of Educational Achievement (IEA) follows a very similar approach with their international large-scale assessments. Both the Trends in International Mathematics and Science Study (TIMSS; e.g., Martin, Mullis, & Foy, 2008) and the Progress in International Reading Literacy Study (PIRLS; e.g., Foy & Drucker, 2011) include numerous questionnaire indices. While PISA assesses only 15-year olds, TIMSS and PIRLS are administered at grades 4 and 8. At both grades, questionnaire indices are primarily based on matrix questions, i.e., questions that comprise a general item stem plus multiple sub-items. Example indices from TIMSS are Home Resources for Learning (5 items), or School Emphasis on Academic Success (5 items). The Gallup Student Poll measures Hope, Engagement, and Wellbeing of fifth- through twelfth-graders in the United States, with 5 to 8 items per index.

Contextual modules with questionnaire indices can add value to the NAEP survey questionnaires in several ways. Modules create more robust reporting through aggregating items into indices. Use of scale indices to describe contextual factors instead of single items is not only beneficial from a measurement perspective (e.g., indices will minimize wording effects of individual contextual questions), but will also enhance the relevance of NAEP to policy makers, educators, and researchers by enriching NAEP reporting and potentially providing trend data on important noncognitive student factors as well as alternative outcomes of formal and informal education.

2 Overview of Key Factors Relevant to Student Achievement

The NAEP statute requires that contextual factors included in the NAEP survey questionnaires must be directly related to the appraisal of academic achievement. A simple way to think of student achievement is as a function of student factors and opportunity to learn factors, and their interplay.

Student factors can be further divided into a student's cognitive ability and "noncognitive factors" capturing a student's attitudes towards school and learning, interest, motivation, self-related competency beliefs, and other dispositions relevant to learning and achievement. The term "noncognitive factors" will be described in more detail in the following section.

Opportunity to Learn (OTL) describes whether a student is exposed to opportunities to acquire relevant knowledge and skills. It was originally defined quite narrowly as whether students had sufficient time and received adequate instruction to learn (Carrol, 1963; see also Abedi et al., 2006). Several different aspects of the OTL constructs have been highlighted since then and, therefore, broadened the definition of the term. In this memo we use a broad definition of OTL as all contextual factors that capture the cumulative learning opportunities a student was exposed to at the time of the assessment. These factors comprise both learning opportunities at school and informal and formal learning outside of school. Examples for opportunities to learn at school are exposure to relevant content, access to resources for learning, and exposure to a positive school climate that encourages learning. Outside of school, a student family's socio-economic background (SES) and the family academic climate/home academic resources can determine opportunities to learn. For example, while a student's mathematical reasoning ability will be a core driver for performance on a mathematics test, whether or not the student has been exposed to relevant learning material, has access to the resources needed, and received support for this learning as needed might play an equally large or even larger role for the student's success. Student factors and opportunity to learn factors can interact as students may differ in how they make use of the opportunities provided, and learning opportunities may help learners develop abilities and shape their attitudes. Figure 1 shows a graphical illustration of this general model.

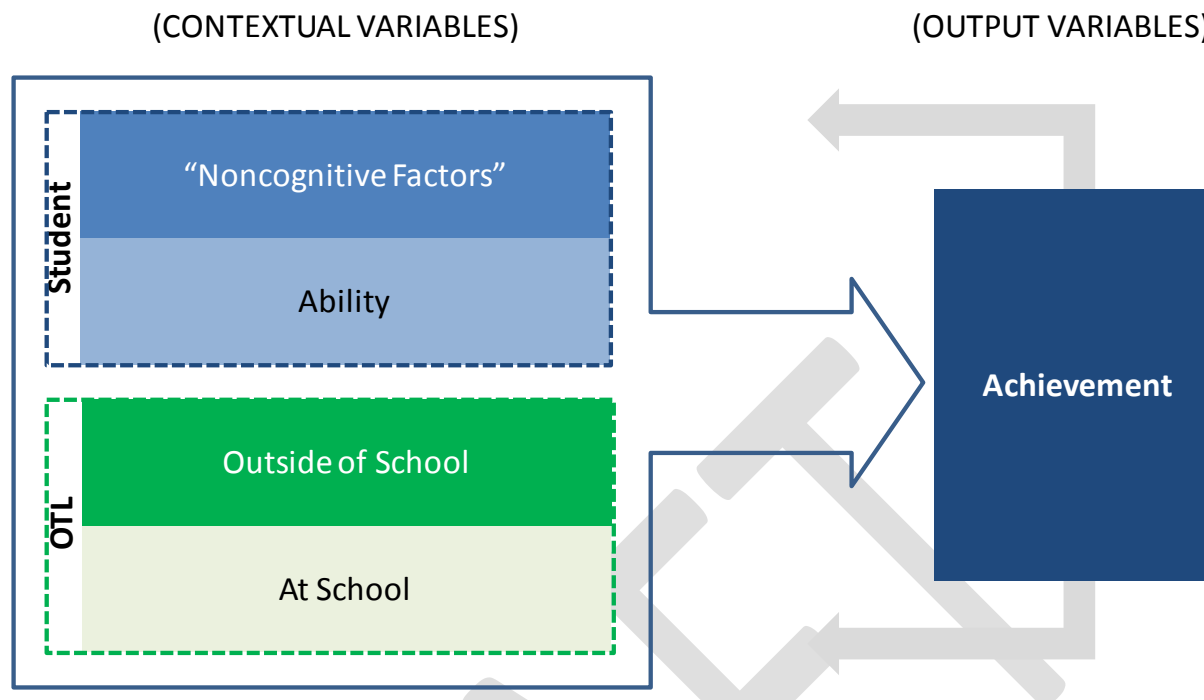


Figure 1 – A Simplified Model of Student Achievement,

Note. Contextual variables can be input, process, or outcome variables at the systems level, school level, classroom level, or individual student level. Complex moderation or mediation pathways are not shown.

This graphical illustration is simplified in several ways: it does not illustrate the multilevel structure with data sources at different levels (such as system level, school level, classroom level and individual level variables) and different types of variables (input, process, output) as distinguished in more complex models, such as the Context-Input-Process-Output (CIPO) model; Purves, 1987; OECD 2013). It also does not depict the possible pathways of moderation and mediation that might characterize the interplay between the components shown. In other words, not all factors depicted in this model might pose direct influence on achievement but effects can be indirect, i.e. mediated through other factors, or variables can impact the relationship between other variables as moderators. For instance, noncognitive student factors (e.g., mindset, academic perseverance) might mediate the relationship between SES and achievement. Moreover, achievement outputs might take the role of input variables for noncognitive or other student factors when, for instance, students with higher achievement levels might develop stronger noncognitive factors (for instance, self-efficacy beliefs). In the context of this memo the model can provide a useful basis for categorizing the different contextual factors relevant to achievement and

aligns with other schematic models proposed in the literature (e.g., Farrington et al., 2012; Heckman & Kautz, 2013).

Despite the importance to general cognitive ability and content knowledge to student achievement in school educational, psychological, and econometric research over the past decades, has shown that psycho-social variables or so-called “noncognitive skills” or “noncognitive factors” are of key importance for success in K-12 and beyond (Almlund, Duckworth, Heckmann and Kauth 2011; Heckmann, Stixrud and Urzua, 2006; Richardson et al., 2012), and also have effects in comparable range on achievement as cognitive ability has (e.g., Poropat, 2009). Success in school and beyond depends, for instance, on applying effort and being committed to succeed and persist during adversity, seeing learning as an opportunity, and respecting and understanding others. Related educational, and especially psychological, research has focused on noncognitive factors for many years, while numerous theories on the respective constructs have been proposed and investigated. Economics literature has only recently focused more on noncognitive skills. Here, the increased interest in these skills can be explained based on studies showing the predictive value of constructs beyond classical cognitive measures of reading and mathematics for important academic and workforce-related outcomes. While the term “noncognitive” is currently the most widely used term to describe student factors outside of those commonly measured by aptitude tests factors, it might reinforce a false dichotomy between traditional academic factors and psycho-social variables when, in fact, almost all aspects of human behavior can be linked to cognition (Borghans, Duckworth, Heckman, & Weel, 2008). Given its wide use and the current lack of a widely accepted alternative term, we use “noncognitive factors” here to refer to skills, strategies, attitudes, and behaviors that are distinct from content knowledge and academic skills, as described by Farrington et al. in their 2012 report for the Consortium of Chicago School Research, “Teaching Adolescents to Become Learners: The Role of Noncognitive Factors in Shaping School Performance”. Alternative labels that have been used in the literature are “non-intellectual correlates of GPA” (Richardson et al., 2012), “Personality” (Heckman et al.) or “incentive enhancing preferences” (e.g., Bowles, Gintis & Osborne, 2000) to describe parameters “that shift the employee’s best response function upward, leading an employee to work harder at every wage rate and holding all else constant” (p. 4). In the context of educational large-scale assessments, this definition can be modified to relate to all student factors that motivate a student to study harder, be more actively engaged in learning, and achieve higher grades, but also in a broader sense, factors that make a student more successful in education, better prepared for adult life as a student and/or member of the workforce, and an active citizen, potentially including factors such as subjective well-being. Most taxonomies of so-called “21st

Century Skills” (e.g., National Academy of Sciences/National Research Council) include noncognitive factors as well.

The National Assessment Governing Board’s first policy principle in their 2012 Policy Statement on NAEP Background Questions and the Use of Contextual Data in NAEP Reporting explicitly highlights the importance of “non-cognitive questions asked of students, teachers, and schools” for enriched NAEP reporting (National Assessment Governing Board, 2012, p. 1). We propose to include, in addition to the subject-specific contextual factors, several domain-general noncognitive student factors in future NAEP questionnaires to broaden the coverage of relevant variables and increase the policy relevance of the NAEP database and reports.

Several larger literature reviews and meta-analyses have recently highlighted the importance of noncognitive factors. Richardson et al. (2012) identified 42 noncognitive factors relevant to student achievement and proposed clustering these into the following five conceptually overlapping, but distinct, research domains, (1) personality traits, (2) motivational factors, (3) self-regulated learning strategies, (4) students’ approaches to learning, and (5) psychosocial contextual influences. Meta-analytical correlations in the range of approximately .20 or larger with Grade Point Average (GPA) were found for 10 noncognitive factors out of the 42 factors investigated: Performance self-efficacy, Academic self-efficacy, Grade goal, Effort regulation, Strategic approaches to learning, Time/study management, Procrastination, Conscientiousness, Test anxiety, and Need for cognition. Correlations with achievement for these noncognitive factors are in the same range as the meta-analytical correlation between general intelligence and GPA. When controlling for cognitive ability, several studies reported conscientiousness to take the role of the strongest predictor of achievement (O’Connor & Paunonen, 2007; Poropat, 2009), and as a “comparatively important predictor” (Poropat, 2009, p. 330) in direct comparison with general intelligence. It was suggested that effort regulation might be the driving force behind these relationships with achievement (Richardson & Abraham, 2009). Other reviews have drawn similar conclusions highlighting goal setting and task-specific self-efficacy as the strongest predictors of GPA (Robbins et al., 2004). A classification of noncognitive factors that seems especially helpful in the context of NAEP is the recent work by the University of Chicago Consortium on Chicago School Research (CCSR). The authors of the report suggest a similar, though slightly different, classification of student success factors compared to the classification suggested by Richardson and others. The five clusters of success factors identified are: Academic Behaviors, Academic Perseverance, Academic Mindsets, Learning Strategies, and Social Skills (Farrington et al., 2012). While some of the research on noncognitive factors (e.g., Heckman & Kautz, 2013; Nyhus & Pons, 2005; O’Connor & Paunonen,

2007; Paunonen & Ashton, 2001; Poropat, 2009; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007) focuses heavily on personality and the so-called Big Five or OCEAN model (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism; Costa & McCrae, 1992; McCrae & Costa, 1989) which was seen primarily as a stable person characteristics in a large part of the traditional literature, Farrington et al. emphasize the malleability of noncognitive student factors, and the importance of teaching in fostering noncognitive factors that help students become active learners who succeed in school. This view is consistent with recent findings from individual differences researchers providing ample validity evidence for the malleability, amenability for interventions, and lifetime changes of noncognitive factors (e.g., Heckman and Kautz, 2013; Specht, Egloff, Schmukle, 2011). As Farrington et al. (2012) describe, social investments in the development of noncognitive factors may “yield payoffs in improved educational outcomes as well as reduced racial/ethnic and gender disparities in school performance and educational attainment” (p. 5). Dweck et al. (2011) highlight that educational intervention and initiatives can “have transformative effects on students’ experience and achievement in school, improving core academic outcomes such as GPA and test scores months and even years later” (p. 3). Several researchers have described effective techniques to positively impact noncognitive factors such as self-efficacy beliefs in various contexts (e.g., Abraham, 2012; Ashford, Edmunds, & French, 2010; Bandura, 1997) and have also highlighted the specific importance of teachers’ behaviors such as setting grades, providing constructive feedback and promoting mastery experiences, especially at early grades (Chen et al., 2000; Lent & Brown, 2006; Stock & Cervone, 1990). Research suggests that performance-focused interventions show larger expected effects on students’ academic achievement than more general counseling services (Richardson et al., 2012). Further, the CCSR model aligns well with multidimensional models of students’ school engagement (Appleton, Christenson, Kim, & Reschly, 2006; Fredricks, Blumenfeld, & Paris, 2004), with the three main engagement components behavioral engagement, emotional engagement, and cognitive engagement. Academic behaviors and perseverance relate to behavioral engagement, and academic mindsets and learning strategies capture cognitive engagement as well as aspects of emotional engagement. The first cluster described in the CCSR review, Academic behaviors, comprises behaviors such as going to class, doing homework, organizing materials, participating in class, and studying. Academic perseverance (cluster 2; also referred to as “grit”) as the second cluster is described as “a student’s tendency to complete school assignments in a timely and thorough manner, to the best of one’s ability, despite distractions, obstacles, or level of challenge. (...) It is the difference between doing the minimal amount of work to pass a class and putting in long hours to truly master course material and excel

in one's studies." (p. 9). Academic perseverance is conceptualized as a direct antecedent to academic behaviors. Academic mindsets (cluster 3) are described as "the psycho-social attitudes and beliefs one has about oneself in relation to academic work" (p. 9) and thereby give rise to academic perseverance. Four key academic mindsets highlighted by Farrington et al. (2012) are (1) "I belong in this academic community", (2) "My ability and competence grow with my effort", (3), "I can succeed at this", and (4) "This work has value for me". Learning strategies (cluster 4) are processes or tactics that help students leverage academic behaviors to maximize learning. Four groups of learning strategies distinguished by Farrington et al. (2012) are: study skills, metacognitive strategies, self-regulated learning, and goal-setting. Social skills (cluster 5) are conceptualized as interpersonal qualities that have mostly indirect effects on academic performance by affecting academic behavior, with key social skills being empathy, cooperation, assertion, and responsibility (Farrington et al., 2012). Farrington et al. (2012) propose a model "as a simplified framework for conceptualizing the primary relationships" (p. 13) for how these five noncognitive factors affect academic performance within a classroom context. In their model, academic mindsets build the foundation for the emergence of academic perseverance that may result in academic behaviors which, as a next step, lead to academic performance. While Farrington's focus clearly is on noncognitive factors, their model also includes classroom factors and socio-cultural context factors that provide a foundation for student learning and may shape noncognitive factors. These factors capture the OTL factors previously described on in this section and illustrated in Figure 1.

3 Modules proposed for future Core Questionnaires

Based on a review of the research literature, as well as a review of approaches for other large-scale assessments, five potential modules, each comprising related constructs, are suggested for future core contextual questionnaires. These modules are (1) Socio-Economic Status (SES), (2) Technology Use, (3) School Climate, (4) Grit, and (5) Desire for Learning¹. Modules may differ in their scope, in terms of the number of questions needed on the questionnaire. SES, Technology Use, and School Climate will likely comprise variables at multiple levels (e.g., school level, classroom level, and individual level) and, therefore, be represented by questions across all respondent groups, while Grit and Desire for Learning are primarily student-level constructs and, therefore, might require fewer questions. Table 2 shows how these modules fit in with the overall model of student achievement described in the previous section. Some modules capture variables spanning both student and OTL factors. Technology use, for instance, includes an ability component (Familiarity with technology), a noncognitive component (Attitudes towards technology), and an OTL component (Access to technology).

Main criteria for selecting these modules were the following:

- (a) Factors captured in each module should have a *clear relationship with student achievement*. Student factors with no clear or low correlations with achievement based on the published research are discarded from inclusion. This criterion directly refers to the NAEP statute. Modules with a strong research foundation based on several studies (ideally, meta-analyses) and established theoretical models will be favored over modules with less research evidence regarding the relationship with achievement or modules with a less established theoretical foundation.
- (b) Factors captured in each module should be *malleable and actionable* in terms of possible interventions in an outside the classroom.
- (c) Factors should be *amenable for measurement with survey questionnaires*. Some of the factors summarized above (e.g., social skills, learning strategies) might require other assessment strategies to provide meaningful and reliable measures.

¹ In an earlier presentation of potential modules the term “Need for Cognition” (NFC) was used. We suggest using the more general term “Desire for Learning” to replace the previous term as it is less technical and broader than NFC with NFC as one possible facets.

- (d) Modules suggested for inclusion in the Core Survey Questionnaires should focus on those student and OTL factors that are *domain-general*, meaning that they are not specific to one of the NAEP subject areas but, first, apply equally to all subject area assessments and, second, cannot be measured better as part of the subject-specific questionnaires.

These modules also show high alignment with the modules suggested by the National Assessment Governing Board's first implementation guideline for questions and questionnaires ("Clusters of questions will be developed on important topics of continuing interest, such as student motivation and control over the environment, use of technology, and out-of school learning, which could be used regularly or rotated across assessment cycles", National Assessment Governing Board, 2012, p. 2) as well as the "Key Education Indicators" (KEI) suggested by Smith and Ginsburg (2013). Technology was suggested as one module and is proposed also in this memo. Motivation was suggested as a module and is captured by the two proposed modules of Grit and Desire for Learning in this memo. Grit captures predominantly students' motivation to work hard, apply effort, and self-regulate their learning. Desire for learning captures intrinsic motives and general learning motivation. Out of school activities play a role in several modules, but are primarily covered in the Technology Use module. Out of school activities related to specific subject-areas are suggested for inclusion in the subject-specific questionnaires, which is in line with current NAEP practices. The Technology and Engineering Literacy (TEL) and Science survey questionnaires, for instance, include several questions specifically targeted at learning opportunities and activities outside of school. School climate was suggested as one KEI and is captured in this memo.

Several important noncognitive and OTL factors are not suggested as possible modules for the core questionnaires as they can be better measured if questions are contextualized within the subject-area questionnaires. This applies, for instance, to self-efficacy, self-concept, confidence, and interest, or to OTL factors such as availability of resources for learning and instruction, and curriculum content. Contextual factors specific to a NAEP subject area are proposed to be measured via the subject-specific questionnaires, in line with current NAEP practices. Table 2 lists not only the suggested domain-general modules, but also examples for the domain-specific indicators that are considered for future survey questionnaires. For each subject area, an Issues Paper (not part of this document) further lays out the contextual variables relevant to each subject area and the subject-specific questionnaires. In the following section, the proposed modules will be described in more detail.

Table 2 – Overview of integration of suggested modules with achievement model; numbers in parentheses indicate the five modules (1: SES, 2: Technology Use, 3: School Climate; 4: Grit; 5: Desire for Learning).

		Domain-general* (Core Questionnaires)	Domain-specific** (Subject Area Questionnaires)
Foundational Skills/Abilities		<ul style="list-style-type: none"> • Familiarity with Technology (2) 	<ul style="list-style-type: none"> • Learning Strategies
Noncognitive Student Factors		<ul style="list-style-type: none"> • Grit (4), including: <ul style="list-style-type: none"> ○ Perseverance ○ Passion for long term goals ○ Effort regulation, self-control, Procrastination (-) • Desire for Learning (5), including: <ul style="list-style-type: none"> ○ Need for Cognition ○ Curiosity ○ Openness • Attitudes towards Technology (2) 	<ul style="list-style-type: none"> • Self-Efficacy • Self-Concept • Confidence • Interest • Achievement Motivation, Grade Goal • Locus of Control
Opportunity to Learn (OTL)	<i>At School:</i>	<ul style="list-style-type: none"> • Access to Technology (2) • School Climate (3), including: <ul style="list-style-type: none"> ○ Physical and emotional Safety ○ Teaching and learning, ○ Interpersonal relationships, ○ Institutional environment 	<ul style="list-style-type: none"> • Resources for Learning and Instruction • Organization of Instruction • Teacher Preparation
	<i>Outside of School:</i>	<ul style="list-style-type: none"> • Socio-Economic Status (1), key components: <ul style="list-style-type: none"> ○ Home Possessions (including access to technology (2) and family academic resources) ○ Parental Education ○ Parental Occupation 	<ul style="list-style-type: none"> • Out of school educational opportunities

Note. *Basic student background characteristics, such as race/ethnicity are not included in this overview table; **This list of domain-specific indicators is not exhaustive; domain-specific contextual factors are described in the Issues Papers for each subject area.

3.1 Socio-Economic Status (Module 1)

Socio-economic status (SES) is a legislatively mandated reporting category in NAEP and questions about SES have been included in all past NAEP survey questionnaires. Along with background variables such as gender, age, and race/ethnicity SES-related variables are also among the standard questions and reporting categories in other large-scale assessments by OECD and IEA (e.g., PISA, TIMSS).

SES has been described as an individual's access to resources for meeting needs (Cowan & Sellman, 2008), the social standing or class of an individual or group, or as a gradient that reveals inequities in access to and distribution of resources (American Psychological Association, 2007). The first research on SES emerged in the 1920s when Taussig (1920) analyzed father's occupational status and observed that students of families with low income or low-status jobs demonstrated lower achievement in school. Sims (1927) and Cuff (1934) took a more comprehensive approach using a score card consisting of 23 survey questions including also home possessions (e.g., books), rooms in the home, cultural activities, and parents' educational attainment. Since then multiple approaches to SES have been taken, and more complex statistical models were applied (e.g., Ganzeboom et al., 1992; Hauser & Warren, 1997). Two large meta-analyses of studies published before 1980 (White, 1982) and between 1990 and 2000 (Sirin, 2005) consistently demonstrated medium to strong relationships between SES and achievement, and further showed that parental educational attainment was the most commonly used measure for SES, followed by occupational status and family income. Sirin (2005) suggested six categories to group indicators of SES (numbers in parentheses denote the number of studies identified by Sirin): parental educational attainment (30 studies), parental occupational status (15 studies), family income (14 studies), free or reduced-price lunch (10 studies), neighborhood (6 studies), and home resources (4 studies). OECD reports an *Index of Economic, Social, and Cultural Status* (ESCS) in their PISA reports that are based on three main components: the highest parental education (indicated as the educational attainment of the parent with the higher educational attainment; classified using the ISCED coding), the highest parental occupation (indicated as the occupational status of the parent with the higher occupational status; classified using the ISCO coding), and an index of home possessions (derived as a composite of approximately 20 items about various wealth possessions, cultural possessions, and home educational resources, plus a measure of the total number of books in the home). While different studies have taken slightly different approaches to the measurement of SES, a common element across the various definitions and measurement approaches for SES is the distinction of the so-called "Big 3" components: education, income, and occupation (APA, 2007; Cowan & Sellman, 2008; OECD, 2013). In 2012, NCES created an Expert Panel that completed a white paper entitled, *Improving the Measurement of Socioeconomic Status for the National Assessment of Educational Progress: A Theoretical Foundation*.² Based on a comprehensive review and analysis of the literature

² The SES Expert Panel White Paper is available at http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

the NAEP SES Expert Panel (2012) suggested the following consensus definition that is adapted for this memo:

“SES can be defined broadly as one’s access to financial, social, cultural, and human capital resources. Traditionally a student’s SES has included, as components, parental educational attainment, parental occupational status, and household or family income, with appropriate adjustment for household or family composition. An expanded SES measure could include measures of additional household, neighborhood, and school resources.” (p. 14)

SES indicators can be defined at different levels, with the systems level (e.g., the general wealth of an economy and spending on education), school level (e.g., a school’s funding situation and the availability and quality of educational resources), and individual level (e.g., home possessions) being three key levels described in the literature (e.g., OECD, 2013). An example for another level is neighborhood SES. Studies often compare socio-economically advantaged with disadvantaged students. OECD considers students socio-economically advantaged if their ESCS index falls into the top quartile (i.e., the top 25 percent) in their country or economy, and socio-economically disadvantaged if their ESCS falls into the bottom quartile, respectively (OECD, 2013). That is, the definition of being advantaged or disadvantaged is, ultimately, relative to a reference population.

The relationship between SES and student achievement has been well documented in the research literature (Bryant, Glazer, Hansen, & Kursch, 1974; Coleman et al., 1966; Cowan & Sellman, 2008; Cuff, 1934; Harwell & Holley, 1916; Kieffer, 2012; LeBeau, 2010; Lynd & Lynd, 1929; Singh, 2013; Sirin, 2005; White, 1982;). This relationship can go in both directions. SES determines students’ opportunity to learn and what skills they acquire, and the distribution of skills across the population can have significant implications on the distribution of economic and social outcomes within societies (OECD, 2013). Data from OECD’s Survey of Adult Skills (PIAAC), for instance, shows that individuals with literacy scores on the highest level are “almost three times as likely to enjoy higher wages than those scoring at the lowest levels, and those with low literacy skills are also more than twice as likely to be unemployed” (OECD, 2013, p. 26). Recursive models and more complex path models have been proposed to explain the observed relationships with achievement based on additional variables such as personal aspirations, peer effects, cultural and social capital, and variables concerning home academic climate and cognitively challenging home environments (e.g., Blau & Duncan, 1967; Reynolds & Walberg, 1992; Spaeth, 1976; Levin & Belfield, 2002; Coleman, 1988).

The availability of SES as a contextual variable enables researchers and policy makers to study educational equity and fairness issues, making the existence of a reliable and valid SES measure an

important indicator that can help monitoring achievement gaps. PISA 2012 results indicate that socio-economic status strongly relates to achievement (“Socio-economically advantaged students and school tend to outscore their disadvantaged peers by larger margins than between any other two groups of students”, OECD, 2012, p. 34). At the same time, the socio-economic gradient (defined as the relationship between SES and performance, OECD, 2013) can be altered by policies targeted at increasing educational equity. PISA results show, for instance, that increasing educational equity goes along with increased achievement overall in a majority of countries (OECD, 2013). SES further is an important covariate with achievement to examine the effects of other variables, and as a matching variable in educational intervention studies. (NAEP SES Expert Panel, 2012).

Current NAEP practice is to measure SES through a set of proxy variables that only partly capture the “Big 3” components. Out of the three main components of SES, education, occupation, and income, NAEP currently assesses parental education (based on student reported data) and household income via several proxy variables including books in the home, household possessions (both student reported), and school reported eligibility for the National School Lunch Program (NSLP; 2008), as well as Title 1 status. For reporting purposes, all of these are treated as individual variables, rather than as a composite index similar to the index of economic, social, and cultural status (ESCS) that is reported by OECD based on PISA.

After reviewing the current SES indicators used in NAEP, the NAEP SES Expert Panel (2012) concluded with four key recommendations for future SES developments in NAEP: First, developing a core SES measure based on the “Big 3” indicators (family income, parental educational attainment, and parental occupational status), second, considering development of an expanded SES measure, which could include neighborhood and school SES variables; third, focusing on SES composite measures rather than relying on single proxy measures; and forth, exploring possibilities of using data from the U.S. Census Bureau, such as the American Community Survey (ACS), to link to NAEP. Similar suggestions had been made earlier, particularly to create a composite measure rather than relying on single proxy measures (Barton, 2003), and to use data linked from other sources, such as the U.S. Census to provide more accurate data on income, parental educational attainment, and parental occupation (Hauser & Andrew, 2007).

At the current stage of item development for the 2017 technology-based core survey questionnaires, main considerations for future development are the design of parental occupation questions and a possible update of existing questions on both household income and education. In this context, we are pursuing a potential link between NAEP and Census that will allow us to obtain SES-related information without increasing student burden. A special study will be conducted in

2015 to link NAEP with the *Early Childhood Longitudinal Study* (ECLS) for grade 4 students. A short supplemental questionnaire will be administered to all ECLS students, including new questions on parental education and parental occupation. Furthermore, re-evaluating the validity of the NSLP measure and some of the key traditional SES questions, such as the number of books in the home, is a priority for future development. Particularly the availability of digital technologies has changed the use of physical books and created new alternative indicators of wealth.

With the 2017 Core Survey Questionnaires we attempt to present a SES composite index that captures the “big 3” components of SES and adds value to OECD’s ESCS index by improving the validity of the parental education and occupation measures and, if feasible, combine student reported data with other data sources in creating the index. These plans directly address the National Assessment Governing Board’s implementation guideline that, “The development and use of improved measures of socio-economic status (SES) will be accelerated, including further exploration of an SES index for NAEP reporting” (National Assessment Governing Board, 2012, p. 3).

In addition, we attempt to further explore creation of an extended SES measure that might also include psychological variables (such as, coping mechanisms, perceptions of the environment; see also, SES Expert Panel, 2012) and potentially a subjective SES measure. In doing so we respond to the NAEP SES Expert Panel’s recommendation that, “psychological variables and some subjective measures of SES may be useful contextual and potentially explanatory variables that could help interpret NAEP scores.” (NAEP SES Expert Panel, 2012, p. 17). Such an extension would correspond to an SES model with an emphasis on social gradients and individuals’ positions relative to others that was described by the American Psychological Association Task Force on Socioeconomic Status as a potential alternative to the traditional materialist SES model (APA, 2007a).

3.2 Technology Use (Module 2)

Over the next few years, NAEP will fully transition from paper-and-pencil assessments to technology-based assessments (TBAs). This represents not only a change in administration format, but also signals the introduction of potentially new and expansive content in the subject area assessments that reflect the way students are being prepared for post-secondary technology-rich environments. Teaching and learning in and outside of the classroom increasingly involve using a variety of digital technologies, such as internet resources, laptops, tablets, and smart phones.

As all NAEP assessments move to technology-based delivery, discerning to what extent students have access to digital technology, are familiar with it, and whether students have positive attitudes regarding the use of technology for learning, is especially important. Thus far, two NAEP assessments, namely the 2011 Writing assessment and the 2014 TEL assessment have been administered via computers. When one examines the contextual variables from these assessments that were designed to measure previous access and exposure to computers, there is only a single contextual item measuring computer access that is common to both assessments – “Is there a computer in your home?” There are no common items that measure familiarity with computers or other relevant technologies across the assessments. With this suggested module, the intent is to develop a set of indicators that help evaluate and monitor over time how prepared students are, in a narrow sense, to take a technology-based assessment and, more generally, to deal with digital technologies in their everyday life, both at school and outside of school. Self-efficacy regarding major use cases of computer software in and outside the classroom, as well as keyboarding skills, will be considered as part of this module as well.

The literature shows that access to technology at school and outside of school is linked to student achievement (Clements, 1999; Clements and Sarama, 2003; Salerno, 1995). For example, studies find that access to technology in the home is linked with improved achievement in mathematics and reading (Espinosa, Laffrey, Whittaker, & Sheng, 2006; Hess & McGarvey, 1987), as well as other achievement indicators such as graduating from high school (Fairlie, 2005). Specifically, Fairlie (2005) found that children who had access to a computer at home were more likely to graduate from high school. Researchers also find that access to the technology at school is positively related to achievement, that is students who have access to technology at school tend to demonstrate higher levels of achievement (Lowther, Ross, & Morrison, 2003; Mackinnon & Vibert, 2002; Siegle & Foster, 2001). Interestingly, Lowther et al. (2003) also found that in addition to general access to technology, student achievement is also influenced by whether students have their own laptop or have to share a computer with other classmates. Specifically, these authors found that students, who had access to their own laptop in the classroom, were more likely to have higher Problem-Solving, Science, and Writing scores than students who had access to shared classroom computers. One encouraging finding shows that at-risk students attending a school where a 1:1 laptop program is implemented (i.e., one laptop is provided to each student) demonstrate the highest gains in Writing (Zheng, Warschauer, Farkas, 2013).

While access to technology does have several educational implications, most notably on student achievement, the literature also shows that familiarity with technology (i.e., knowing how to access

and search the Internet, use functions in Word, Excel, etc.) is crucial to student academic success (Cuban, Kirkpatrick, & Peck, 2001) and shapes students attitudes about technology (Peck, Cuban, & Kirkpatrick, 2002). Familiarity with technology, often referred to as computer literacy, technology literacy, or information and communications (ICT) literacy (i.e., knowledge about computers and other related technology), encompasses a wide range of skills from basic knowledge/skills such as starting a computer, opening software programs (e.g., Word or Excel) or opening a web browser (e.g., Internet Explorer) to more advanced skills such as advanced programming.

OECD conceptualizes ICT literacy as the “availability and use of information and communications technology (ICT), including where ICT is mostly used, as well as on the students’ ability to carry out computer tasks and their attitudes towards computer use” (OECD, 2009). ICT literacy is considered within the context of the home and at school, for example, the 2009 ICT questionnaire included items related to devices available to students, activities, or tasks that students complete (e.g., home: “Download music, films, games or software from the Internet”; school: “Post your work on the school’s website”). In PISA, the importance of ICT literacy for learning and instruction is reflected by a special questionnaire for students that is administered in addition to the regular student questionnaire in a growing number of countries (45 countries in 2009). The optional ICT questionnaire includes socio-economic factors (e.g., access to technology devices at home and technology equipment at school), familiarity with specific tasks (e.g., using a spreadsheet or creating a presentation), and attitudes towards computers (e.g., “it is very important to me to work with a computer”) (OECD, 2009). Students who were more confident in their ability to perform routine ICT tasks (e.g., open a file or save a file) and Internet tasks (e.g., browse the internet or use email) also tended to demonstrate higher levels of mathematics and reading proficiency (OECD, 2003; 2010). PISA also includes questions in the school principal questionnaire asking about the availability of computers in schools and whether principles experience a shortage in computers that might negatively impact instruction in their school (OECD, 2010).

In line with these results, other studies such as Cuban et al. (2001) and Peck et al. (2002) found that increased technology literacy is positively associated with several non-cognitive factors such as self-confidence and motivation to excel in school. Similarly, another study found that students who have access to and use technology also report higher participation rates in class, more interest in learning, and greater motivation to do well in class (Trimmel & Bachmann, 2004). In addition, students also believe that the use of laptops, and technology in general, positively affects their study habits and general academic learning (Demb, Erickson, & Hawkins-Wilding, 2004).

3.3 “School Climate” (Module 3)

School climate is a concept that captures a variety of experiences from the learning environment. It is best thought of as a multidimensional construct. School climate refers to the quality and character of school life. It sets the tone for all the learning and teaching done in the school environment (National School Climate Center, 2013) and thereby also represents an important opportunity to learn factor. School climate not only sets the tone for learning and teaching in the school, but may also relate to student subjective well being (defined as “people’s experiences of their lives as desirable”, Diener and William, 2006, p. 28) and happiness at school. The Gallup Student Poll, for instance, includes a set of questions addressing student well-being. Several studies demonstrated the strong impact that a student’s well-being and sense of belonging in a school or classroom can have on achievement (Battistich, Solomon, Kim, Watson, & Schaps, 1995; Cohen & Garcia, 2008; Furrer & Skinner, 2003; Goodenow, 1992; Goodenow & Grady, 1993; McMillan & Chavis, 1986; Ryan & Deci, 2000; Solomon, Watson, Battistich, Schaps, & Delucchi, 1996; Wentzel & Asher, 1995; Wentzel & Caldwell, 1997). Particularly the feeling of being part of a school or classroom community can have considerable psychological benefits for students and makes them more likely to engage in productive academic behaviors. School climate can have impact on students’ academic mindsets and thereby, indirectly, impact academic perseverance and behaviors (Farrington et al., 2012).

The literature suggests some common areas to address with any school climate measure (e.g. Clifford, Menon, Condon, and Hornung, 2012; Cohen et al. 2013; Haggerty, Elgin, and Woodley, 2010; Voight and Hanson, 2012). One of the latest reviews by Cohen et al. (2013) identifies four areas of focus: safety (emotional and physical), teaching and learning, interpersonal relationships, and the institutional environment. The various sub-dimensions for these four areas are discussed below.

Safety includes the sub-dimensions of rules and norms, sense of physical security, and sense of social-emotional support. Rules and norms are measured by indicators of how clearly rules about physical violence, verbal abuse, harassment, and teasing are communicated and enforced (e.g., “Rules in this school are made clear to students”). Sense of physical security refers to a sense that students and adults feel safe from physical harm in the school (e.g. “Students feel safe in this school”). Sense of social-emotional security is measured by indicators of students who feeling safe from verbal abuse, teasing, and exclusion (e.g. “Students left me out of things to make me feel

badly”). The contextual questionnaires in TIMSS and PIRLS, for instance, include a scale that captures whether students feel that they are bullied at school.

Teaching and learning includes the sub-dimensions of support for learning, and social and civic learning. Support for learning includes indicators of several different types of teaching practices that provide varied opportunities for learning, encourage students to take risks, offer constructive feedback, and foster an atmosphere conducive to academic challenge (e.g. “My teachers will always listen to students' ideas”). Social and civic learning is measured by indicators of civic knowledge, skills, and dispositions such as effective listening, conflict resolution, and ethical decision making (e.g. “I can always find a way to help people end arguments”).

Interpersonal relationships include the sub-dimensions of respect for diversity, social support from adults, and social support among students. Respect for diversity is measured by indicators of mutual respect for individual differences at all levels of the school (e.g. “Students respect those of other races”). Social support from adults is measured by indicators of supportive relationships between adults and students, high expectations for student success, willingness to listen to students, and personal concern for students (e.g. “Adults who work in this school care about students”). Social support among students refers to the level of peer relationship or friendship between students (e.g. “Students are friendly with each other”).

Institutional environment includes the sub-dimensions of school connectedness or engagement and physical surroundings. School connectedness or engagement refers to whether the students positively identify with the school and the norms for broad participation in school life (e.g. “I am happy to be at this school”). The physical surroundings sub-dimension refers to how appealing the schools facilities are and whether the school has adequate resources and materials (e.g. “This school has clean and well-maintained facilities and property.”)

A great deal of research on school climate has been conducted in the United States at the national level. The School Climate Surveys (SCLS) will pilot new questionnaires with middle and high schools in 2015. Longitudinal surveys (such as the Early Childhood Longitudinal Study, ECLS-K) include measures of school climate on their student, teacher, and school administrator survey instruments. State-wide surveys are also common. States such as Alaska, California and Delaware have undertaken item development efforts to develop their own surveys of school climate (American Institutes of Research, 2011; Bear & Yang, 2011; Hanson, 2011). The PISA student questionnaire includes several measures of school climate, such as *Student-Teacher-Relations*, *Sense of Belonging*, and *Disciplinary Climate* that have been consistently used in the survey since 2000.

PIRLS and TIMSS report several indices related to school climate as well (e.g., *Students Bullied at School Scale*; *School Discipline and Safety Scale*). Finally, there are nonprofit organizations such as the *National School Climate Center* (<http://www.schoolclimate.org>) and the *Center for the Study of School Climate* (<http://www.schoolclimatesurvey.com>) that assists schools with assessing school climate and developing strategies for improving it at their school. Item development for the proposed school climate module will consider using existing questions from other surveys where appropriate to further strengthen the linkage between NAEP and other large-scale assessments and surveys, as called for in the National Assessment Governing Board's implementation guidelines for future survey questionnaires ("NAEP will include background questions from international assessments, such as PISA and TIMSS, to obtain direct comparison of states and TUDA districts to educational practices in other countries", National Assessment Governing Board, 2012, p.3).

Research has shown a relationship between several of the sub-dimensions of school climate and student achievement. Information on school-level factors which help improve schools, and thereby also positively affect student learning, is of high policy relevance. A positive school climate creates an environment that is conducive to student learning and achievement. School climate has been proven to show an increase in a student's motivation to learn (Eccles et al., 1993). It has also been shown to moderate the impact of socioeconomic context on academic success (Astor, Bennebnisty, and Estrada, 2009).

There has been research showing that each of the sub-dimensions of school climate effect student achievement. In the area of safety, schools without supportive norms, structures, and relationships are more likely to experience violence and victimization which is often associated with reduced academic achievement (Astor, Guerra, and Van Acker, 2010). The relationships that a student encounters at all levels in school also have an effect on student achievement. Students' perceptions of teacher-student support and student-student support are positively associated with GPA (Jia et al., 2009). The student-teacher relationship even very early on in school, such as kindergarten, portends future academic success (Hamre and Pianta, 2001). Positive perceptions of the racial climate in a school are also associated with higher student achievement while negative racial climate can negatively influence college preparation (Griffin and Allen, 2006).

Perhaps some of the strongest predictors of achievement related to school climate refer to the teaching and learning practices in a school. Several correlational studies have shown a positive relationship between school climate in this area and academic achievement in elementary (Sterbinksky, Ross, and Redfield, 2006), middle school (Brand, Felner, Shim, Seitsinger, and Dumas, 2003), and high school (Stewart, 2008). Research shows that positive school climate not only

contributes to immediate student achievement, but endures for years (Hoy, Hannum, and Tschannen-Moran, 1998). Specific types of social and civic learning practices have been shown to be related to higher achievement. For example, evidence-based character education programs are associated with higher achievement scores for elementary students. One meta-analysis of 700 positive youth development, social emotional learning, and character education programs found that socio-emotional learning led to a gain of 11-17 percentile points in achievement (Payton et al., 2008). There is also research suggesting that the institutional environment is related to achievement. School connectedness or engagement has been shown to be predictive of academic outcomes (Ruus, 2007).

A school climate measure for NAEP should take into account the various major focus areas and sub-dimensions reviewed above. A selection of the most important sub-dimensions to focus on in future NAEP contextual questionnaires seems important. Also, different respondent groups might be more appropriate for the measurement of different sub-dimensions.

3.4 “Grit” (Module 4)

One key finding from the research literature reviewed in the previous section is that academic perseverance is one of the strongest predictors of achievement. This module focuses not only on academic perseverance but combines perseverance with other, related factors that are comprised under the factor “Grit”. Grit is defined as perseverance and passion for long-term goals (Duckworth, Peterson, Matthews, and Kelly, 2007). Grit can contribute to understanding student achievement beyond variables related to SES and other OTL factors. It is related to conscientiousness, defined as the degree to which a person is hard working, dependable, and detail oriented (Berry et al., 2007), but focuses on its facets perseverance, industriousness, self-control, and procrastination (negatively), which are among the facets that are strongest related to achievement (e.g., Barrick, Stewart and Piotrowski, 2002). Students’ persistence even on difficult tasks (*perseverance*, e.g., not to put off difficult problems, not to give up easily), general work ethics (*industriousness*, e.g., prepare for class, work consistently throughout the school year), and low level of procrastination are not only among the strongest non-cognitive predictors of GPA (Richardson et al., 2012), but are also important predictors of success in higher education and the workforce in general (e.g., Heckman, Stixrud & Urzua, 2006; Lindqvist & Vestman, 2011; Poropat, 2009; Roberts et al., 2007). Meta-analyses (e.g., Poropat, 2009) have shown that perseverance and related person characteristics predict educational success to a comparable degree as cognitive ability measures. In other words, a prediction of a person’s educational outcomes, such as GPA, based on a score

reflecting the person's level of perseverance is about as accurate as a prediction of the same outcome based on a person's IQ.

Grit goes beyond what is captured with these conscientiousness facets by including the capacity to sustain both the effort and interest in projects that take months or even longer to complete. Grit is a noncognitive factor that may explain why some individuals accomplish more than others of equal intellectual ability. Early psychologists recognized that there are certain factors that influence how individuals utilize their abilities. William James suggested that psychologists should study both the different types of human abilities and the means by which individuals utilize these abilities (James, 1907). Galton studied the biographical information of a number of eminent individuals and concluded that high achievers had "ability combined with zeal and with capacity for hard labor" (Galton, 1892). There are also more recent examples in modern psychology that demonstrate renewed interest in the trait of perseverance (Peterson and Seligman, 2004). Howe (1999) studied the biographical details of geniuses such as Einstein and Darwin and concluded that perseverance must be as important as intelligence in predicting achievement. Similarly, Ericsson and Charness (1994) found that in chess, sports, music, and the visual arts, dedicated or deliberate practice was an important predictor of individual differences between individuals. Interestingly, these same studies show that grit predicts achievement over and beyond the contribution of intelligence.

Grit is related to some of the Big Five personality traits. In particular, it shares some commonality with the trait of conscientiousness. In contrast to conscientiousness, however, grit focuses on long-term endurance. Grit may also be similar in certain aspects to an individual's "need for achievement" (McClelland, 1961). Need for achievement considers an individual's ability to complete manageable goals that provide immediate feedback on performance. While the idea of working towards a goal may be similar between need for achievement and grit, individuals high in grit are more likely to set long-term goals and continue to pursue these goals even without any positive feedback.

Grit has been measured in different settings. It has been measured with both children and adults, and there are similar measuring instruments available for both children and adults. The questionnaire has been administered on both the Web and by pencil and paper. A series of studies that have been used to validate the measure were conducted on a variety of populations (Duckworth, Peterson, Matthews, and Kelly, 2007; Duckworth and Quinn, 2009). These include visitors to a website providing free information about psychological research, undergraduate students majoring in psychology, incoming United States Army cadets, and children age 7-15 years old participating in a national spelling bee. Grit is highly relevant to NAEP as a noncognitive factor

that explains individual differences in achievement. Students higher in grit may develop different study habits that allow them to use more of their intellectual ability than other students with similar levels of intelligence. Duckworth, Peterson, Matthews, and Kelly (2007) have provided some evidence in this direction. When SAT scores were held constant, grit was shown to have roughly the same association to GPA as SAT scores. These findings suggest that what student's may lack in general cognitive ability, as reflected in traditional test scores, be able to be made up in "grittiness". They have also found that children higher in grit were more likely to advance to higher rounds in a national spelling bee than children who were lower in grit. Furthermore, this relationship was mediated by the number of hours that the children practiced on the weekend—that is, children higher in grit seem to be more likely to spend time practicing on weekends, which leads to better achievement in the spelling bee. Other studies have shown that undergraduate students higher in grit have higher GPAs than students lower in grit (Duckworth, Peterson, Matthews, and Kelly, 2007). This was true even though grit was associated with lower SAT scores. In addition, U.S. military cadets who are higher in grit have been shown to be less likely to drop out than cadets who are lower in grit (Duckworth, Peterson, Matthews, and Kelly, 2007). This relationship holds even after controlling for other factors such as Scholastic Aptitude Test (SAT) scores (as mentioned earlier), high school rank, and Big Five personality characteristics.

3.5 “Desire for Learning” (Module 5)

Desire for Learning is proposed as a second main domain-general noncognitive student factor that adds to Grit in that need for cognition assesses whether individuals see learning as an opportunity and approach learning situations at school and outside of school with an academic mindset that helps them apply effort, persevere, and refrain from procrastination attempts. As highlighted in the overview section of this paper, grit and academic perseverance are key factors to student achievement in the classroom. At the same time, the research suggests that “an isolated focus on academic perseverance as a thing unto itself may well distract reformers from attending to student mindsets and the development of learning strategies that appear to be crucial to supporting students’ academic perseverance.”(Farrington et al., 2012, p. 27). We therefore suggest including “Desire for Learning” as an additional module that will provide policy relevant data on students’ mindset in terms of their need for cognition, curiosity, and intrinsic motivation to learn and grow further. Desire for learning plays an essential role in order to teach students to become truly engaged learners, as highlighted by the authors of the CCSR review on noncognitive factors:

“Teaching adolescents to become learners requires more than improving test scores; it means transforming classrooms into places alive with ideas that engage students’ natural curiosity and desire to learn in preparation for college, career, and meaningful adult lives. This requires schools to build not only students’ skills and knowledge but also their sense of what is possible for themselves, as they develop the strategies, behaviors, and attitudes that allow them to bring their aspirations to fruition.” (p. 77). Desire for learning relates to cognitive engagement in the multidimensional model of school engagement described earlier on in this memo, particularly students’ motivation to learn, intrinsic motivation, and task valuing in school (Ames, 1992; see also Eccles et al, 1993: subjective value of learning scale), and mastery goal orientations (Wentzel, 1998).

A main theoretical basis for the relevance of desire for learning comes from research on so-called “Need for Cognition”. Drawing on earlier work in social psychology, particularly the work of Cohen (e.g, Cohen, 1957), Cacioppo and Petty (1982) described the need for cognition construct (that is, “the tendency for an individual to engage in and enjoy thinking,” p. 116), and introduced a scale to measure it, and presented evidence for the scale’s validity. For example, their first study showed that university faculty had higher scores on the need for cognition than assembly line workers did. A review of work in the ensuing 12 years (Cacioppo, Petty, Feinstein, and Jarvis, 1996) found that the construct had been examined in more than 100 empirical studies; work on the need for cognition has continued to the present day. The original scale for measuring need for cognition included 34 items, but Cacioppo, Petty, and Kao (1984) introduced a shorter version with 18 items that appeared just as reliable as the original.

More than 30 studies have examined reliability of scale scores, most of them using Cronbach’s alpha; these studies generally find that the scale has high reliability. Numerous studies have also examined the factorial structure of the original or short forms of the need for cognition scale; most of them find a single dominant factor, with a few exceptions. For example, Tanaka, Panter, and Winborne (1988) argue for three dimensions—cognitive persistence, cognitive confidence, and cognitive complexity. Generally, researchers have treated the need for cognition as a one-dimensional construct. Those who are high on need for cognition enjoy effortful cognitive endeavors and engage in them; those who are low on need for cognition do not enjoy such endeavors and try to avoid them.

The need for cognition scale has been translated into several languages (including German, Dutch, and Turkish) and has been administered in a variety of settings. The original items were designed for self-administration. Respondents are presented with 18 or 34 statements (“Thinking is not my

idea of fun”) and are asked to rate each statement on a five-point scale, ranging from “extremely uncharacteristic” to “extremely characteristic”. The items are balanced in the sense that half of the statements indicate the presence of the need for cognition and half indicate the lack of it.

A few studies have included the need for cognition items in large-scale mail surveys (Verplanken, 1989, 1991, reports their use in a mail survey in the Netherlands), and the items would seem to lend themselves to computerized administration (such as a web survey). The vast majority of studies using the scale have administered it to undergraduates. The only studies we have found that have used the items with respondents in the age range of the NAEP participants were conducted in Germany (Bertrams and Dickhäuser, 2009; Preckel, Holling, and Vock, 2014). Some of the items in the English version could exceed the vocabulary of the typical fourth grader. Thus, a version of the scale might need to be developed for use with the NAEP student samples.

Several studies show that desire for learning/need for cognition is related to achievement in school (e.g., Bertrams and Dickhäuser, 2009; Preckel, Holling, and Vock, 2006; see also Petty and Jarvis, 1996) and one of the stronger predictors of GPA based on meta-analytical data (Richardson et al., 2012). There are several pathways that could account for the link between desire for learning/need for cognition and academic success. Need for cognition reflects willingness to expend cognitive effort and this is clearly a prerequisite for mastering difficult material. In addition, persons with higher desire for learning engage in more effortful cognitive processing and seek out information more than their counterparts who are low in desire for learning/need for cognition (Cacioppo et al., 1996). Finally, those high on need for cognition also have higher intrinsic motivation to perform challenging cognitive tasks (Cacioppo et al., 1996). Whatever the exact causal path, need for cognition does seem to predict academic achievement, whether measured by GPA or standardized test scores.

Desire for Learning also captures aspects of Openness, reflecting people’s willingness to make adjustments to existing attitudes and behaviors once they have been exposed to new ideas or situations (Flynn, 2005). PISA 2012 includes a 4-item openness for problem solving scale (e.g., “I like to solve complex problems”) that shows some conceptual overlap with the Need for Cognition (NFC) scales described above. Correlations of the scale with achievement are among the largest across all noncognitive indices included in the PISA questionnaires based on PISA 2012 data.

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